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Section 1 of 2

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Waste Feed Delivery System Phase 1 Preliminary Reliability, Availability, Maintainability Analysis

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Abstract: The document presents updated results of the preliminary reliability, availability, maintainability analysis performed for delivery of waste feed from tanks 241-AZ-101 and 241-AN-105 to British Nuclear Fuels Limited, Inc. under the Tank Waste Remediation System Privatization Contract. The operational schedule delay risk is estimated and contributing factors are discussed.

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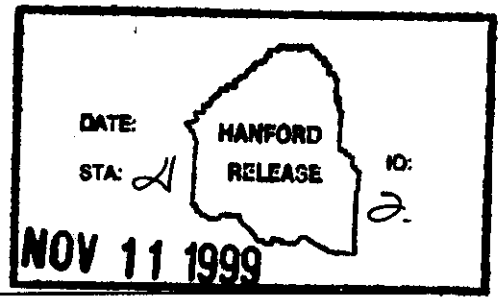

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Waste Feed Delivery System
Phase 1
Preliminary RAM Analysis

November 1999

by

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Acronyms & Abbreviations

BIO	Basis for Interim Operation (Jones, 1999)
BNFL	British Nuclear Fuels, Limited
CIL	critical items list
DOE	Department of Energy
DST	double-shelled tank
EIN	equipment identification number
FMEA	failure modes and effects analysis
FOM	figure of merit
HANDI	Hanford Data Integrator
HLW	high-level waste
HVAC	heating, ventilation, and air conditioning
ICD	Interface Control Document
IWFST	intermediate waste feed staging tank
JCS	Job Control System
LAW	low-activity waste
LCO	limiting condition for operation
MEL	(Hanford) master equipment list
MOV	motor-operated valve
MTTR	mean time to restore
NPNF	no problem/no failure
O&M	operations and maintenance
ORPS	Occurrence Reporting and Processing System
ORR	operational readiness review
OSR	operating safety requirement
P&ID	piping and instrumentation diagram
P3	Primavera Project Planner
PPE	personal protection equipment
RAM	reliability, availability, and maintainability
RF	range factor
RPP	River Protection Project (formerly TWRS)
SRS	Savannah River Site
SSCs	structures, systems, and components
SST	single-shelled tank
TBR	to be refined
TWRS	Tank Waste Remediation System (now known as RPP)
WFD(S)	waste feed delivery (system)
WTD	waste transfer date/day

1. Introduction

This report presents the updated results of the preliminary reliability, availability, and maintainability (RAM) analysis of selected waste feed delivery (WFD) operations to be performed by the River Protection Project (RPP) organization during Phase I activities of the *Tank Waste Remediation System Privatization Contract* (DOE 1998c). It reflects the baseline design and operating concept, as of the beginning of Fiscal Year 1999, for the delivery of feed from source tanks 241-AZ-101 and 241-AN-105. The preliminary RAM analysis quantifies the potential schedule delay associated with operations and maintenance (O&M) field activities needed to accomplish these operations. The results are being used to support the continuing development of an O&M Concept tailored to the unique requirements of the WFD Program.

1.1 Background

Underground storage tanks have been used at Hanford to process and store radioactive and chemical-mixed waste. The tank farms are located in the 200 East and 200 West areas of Hanford. They consist of 28 underground double-shell tanks (DSTs) with a capacity of 118,400 m^3 and 149 single-shell tanks (SSTs) with a capacity of approximately 139,000 m^3. The tanks store highly radioactive sludge, salt cake, and supernatant consisting of a variety of chemical components.

The RPP organization is responsible for maintaining the tanks in a safe configuration and readying them for decommissioning. The current operation for DSTs focuses on ensuring safe storage, providing surveillance to comply with U.S. Department of Energy (DOE) Order 5820.2A requirements, and evaporating condensate to store a concentrated slurry in the least amount of space. Similarly, there is a program for the surveillance, interim storage, stabilization, and isolation of the SST waste. Waste characterization and assessment are also being conducted to support decisions for future remedial action.

In 1996, the DOE proposed a strategy to retrieve and treat the waste in the Hanford Site's tanks using existing DOE contractors and privatization contractor teams in combination. DOE divided the treatment of the tank waste into a demonstration phase, called Phase 1, and a full-scale production phase, called Phase 2. The mission of the WFD Program is to retrieve wastes from radioactive waste storage tanks and provide waste as feed to the privatization contractor for processing consistent with the *Tank Waste Remediation System (TWRS) Privatization Contract* (DOE 1998a). The waste feed provided to the Privatization Contractor must: (1) meet contractual limits for chemical and radioactive constituents based on preestablished compositional envelopes (i.e., feed quality); (2) be in acceptable quantities within a prescribed sequence to meet contract order quantities (i.e., feed quantity); and (3) meet contractual schedule requirements (i.e., feed timing).

1.2 Objectives and Scope

Consistent with the FY 1999 Baseline planning guidance (DOE 1998a, DOE 1998b), the immediate objectives of the preliminary RAM analysis are to:

- Support evaluating the ability of the FY 1999 baseline system design and O&M concept to meet the WFD schedule requirements for two representative Phase 1 source tanks:
  - HLW in tank 241-AZ-101
  - LAW in tank 241-AN-105.
- Estimate the likelihood and magnitude of delivery delays associated with the tank farm O&M activities that can result in penalties to Hanford.
- Identify preliminary RAM-related design and O&M Concept changes to enhance operating margins for meeting waste delivery schedules.

Source tank 241-AZ-101 contains HLW in a consolidated layer of particulate solids at the bottom of the tank. The major activities associated with delivery of waste feed from that source tank to BNFL consist of mobilization of the solids, qualification of the feed, and subsequent delivery of nine, roughly equal, incremental lots of the tank's contents to BNFL in accordance with Interface Control Document (ICD-20) (BNFL, 1998b).

Source tank 241-AN-105 contains LAW as both supernatant and precipitated salts. The major activities associated with delivery of waste feed from that source tank to BNFL consist of degassing the tank, transferring the supernatant to staging tank 241-AP-102 and qualifying the waste, dissolving the precipitated salts present in the source tank, transferring the resulting dissolved LAW to staging tank 241-AP-104, and qualifying the waste. Once qualified, the LAW in each tank is sent to BNFL's LAW feed tank 241-AP-106 as separate batch transfers in accordance with Interface Control Document (ICD-19) (BNFL, 1998a).

The preliminary RAM analysis addresses the field activities of tank farm O&M organizations necessary to achieve the activities stated above once the RPP has been given the approval to commence operations. This assumes that issues and uncertainties identified during the development process that could delay field activities have been resolved. Specifically:

- To the extent possible, the design has been analyzed and tested to demonstrate that the system design and O&M Concept are capable of accomplishing their intended functions in accordance with the process flowsheets.
- The Operational Readiness Review (ORR) has verified that O&M planning has been effective.
- The project development and ORR will be successful in eliminating process-related problems that could stop waste transfer operations because a physical condition occurs that the development did not anticipate.

- All the resources and administrative systems necessary to sustain O&M activities to successfully complete the mission are in place.

The preliminary RAM analysis accounts for the fact that any system is subject to interruption and delay during the course of normal operation. It addresses random failures of hardware in the system and other off-normal events that typically occur during operations in the field. These include human error during the execution of procedural tasks, weather-related delays, and random non-catastrophic external events. Its output includes the expected frequency and duration of schedule delay due to random off-normal events, and a ranking of the contributors to those delays.

This revision of the RAM analysis focuses on the potential for paying idle facility penalties to the privatization contractor because of delays in transferring waste feed batches within the acceptable delivery window. The O&M Concept provides guidance to RPP personnel for using these metrics, within the safety basis established by the Basis for Interim Operation (BIO) (Jones 1999) and any other regulatory requirements, to establish and prioritize procedures and activities designed to optimize RPP operational availability.

The ultimate objective of the preliminary RAM analysis is to guide the collection and use of site-specific RAM performance data to provide practical information that will support the allocation of resources for the O&M Concept. This will assist the RPP organization to optimize the system's capability for meeting the *TWRS Privatization Contract* requirements within the budget available, while maintaining an acceptable margin of safety.

1.3 Relationship of the Preliminary RAM Analysis to the WFDS Technical Basis

The preliminary RAM analysis complements the project development and design work being accomplished by the RPP organization in preparation for privatization. The technical approach and data for delivering feed from individual source tanks is defined in separate volumes of HNF-1939, *Waste Feed Delivery Technical Basis* (Rasmussen 1998, Orme 1999a, Orme 1999b, Orme 1999c, and Carlson 1999). HNF-1939 consists of a process concept and flowsheets in Volume II, system description and equipment concept in Volume III, and O&M Concept in Volume IV. These three concept documents are developed in conjunction with the preliminary RAM analysis presented in this document, and a risk assessment accomplished in accordance with HNF-IP-0842, Volume IV, Section 2.6, Risk Management.

The process flowsheets in Volume II provide material and energy balance and process flow information for each source tank. The system description describes the existing physical system in the tank farms, and the retrieval and transfer system being designed and constructed by various projects that will support WFD mission. The O&M concept describes the operational activities associated with delivering waste feed to the privatization contractor once active waste processing has begun. The preliminary RAM analysis assists quantifying the expected performance of that system by addressing failure modes and recovery times for random equipment failures, human error, and off-normal external events during scheduled WFD activities. The uncertainties associated

with the technical approach and programmatic issues are captured by the risk assessment.

The preliminary RAM analysis supports the policy stated in DOE O 430.1, *Life Cycle Asset Management*, and implemented in the Good Practice Guides (see *Guide to the Guides*, GPG-FM-000). The development of an O&M Concept and the preparation of a preliminary RAM analysis form a significant part of the iterative process of developing and validating the technical approach for achieving the WFD mission. The operational figures-of-merit (FOM) and supporting metrics generated by the RAM analysis assist the project development team in anticipating and prioritizing risks. This systematic evaluation of anticipated performance during the operational phase of the life-cycle is assisting planners to recognize and address problems in the technical basis of the facility before they become engrained in the system.

1.4 Organization of This Report

Section 2, "Structure of the RAM Model," discusses the general approach used to accomplish the preliminary RAM analysis and summarizes the scope and overall structure of the RAM model of the current RPP processing and operating concept for the two source tanks being addressed. The processing logic is derived from the most recent version of the process flowsheets available and represents a no-problem, no-failure scenario. This section also includes a summary of assumptions used for the analysis. Appendices A, E, and F support Section 2.

Section 3, "Frequency of Off-Normal Events," describes the development of the RAM parameters needed to quantify the frequency of off-normal events that can lead to delays during the transfer activities addressed by the analysis. Off-normal events that stop progress on critical path activities in the Primavera schedule for the transfers become the basic events of the RAM model. Section 3 then cites the available evidence and summarizes how that evidence has been interpreted to establish appropriate RAM parameters for the analysis. Appendices B through D provide more detailed information regarding these parameters.

Section 4, "Time Required to Restore to Normal Activities," discusses the recovery from off-normal events. The duration of recovery activities is defined to be the total time between the cessation of progress on scheduled activities and the point at which scheduled activities will move the transfer process beyond the condition that existed when the off-normal event occurred. This section is based on the analysis described in Section 4 of the O&M Concept Document, HNF-1939, Volume IV (Carlson 1999).

Section 5, "Results of Preliminary RAM Quantification," summarizes the results of the preliminary RAM analysis of the qualification and batch transfer of waste in source tanks 241-AZ-101 and 241-AN-105. It also presents the overall conclusions and discusses some of the insights derived from the study. It also suggests areas for further applications of RAM model to support more detailed planning and development. Appendices E through G support Section 5.

Appendix A provides a summary of the structure of the RAM model, definitions of RAM database fields, a comprehensive list of component failure modes considered, and a sample Failure Modes and Effects Analysis (FMEA).

Appendix B contains the generic hardware failure rate database used to quantify the RAM model.

Appendix C contains the results of evaluations of the Occurrence Reporting and Processing System (ORPS) and Job Control System (JCS) for generating site-specific failure rate and recovery time parameters for use in the preliminary RAM analysis.

Appendix D contains the tables generated to support the evaluation of human reliability during the performance of procedural tasks.

Appendix E provides selected detailed reports from the RAM database generated from the evaluation of WFD activities associated with source tank 241-AZ-101.

Appendix F provides selected detailed reports from the RAM database generated from the evaluation of WFD activities associated with source tank 241-AN-105.

Appendix G provides the details of a case study evaluating the RAM implications of conducting transfer operations within the constraints of the existing BIO requiring immediate response to selected instrumentation signals from interconnected systems.

Appendix H documents the peer review of the preliminary RAM analysis.

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2. Structure of the Preliminary RAM Model

This preliminary RAM analysis quantitatively estimates the likelihood and impact of potential schedule-delaying events during the qualification and transfer of waste to BNFL, Inc. Waste transfers from 241-AZ-101 and 241-AN-105 were selected to define the representative waste transfer activities for HLW and LAW, respectively. Rather than measure the average operational availability, a typical metric for a system designed to operate continuously over a specific mission time, this preliminary RAM analysis addresses specific well-defined batch transfer activities encompassing both single "batch"-related functions and continuous safe storage during the mission. This is accomplished via the definition and quantification of system exposure to specific transfer schedule-delaying events, which can be a mix of demand-related functions and continuous operation functions.

The preliminary RAM analysis methodology and approach is presented in Section 2.1. Section 2.2 then describes the WFDS configuration addressed by the preliminary RAM analysis. Section 2.3 discusses selected methods used to develop the RAM model for this analysis. Section 2.4 develops the FOM used to evaluate the potential for idle facility penalties during the qualification and transfer of waste feed from source tanks 241-AZ-101 and 241-AN-105 to BNFL. Section 2.5 provides a table consolidating the assumptions used during the preliminary RAM analysis.

2.1 Overview of the RAM Analysis Methodology

The general approach for developing the preliminary RAM analysis is shown in Figure 2-1 and described below. Although the description indicates a linear progression of analysis steps, it should be recognized that the tasks are interrelated. The items represented by dashed lines in Figure 2-1 are not within the content of this preliminary RAM analysis.

- **Describe Facility/Process**

  This step establishes the context for the RAM analysis by describing the overall extent of the facility(ies) and/or process(es) to be analyzed. Experience has shown that widening and fine-tuning the definition of the facility to be analyzed can have a significant impact on subsequent capability to adequately define and appropriately evaluate the metrics for efficient and cost-effective facility O&M decisions throughout the facility life cycle. Section 2.2.1 describes the facilities and processes addressed by the preliminary RAM analysis.

- **Define Specific Process Functions**

  Define specific processes to be analyzed by breaking down the overall process into functions that have identifiable physical and temporal limits. This is the first step that leads to measurable process success criteria. As an example, for this model the general processes are those related to waste feed preparation and batch delivery to the privatization contractor. These processes are then broken

into waste storage, sampling, degassing, waste feed transfer (decanting) from tank to tank, waste mixing and settling within tanks, and supporting valve alignment and pump start/stop operations (i.e., supporting human actions that are generally identified in specific procedural steps). Sections 2.2.2 and 2.2.3 present and describe the HLW and LAW activity logic, respectively.

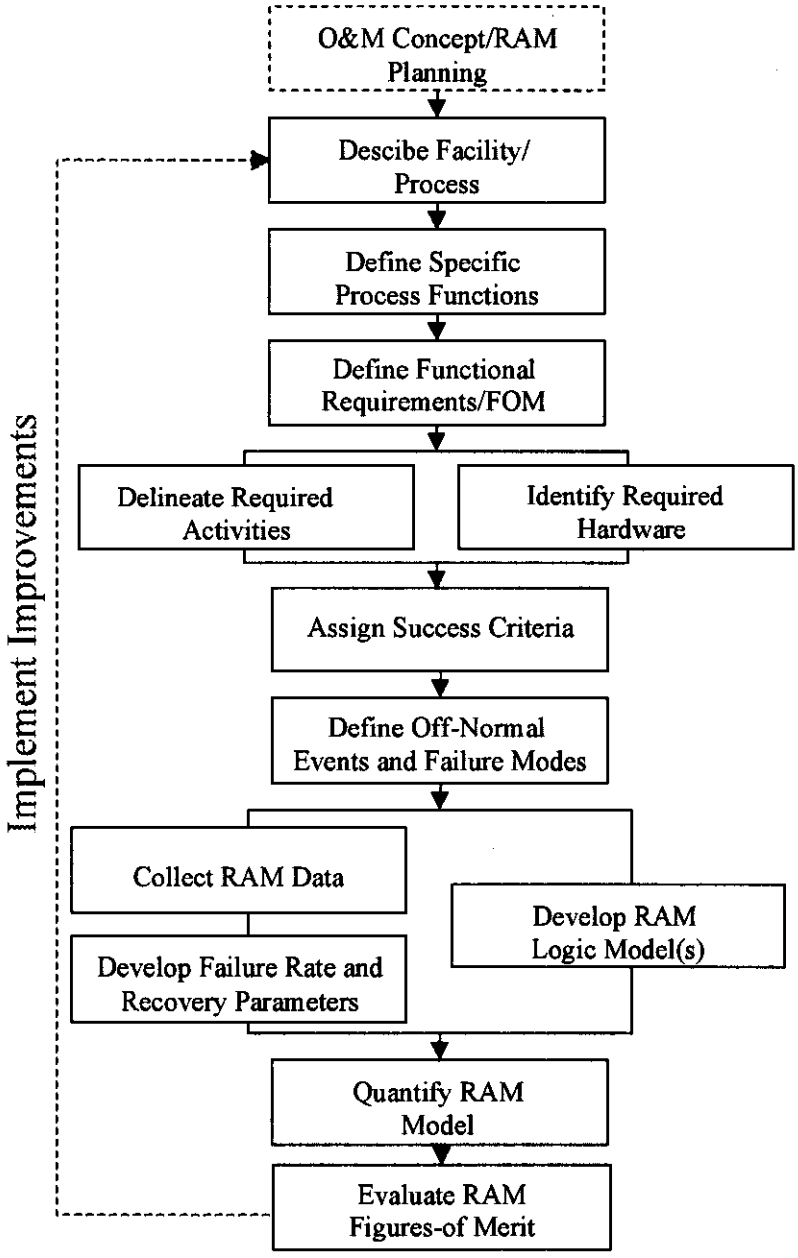

Figure 2-1. Steps for Performing a Reliability, Availability, and Maintainability Analysis

- **Define Functional Requirements/FOMs**

  Functional requirements are derived from the objectives of the process functions, which are discussed in detail in the process flowsheets (Orme, 1999a, 1999b, 1999c). The functional requirements are derived from the physical changes that must be achieved to move a process from its initial state to the objective. Waste transfer batch volumes summarized in Tables E-1 and F-1 for HLW and LAW, respectively, are the primary functional requirements addressed in the preliminary RAM analysis. The functional requirements will then be used to delineate the number and duration of activities necessary to achieve the desired results.

  A FOM is a measure selected to evaluate and understand the effectiveness of a system for accomplishing its mission. In this preliminary evaluation, the FOM quantifies the confidence that waste feed qualification and batch transfer operations can assure that BNFL will not have to idle its facilities due to lack of waste feed. This is accomplished by quantifying the frequency and duration of off-normal events that interrupt and delay the execution of schedule critical waste feed delivery activities. Early definition of FOMs will assist to focus both the RAM analysis's utility for improving the waste feed delivery O&M concept. Section 2.4 discusses the FOM for the preliminary RAM analysis in more detail.

- **Delineate Required Activities**

  This step breaks down the functional requirements into activities having specific physical and temporal boundaries suitable for defining a quantitative mission for preliminary RAM analysis. The activities are generally best defined with a process or logic diagram. The RPP Primavera Project Planner (P3) logic diagram, the RPP logic simulation model, and existing process flowsheets are good examples of tools that support the clear definition of activity functional boundaries. Figures 2-4 and 2-6, which summarize the P3 logic, delineate the activities associated with the HLW and LAW transfers, respectively. Section 2.2.4 explains what is included and excluded from the preliminary RAM model.

  Specific human actions for setting up and controlling the process functions are included in the preliminary RAM. Candidate actions are extracted from the operational procedures for the activities. Section 2.2.4.2 discusses the criteria for including actions in the RAM model. Those actions retained for quantification are listed in Appendix D, Table D-2, and Table D-3 for HLW and LAW, respectively.

- **Identify Required Hardware**

  This step identifies the structures, systems, and components (SSCs) required for accomplishing the activities that will achieve the functional requirements. Consideration must be given to not only "frontline" systems that participate directly in the process activity, but also to utility and support systems that the frontline systems depend upon to operate. It also includes the instruments and control systems needed to assure that the activities are performed safely and in accordance with process specifications.

Clear delineation of the boundaries between systems and hardware is necessary to assure all SSCs required for mission success are included in the preliminary RAM analysis, while also avoiding overlap and duplication. The hardware boundaries should be specific, readily identifiable, and coordinated with the data evaluation task. Typically, SSC boundaries are broken down only to the level at which operational and failure experience is available.

For completeness and to avoid duplication, it may be necessary to define explicit boundaries between SSCs. Typical hardware boundaries include: designated pipe flanges, nozzles, or weld boundaries, jumper nozzles, flanges, or weld boundaries, valve flanges or weld boundaries, pump flanges or weld boundaries, junctions with tanks, electrical breaker connections, circuit lead connections, instrument lead connections, etc.

Hardware required for the qualification and transfer of HLW in source tank 241-AZ-101 and LAW in source tank 241-AN-105 are generally described in Sections 2.2.2.2 and 2.2.3.2, respectively. A complete listing of the hardware by Equipment Identification Number (EIN) is provided in Appendices E and F, Tables E-6 and F-6 for HLW and LAW, respectively.

- **Assign Success Criteria**

Success criteria define specific operational requirements for hardware and personnel participating in a specific activity. Examples include the number of alignments, startups, and operational transitions that must be accomplished as well as the total operating time that hardware must operate to complete the mission functions. The success criteria provide the basis for defining exposure of the system to hardware and non-hardware failure modes.

Hardware success criteria are assigned to each SSC that will be quantified individually within the RAM model for a given process activity. Tables 2-1 and 2-2 delineate the specific hardware success criteria associated with the HLW and LAW transfers, respectively.

Human action success criteria are assigned to specific procedural steps that must be completed to enable hardware to accomplish the next process activity. A common human action falling into this category is aligning the system for a waste transfer between two tanks. The operational procedures listed in Appendix D, Table D-2, and Table D-3 of Appendix D for HLW and LAW, respectively, define the tasks upon which the human success criteria are based.

- **Define Off-Normal Events and Failure Modes**

This step defines process, system, and component failure modes and their effects on the entire facility process. A failure mode is a deviation of a process, system, or individual piece of hardware from a state needed to complete the current activity. The functions may be active (both safety and process related) or passive (providing containment, protection, or structural support). A variety of deviations may occur to any one item, and their effects may impact an activity in a variety of ways. This preliminary RAM analysis focuses on failure modes

producing off-normal events that interrupt and delay waste feed delivery schedule critical activities.

Failure modes can be defined at the system, functional, or individual hardware level. The level normally depends on the resolution of information available on the off-normal event. External events, such as forced stoppage due to weather conditions, generally produce system level failure modes. Site wide support functions are evaluated at a system level. Human action failure modes are keyed to the specific activities being accomplished and consider the capability of the personnel involved to react to correct an error before it evolves into an off-normal event that interrupts the activity. For process related hardware, failure modes are developed for the SSCs designated when required hardware was identified and their boundaries were defined.

Section 2.3.1 discusses the process the preliminary RAM analysis used to assemble the information needed to define a complete set of failure modes. In Appendix A, Table A-2 defines hardware failure modes, while Table A-3 provides a sample of the failure mode and effects analysis done to generate the RAM quantification tables.

- **Develop RAM Logic Models**

The RAM logic model is the vehicle used for organizing combinations of failure modes into a structure that represents a complete set of off-normal events that impact the waste feed delivery schedule. Depending on complexity and redundancy of the system, RAM logic models can be developed in a variety of formats.

The model selected to organize off-normal events for this preliminary RAM analysis flows from the fact that active waste transfer operations are stopped following any failure mode that could impact the safe and compliant completion of the operation. O&M personnel then verify that safe conditions exist, and recover from the failure mode prior to resuming active waste handling. Consequently, the WFDS may be considered to be a series system with no redundancy against shutdown. Therefore, a list of all the individual failure modes that can interrupt the process activity will constitute a valid logic model of off-normal events that produce schedule delay. Backup components, such as secondary HVAC fans and filters in ventilation systems, expedite restoration of function. However, since they must be manually aligned, they do not prevent the disruption.

The table generated during the failure modes and effects analysis step provides a convenient format for listing and categorizing all off-normal events for RAM quantification and reporting of results. Section 2.3.1 discusses the development of the RAM computer model to reflect this structure.

- **Collect RAM Data**

The analysis of RAM data involves the collection of generic industry evidence and RPP-specific historical RAM performance data. Generic industry evidence is generally in the form of failure rate and recovery time distributions. Frequently the detailed raw data supporting these derived parameters are not readily

available. Consequently, their applicability to Hanford must be evaluated based on the reputation of the source and the similarities between the original application and the conditions at Hanford.

Applicable failures are those that produce a cessation of the desired component function that can be attributed to a fault in that component, as opposed to an induced failure caused by an external event that is out of the design envelope. (Induced failures should be also be recorded, but would be included in an external events analysis.) Applicable information on total exposure is obtained from the operational history of SSCs under conditions similar to the mission of interest. Exposure data is typically recorded as hours of run time for "running" failures or the total number of demands for operation in the case of "transition" failures. Repair and restoration times relate to the total clock time required to make the component and the system it supports fully functional.

Site-specific data supporting calculation of RAM parameters is collected from experience with the WFDS equipment or similar equipment that will be used for a specific activity. This raw RAM data includes time-based or "running" failures, demand-based or "transition" failures, their associated repair and restoration times, and the total operational exposure that produced those failures. The results of the data collection effort to identify site-specific Hanford data is presented in Section 3.2.

- **Develop Failure Rate and Recovery Parameters**

  During this step, the RAM data is converted into failure rates and recovery durations that can be applied to the failure modes in the RAM logic model. Failure rates are developed for individual hardware failure modes, support system outage rates, human error rates, and external event frequencies.

  A failure rate is an estimate of the likelihood that a failure mode will occur per unit of exposure. The exposure is directly related to the function performed during a process activity. Failure rates are represented by distributions that reflect on one's confidence in the available evidence. Processing involves assessing the applicability and relative weight of both the generic failure rate parameters and failure rates calculated from samples of actual experience similar to the activities addressed by the preliminary RAM analysis. If a generic failure rate distribution is judged to be applicable, it can be used directly. If site-specific data is also found to be applicable, Bayesian statistics may be used to produce an updated distribution that properly reflects the relative strength of the two sources of evidence. See Section 3 for a further discussion of failure rate development.

  There are two aspects to the recovery process, 1) restoration of function and 2) repair or replacement activities necessary to recover full design capability. Restoration of function pertains to the total elapsed clock time from the interruption of normal process activities to the point at which the system resumes mission-related process activities past the point of the interruption. The preliminary RAM analysis uses restoration time to calculate schedule delay resulting from off-normal events. However, the recovery to full design capability is important for maintaining long term reliable operations. The differences between restoration and full recovery are discussed more fully in Section 4.

Both restoration and repair time distributions are assigned to every SSC included in the preliminary RAM model. When a means to manually switch to a backup method of providing the required function exists, the restoration time will reflect the estimate of the time needed to accomplish the switchover and resume waste transfer operations. The repair distribution provides an estimate of the time and effort needed to recover full operability of the failed SSC for use in planning O&M resources. The preliminary RAM assumes that the manual backup SSC will not fail while repair is underway. When an SSC does not have a manual backup, the repair time distribution also represents the restoration time.

For non-hardware failures that do not result in physical damage to the system, the delay is directly tied to the duration of the condition that caused the interruption. Weather related work stoppages are an example. The duration of delays caused by support system failures and external events are estimated using the experience from past outages, tempered by provisions of corrective actions taken to prevent a repeat of long delays. See Section 4 for a further discussion of recovery durations.

- **Quantify the RAM Model**

  During this step, the RAM failure rates and recovery times are assigned to the components in the RAM logic model(s) to quantify the frequency and durations of RAM-related delays. Because any given failure mode can occur more than once during a given activity, the quantitative system model is straightforward. The failure frequency of each off-normal event during a specific activity is quantified by multiplying its failure rate per unit of exposure by its total exposure to that failure mode during that activity. Once generated, the complete set of off-normal event failure frequencies can then be used with their associated restoration times to generate output metrics to evaluate the RAM FOM. Section 2.3.1 describes the generation of the quantification tables in the RAM computer model.

- **Evaluate RAM FOM**

  Two approaches are used in this preliminary RAM analysis to support the evaluation of the FOM.

  To estimate the risk of idle facility penalties for failing to deliver a batch of waste feed to BNFL, Inc., a distribution of total schedule delay is generated using a Monte Carlo simulation. The results of this simulation are then used to develop distributions of activity completion times for comparison to the allowable waste feed delivery window. This process is fully explained in Section 2.4.

  The output of the RAM quantification is also used to develop critical item lists (CILs) that rank the relative contribution of off-normal events to process interruption and associated schedule delay. The failure frequency and expected delay time of all the off-events are used for ranking. The expected delay time of an off-normal event is obtained by multiplying the failure frequency by the mean value of the restoration time distribution. The failure frequency and resulting expected delay time of the individual off-normal events may then be selectively summed to obtain the expected number of off-normal events and total expected delay time by various categories. To support decision making, this information

may be generated at several levels of indenture relative to the waste feed delivery system, including: processing function, system type group, component type group, individual component, and individual component failure. The results of the preliminary RAM quantification are presented in Section 5.

2.2 Facility and Process Definition

This section provides a brief system description of the functions and components needed to accomplish the WFD program mission; these form the basis for the mission success criteria of the RAM analysis. It outlines the basic functional requirements for the transfers, the systems designated to meet those requirements, and relates them via the operational activities contained within the RAM model. HNF-1939, Vol. III (Rasmussen, 1998), *WFD System Description;* HNF-1939, Vol. IV (Carlson, 1999), *WFD Operations and Maintenance Concept;* and HNF-SD-WM-TRD-007, Rev. E Draft (Grenard, 1998), *System Specification for the Double-Shell Tank System* contain detailed system and function descriptions.

The DST facility includes six tank farms containing 28 DSTs. Five of the DST farms are located in the 200 East Area (241-AN, 241-AP, 241-AW, 241-AY, and 241-AZ), and one is located in the 200 West Area (241-SY). Currently, the preliminary RAM analysis involves only tanks 241-AN-105, 241-AZ-101, 241-AP-102, and 241-AP-104 and their supporting systems. Although the FY1999 baseline states that LAW feed will be delivered to tank 241-AP-106, this tank is operated by the privatization contractor, BNFL, and it is not covered in the preliminary RAM analysis.

2.2.1 *Facility and Process Functions Addressed by the Preliminary RAM Analysis*

The WFD Program mission is to retrieve low-activity and high-level tank waste and deliver it to a privatization contractor for immobilization through a vitrification process. Waste is moved among DSTs by transfer systems using transfer pumps, valve manifolds, jumpers, and underground pipelines. The waste is routed through valve and pump pits to its destination. A set of functions have been determined within *System Specification for the Double-Shell Tank System* (Grenard, 1998) for operation of the DST system. Figure 2-2 shows those functions addressed within this preliminary RAM analysis. Functions in the system specification, such as blending waste and transferring HLW to interim staging tanks, are not modeled in this preliminary RAM analysis, because they are not accomplished as part of the final qualification and transfer to BNFL, and are therefore outside the scope for this analysis. The DST facility architecture addressed within the preliminary RAM analysis is shown in Figure 2-3. Other facility systems have been determined to compose the overall DST system but are not applicable to this preliminary RAM analysis for the same reason stated for the WFD functions above. These include the maintenance and recovery system and the currently undefined waste sampling system.

For this preliminary RAM analysis, the HLW waste feed delivery functions involve mixing and sampling waste in source tank 241-AZ-101 for analysis and certification. Once agreement regarding certification is achieved, the waste is transferred in nine batches

directly to the privatization contractor. Each batch transfer must be completed within 30 days of the waste transfer day (WTD) requested by BNFL.

The LAW WFD functions involve preparing and transferring the LAW in 241-AN-105 to interim waste feed staging tanks 241-AP-102 and 241-AP-104. Each of these tanks is then sampled for analysis and certification. Once agreement regarding certification is achieved for the waste in a tank, the waste in that tank (241-AP-102 or 241-AP-104) must be transferred in one batch to BNFL within 30 days of the WTD requested by BNFL. In all cases, the safe storage function and adequate utility distribution must also be maintained during the qualification and delivery functions.

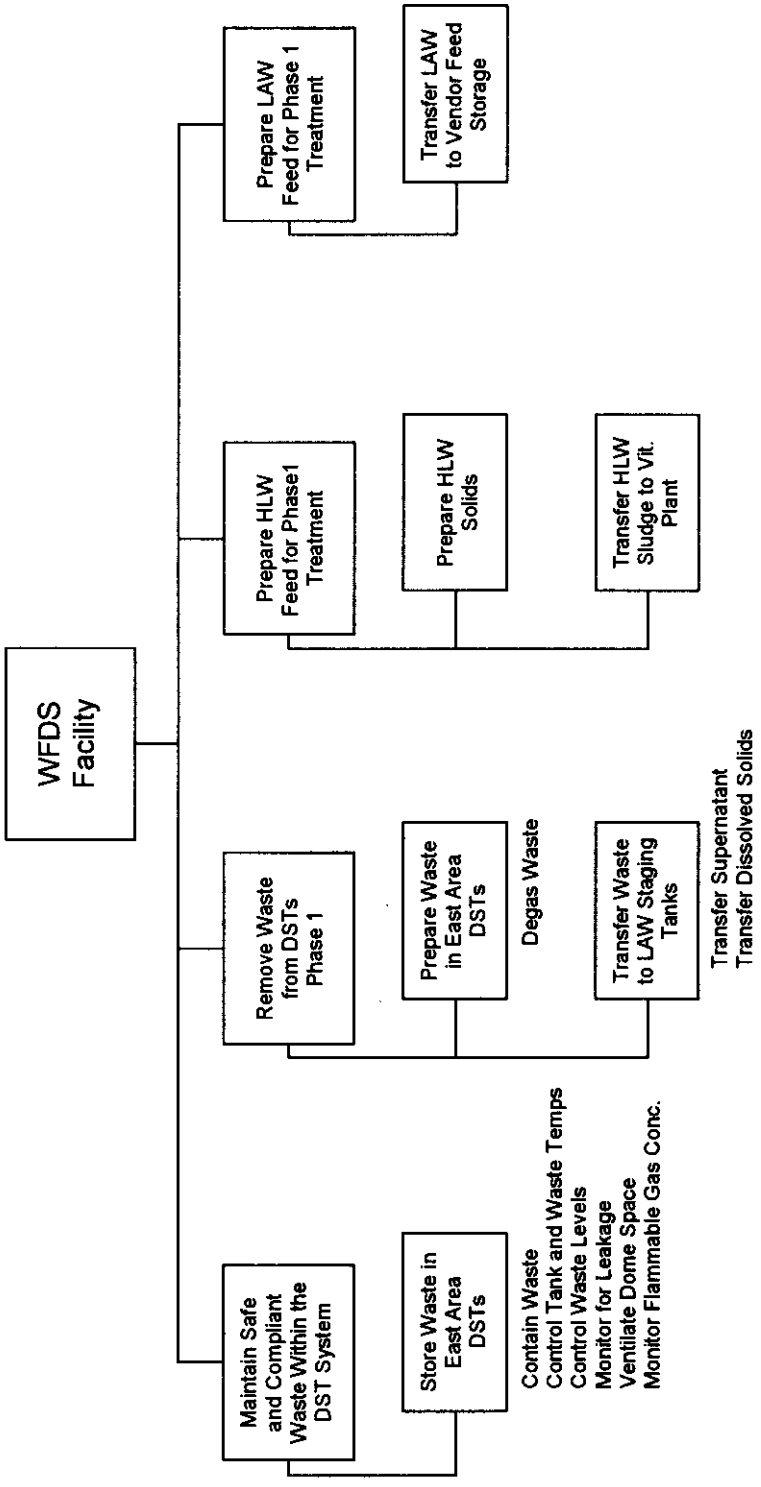

Figure 2-2. Waste Feed Delivery System Functional Hierarchy

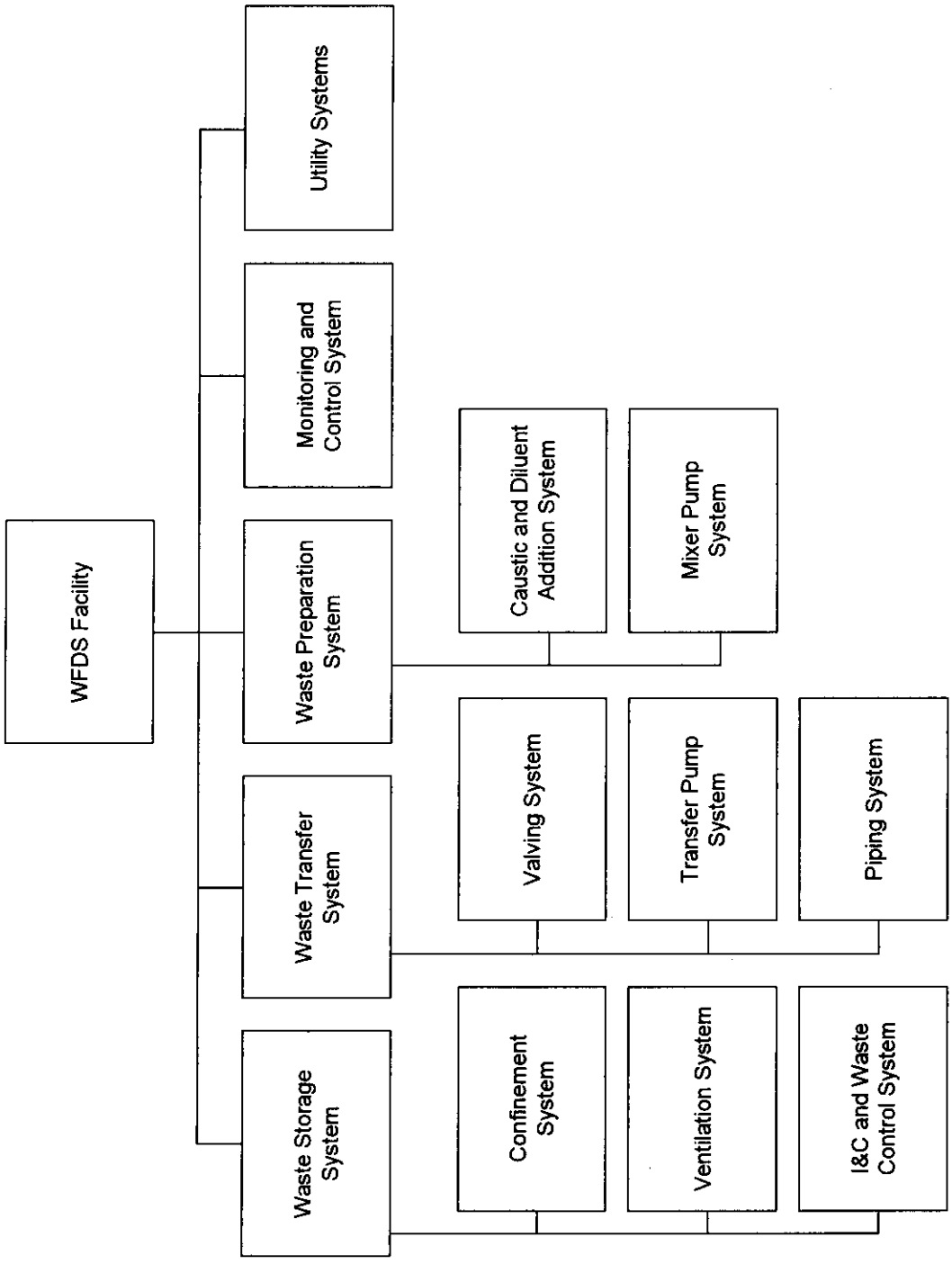

Figure 2-3. Waste Feed Delivery System Architecture Breakdown

2.2.2 *High Level Waste Qualification and Delivery Process Functions*

2.2.2.1 Activities Required for HLW Feed Delivery

The delivery of the entire 241-AZ-101 tank contents involves one qualification process and nine separate batch preparation and deliveries. Figure 2-4 shows the expected activities required to accomplish the various feed delivery functions. Table 2-1 shows the activities with their associated no-problem/no-failure times and how they are modeled within the preliminary RAM model. A description of the basic activities follows.

Feed Qualification

Feed qualification involves initial mixing of the high level liquid and solid fraction utilizing two mixer pumps installed in the tank. The mixing operation is designed to mobilize the sludge layer into the liquid fraction to create a homogeneous mixture. The process flowsheet assumes this mixing operation lasts five days, and that both of the mixer pumps will run for the entire five-day time period. Only one set of samples will be taken for the entire 241-AZ-101 delivery, and these samples will be used to certify the waste for all nine batch transfers.

Feed Delivery

Prior to each HLW batch transfer, it will be mixed for an estimated two-day period with two mixer pumps. This will resuspend the solids and provide a homogeneous mixture for transfer operations. The resuspension requires a shorter mixing duration than the initial mobilization for sampling, because mixing operations within the tank occur on a frequency that prevents reconsolidate on the bottom of the tank during the time between mixing operations. Waste feed is pumped from tank 241-AZ-101 through the 241-AZ-01A central pump pit, through the AZ valve pit directly to the BNFL receipt tank. It is expected that the mixing operation will continue during the waste transfer process as well in order to counteract the effects of particle settling within the waste during the actual transfer operation. The primary equipment required for the initial batch delivery includes the waste transfer pump and piping, in-line valves, piping and valve instrumentation, leak detectors, and other various I&C components. After each batch transfer operation, the line is flushed with at least one line volume, and no more than two line volumes of water that has been chemically adjusted to prevent corrosion.

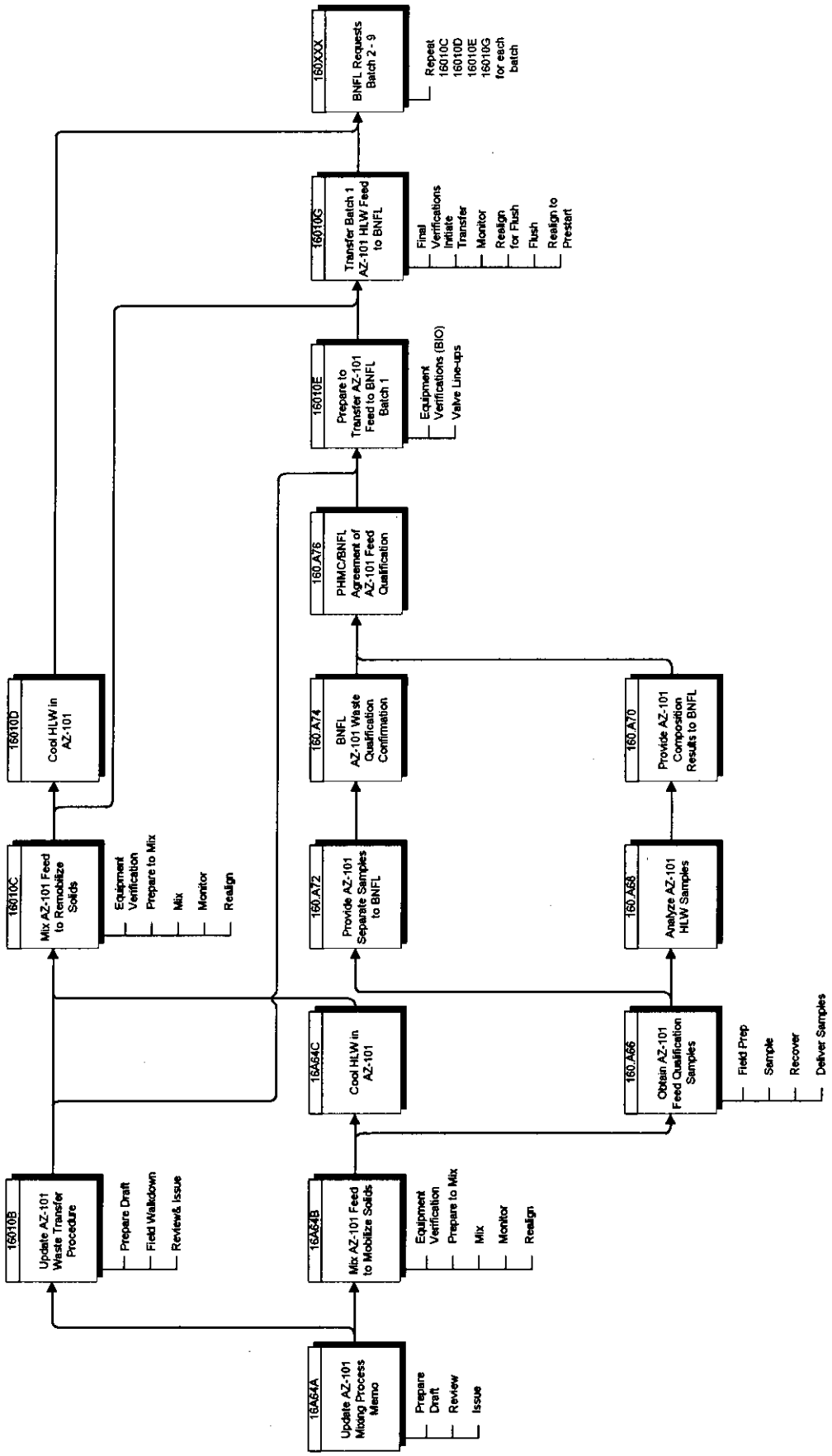

Figure 2-4. 241-AZ-101 HLW Activity Logic Diagram

Table 2-1. RAM Mission Profile for HLW Feed Delivery Operations

ACTIVITY CODE	ACTIVITY TITLE	P3 SCHEDULE DURATION (days)	RAM NPNF DURATION (hours)	Tank Farm Safety & Support Function (SA1 & SP1) Hours / Comments	RAM Delay Contributor?	Active NPNF Time (hours)	Active NPNF Pump Demands	NPNF Valve Demands	Remarks
AZ-101 Batch Qualification Activities									
16A64A	Update AZ-101 Mixing Process Memo	3	72	Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity	Safety/ Support System Carryover				Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity
16A64B	Mix AZ-101 Feed to Mobilize Solids	5	120	120	YES	120 for each pump	1 for each pump		Start on 7/1/2005. Two pumps operate for 5 days
160.A66	Obtain AZ-101 Feed Qualification Samples	7	96	96	YES	0	0	0	All samples can be obtained in 4 days. Safety and support system failures can stop sampling activities.
160.A68	Analyze AZ-101 HLW Feed Qualification Samples	60	1440	RAM Failures do not impact Schedule					
160.A70	Provide AZ-101 Composition Results to BNFL	14	336	RAM Failures do not impact Schedule					
16A64C	Cool HLW in AZ-101	22	0	Do not include in duration - in parallel with sample analysis					
160.A72	Provide AZ-101 Separate Sample to BNFL	7	0	Do not include in duration - in parallel with analysis					
160.A74	BNFL AZ-101 Waste Qualification Confirmation	60	0	Do not include in duration - in parallel with analysis					
160.A76	PHMC/BNFL Agreement of AZ-101 Feed Qualification	14	336	RAM Failures do not impact Schedule					
	Waiting for BNFL to request AZ-101 Batch 1 WTD	6/27/05	97.0	10/2/05					
		Schedule Start Date	NPNF days	Early Finish Date					
Transfer Activities Pinned to the WTD requested by BNFL and agreed to by DOE									
16010B	Update AZ-101 Waste Transfer Procedure	8		Do not include in duration - in parallel with other activities					
16010D	Cool HLW in AZ-101	22	120	120	YES	120			Model currently requires 5 days of active cooling to remove excess heat added by mixer pumps from previous batch. (generic batch)
16010C	Mix AZ-101 Feed to Remobilize Solids	2	24	24	YES	43 for each pump	1 for each pump	0	24 hours of mixing plus 19 hours of mixing during the transfer period. Both mixer pumps required to operate
16010E	Prepare to Transfer AZ-101 Feed to BNFL	5	6	Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity	Safety/Support Failure Carryover				Last 6 hours of preparation are assumed to occur on the WTD, which reduces pumping time before deadline
16010G	Transfer AZ-101 HLW Feed to BNFL Batch 1	2	19	19	YES	19	1	1	Use Batch 1 for generic quantity (maximum volume). Begin actual transfer on WTD (scheduled for 4/1/2006)
16010G	Flush		1	1	YES	1		1	
		03/26/06	7.0	4/2/06					
		Schedule Start Date	NPNF days	Early Finish Date					
	NPNF Time after WTD starts		26 hours						

Maintain Safe Storage

Safe storage functional requirements are maintained at all times. A particular function important to HLW feed delivery is to maintain waste temperature limits. The process flowsheet (Orme, 1999a) shows that the addition of heat from the mixer pumps to the waste results in the bulk waste temperature exceeding the Basis for Interim Operation limit. The preliminary RAM analysis assumes that five days of supplemental waste cooling will be required by both the annulus ventilation and the air lift circulators to remove the heat deposited in the waste during mixing. As succeeding batches are delivered, a smaller remaining volume of liquid waste and sludge may eventually result in the ability to transfer waste with no preliminary or post-transfer cooling. The basis for this assumption was derived from *Letter Report, Simulation of Tank 241-AZ-101 Mobilization Tests and TEMPEST Code Performance Evaluation - RET-093096*, by Z. I. Antoniak and K. P. Recknagle, September 30, 1996 (Antoniak, 1996). This document indicates that once the solids are initially mobilized, subsequent homogenization can be achieved on the order of an hour rather than days assumed in the process flow sheet for sampling purposes. Under these circumstances the importance of supplemental HVAC for cooling the waste between batches may decrease significantly, since the heat added by mixing is proportional to mixing time. These issues should be addressed more explicitly as the O&M concept for these transfers is clarified and the mixer pump testing is accomplished.

Other safety support items must function in the background to remain compliant with the safety basis published in the BIO (Jones, 1999). This includes the primary HVAC, the annulus HVAC, continuous air monitors, level instrumentation, and other related components. These components operate at all times and, if they fail, may delay schedule-related activities that are underway.

Support Utilities

Support equipment includes those systems that provide general utilities and services to allow other major items to function but do not necessarily provide a safety function. For this analysis, this includes electrical supply, raw water, process air, instrument air, and nitrogen gas. It is assumed that these systems must operate at all times, similar to safety support equipment.

2.2.2.2 *Hardware Required for HLW Feed Delivery*

This section provides a brief system description for completing HLW feed deliveries, maintaining safe storage, and providing supporting utility needs. Figure 2-5 provides an overview of the system configuration.

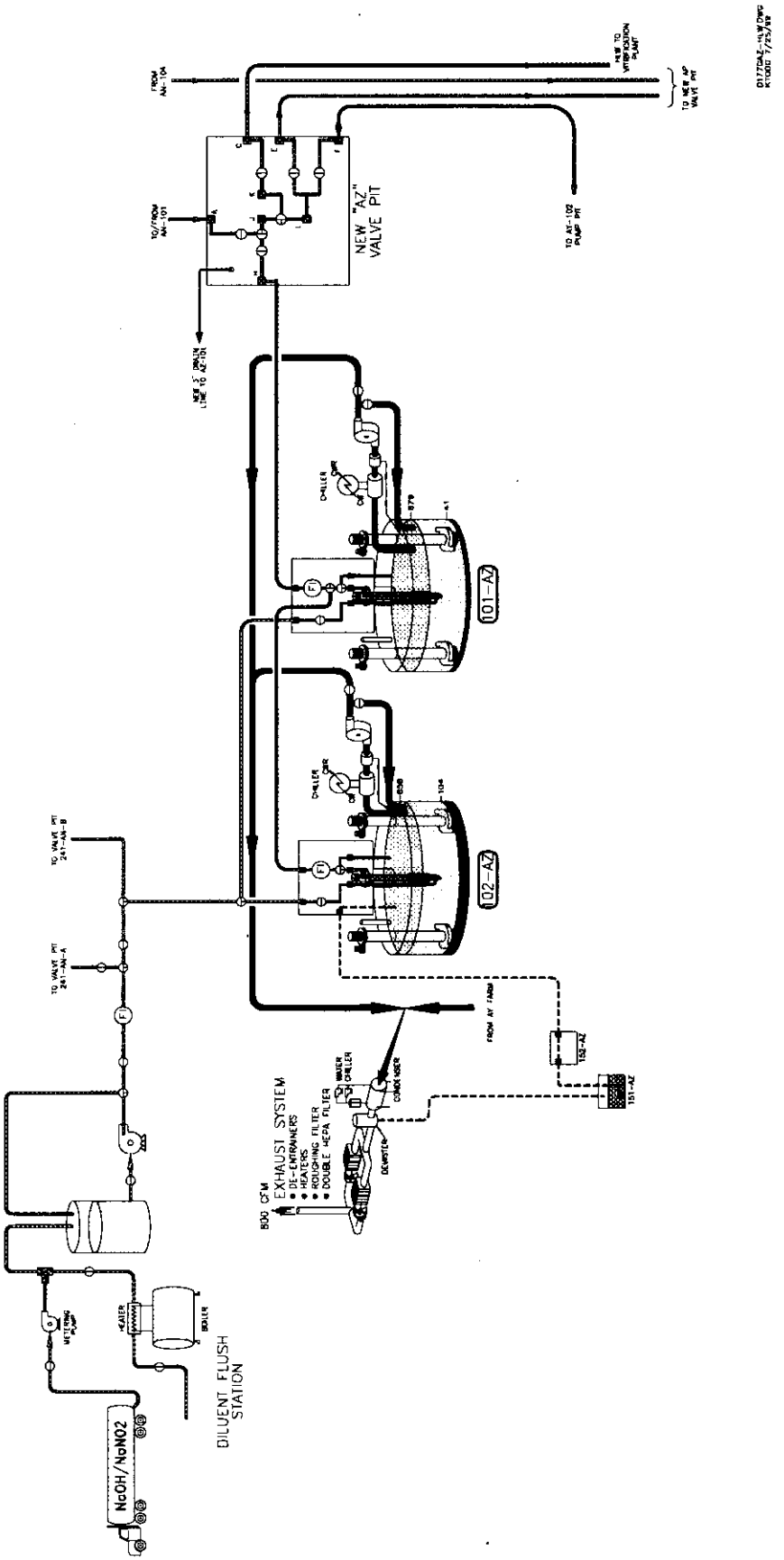

Figure 2-5. Schematic Depiction of the Systems Involved in HLW Feed Delivery Activities

Waste Transfer System

The waste transfer system is composed of the following:

- *Transfer Pump* – Tank 241-AZ-101 is equipped with one 60-hp transfer pump capable of pumping tank waste at 140 gallons per minute through a fixed intake. This pump provides the motive force for transporting waste materials from one tank to another. It is mounted in the central pump pit with a shaft and impeller unit extending into the tank. It is equipped with a variable frequency drive and performance monitoring equipment. It is also monitored and controlled by the master pump shutdown system. The transfer pump has a connection to the flush/dilution system to support flushing the pump after use, delivering flush solutions into transfer lines after completed transfers, and performing in-line dilution. In-line dilution is not required for the 241-AZ-101 delivery. The pump is supported by the electrical system for motor drive and the nitrogen system for pump seal containment. The transfer pump and its related components are modeled in the RAM model as part of the TRANSFER system.
- *Valving* – Transfer system valves provide the means to contain waste and route it to the intended location. They also support the controlled movement of flushing and dilution fluids within the transfer system. Valves are primarily three-inch ball valves and may be either manual or motor-operated (MOV). The valves are equipped with position switches and/or indicators mounted above grade. MOVs may also be operated manually if the motor should fail. The transfer system valves are connected to the master pump shutdown system to guard against misrouting of waste should they inadvertently change position. MOVs are supported by the electrical system. Transfer system valves are modeled in the RAM model as part of the TRANSFER system.
- *Piping* – Transfer system piping consists of three-inch carbon steel pipe runs in length up to 4,800 feet and pipe jumper segments within process valve pits. Jumper segments provide the mechanism to connect transfer pipe runs to transfer system components, flush/dilution system components, and other jumper segments through the use of jumper connectors. The piping system provides the confinement and route control mechanism to transport waste materials and flush/dilution fluids throughout the transfer system. Piping outside of valve pits is double contained with leak detection capability. Within valve pits, jumpers are single wall segments with the pit itself acting as the secondary containment. Within jumper segments there are various process control interfaces such as flow meters, pressure sensors, rupture disks, and densitometers. Piping for supporting systems (e.g., raw/service water) is modeled as belonging to those systems. Transfer system piping is modeled in the RAM model as part of the TRANSFER system.
- *Mixer Pumps* – Tank 241-AZ-101 is provided with two mixer pumps. The mixer pumps provide the mechanism for mobilizing the solids in this tank. Each pump is provided with a 300-hp motor and turntable assembly mounted above the tank in the pump/valve pit. A shaft and impeller unit extends into the waste with the intake just above the tank bottom and the discharge unit approximately one foot above the bottom. The pump has the capacity to discharge at 5,000 gallons per minute through each of two nozzles. The turntable assembly allows the pump to

be rotated so that full 360-degree mixing can be achieved. During operations, the mixer pumps are monitored for vibration, bearing temperature, motor speed and amperage, discharge pressure, and nozzle position. The 241-AZ-101 mixer pumps are operated and monitored from a remote location in building 241-AZ-156. They do not directly interface with other primary systems and are not connected to the master pump shutdown system. They are supported by the electrical system for motor power and monitoring and the flush dilution system for filling the pump column with filtered water and for seal containment. The mixer pumps are modeled in the RAM model as part of the TRANSFER system.

- *Dilution/Flush* – The AZ flush dilution system provides both service water and chemically-adjusted water for waste dilution and transfer system flushing. The system also provides the means to provide caustic delivery in order to adjust the chemical composition of the tank wastes. Waste dilution or chemical composition adjustment is not required for the delivery of 241-AZ-101 tank wastes. The system is composed of a service water skid to supply filtered raw water to a local boiler for heating as required. Water is pumped from the boiler to a static mixer for chemical adjustment and then fed into a 5,000-gallon lag storage tank where the required temperature is maintained until the solution is required. If chemicals are needed, they are supplied through a chemical metering pump skid into the static mixer as well. When needed, flush/dilution solutions are delivered with a 40-hp pump. The flush/dilution system is operated from the 241-AZ-156 building and provides flush/dilution support to the AZ, AY, and AN tank farms.

Confinement System (Specific to HLW Feed Delivery)

The confinement system is composed of the 241-AZ-101 tank itself and its associated pump and valve pits. For the purposes of this preliminary RAM analysis, confinement means confinement of liquid waste materials and does not include HVAC confinement. Also included in this system are the valve pits along the transfer path. Within the RAM model, only the waste tank is modeled and is contained in the TRANSFER system. The valve pits provide secondary confinement, which is not challenged unless leakage from the primary boundary occurs. For the purpose of schedule delay estimation, operations are assumed to be halted if the primary boundary is breached.

Ventilation System

The ventilation system consists of the following:

- *HVAC Primary* – The 241-AZ-101 Primary HVAC system maintains a negative air pressure within the tank to control radiological air emissions and serves as the primary motive force for removing heat from the dome space of the tank. The primary ventilation system consists of individual tank air inlets and filters, an exhaust condenser and high-efficiency mist eliminator, redundant primary exhaust fans and filter banks, and an exhaust stack with radiological sampling equipment. Each filtration bank provides an electric heater, high-efficiency particulate filters, and a high-efficiency gas absorber filter. The exhaust fans pull exhaust air from the ventilation condenser cooling recirculation return air stream. The exhaust and filter bank fans provide a manual switchover redundancy

capability in case of a loss of one train of exhaust filters or exhaust fan. The primary HVAC components are modeled in the RAM model as the HVAC PRIMARY system.

- *HVAC Annulus* – The annulus HVAC system provides a waste cooling function, a secondary leak detection function, and a radiological emissions function should a leak into the annulus occur. Much of the heat generation within tank 241-AZ-101 occurs in the solids layer that has settled to the bottom of the tank. After the initial mixing and settling of the waste prior to each transfer, it is necessary to provide cooling in order to ensure the waste remains below BIO temperature limits. Leak detector probes that serve as the primary leak detection mechanism are available within the tank annulus. However, the backup capability is provided by the annulus HVAC continuous air monitor, which requires annulus HVAC flow in order to operate. Annulus HVAC components are modeled in the RAM model as the HVAC ANNULUS system.
- *Ventilation Condenser Cooling* – The ventilation condenser cooling system takes exhaust tank air, cools it, and returns a portion to the source tank. The remaining portion of exhaust air is diverted to the primary ventilation exhaust. If cooling is not needed, then the recirculation fan is cycled to the off position. The ventilation condenser cooling system is modeled in the RAM model as the VENT CONDENSER COOLING system.
- *Recirculation Condenser Cooling* – The recirculation condenser cooling system provides closed loop secondary cooling for the ventilation condenser cooling fluid. The recirculation condenser cooling system is modeled in the RAM model as the RECIRC COND COOLING system.
- *Air Lift Circulators (Service Air)* – The air lift circulator system provides an additional mechanism for cooling the high-level waste within tank 241-AZ-101. It is comprised mainly of a series of 22 pipes at two different heights that supply service air into the tank waste. The air bubbles up through a guide pipe mounted in the tank that circulates the local waste to the top of the waste level and transfers the heat to the dome space. Each air supply line also has a water flush capability should the air line become plugged. The air lift circulator system is modeled within the SERVICE AIR system in the RAM model.

Instrumentation and Control

Instrumentation and control consists of the following:

- *Monitoring Instrumentation* – The I&C system provides monitoring capabilities within the tank system for safe storage capabilities. This primarily includes waste temperature, tank pressure, tank level, leak detection, and radiation monitors. All monitors and detectors are monitored from a central control station or farm-specific control building. The leak detection system interface with the transfer system also provides an input to the master pump shutdown system. In most cases, these components are modeled in the RAM model as the MONITORING system.
- *Monitoring and Control (Process)* – The monitoring and control system contains process-related instrumentation related to the transfer of waste materials. This includes flow meters, pressure monitors, rupture disks, and densitometers.

These indicators are monitored from either a central control room or a farm-specific control building. In most cases, they are modeled within the RAM model as the INSTRUMENTATION system.

Utility Systems

The following utilities are modeled in the preliminary RAM analysis. When the system is an integral part of a tank system, such as a service water connection to a mixer pump, the individual components were included. The supply of the system product itself was modeled as a system block. For example, the electrical distribution system was modeled as a system block while leak detector relays were modeled individually.

Utility System	Systems Supported
Electric Power	All Systems
Instrument Air	I&C; Ventilation; Monitoring Instrumentation
Nitrogen	Transfer Pump
Process Air	Instrument Air; Air Lift Circulators
Raw/Service Water	Flush/Dilution Mixer Pumps; Air Lift Circulators; Ventilation Condenser Cooling

2.2.3 *Low Activity Waste Qualification and Delivery Process Functions*

2.2.3.1 Activities Required for LAW Feed Delivery

The preliminary RAM analysis performed and described herein includes activities necessary to accomplish the waste transfers from tank 241-AN-105 to the privatization contractor tank 241-AP-106. The starting and ending point of these activities are derived from the *Waste Feed Delivery Technical Basis*, HNF-1939-Vol. II, Revision 0c Draft, Waste Feed Delivery Flowsheet for Tank 241-AN-105, (Orme, 1999b). This document describes the latest process information to meet delivery requirements for tank 241-AN-105 to meet Envelope A constraints. The basic outline of activities requires delivering the waste from the source tank to two interim staging tanks using two separate deliveries. The first delivery requires a degassing process to release retained gasses. This is followed by a decanting of the concentrated supernatant using in-line dilution. The second transfer is made with a diluent addition and salt dissolution process as its preparatory step. The transfer is made without further in-line dilution to the second interim tank. The waste staged in both interim tanks is sampled and analyzed to verify Envelope A qualifications and then transferred in two separate transfers to the vitrification contractor's tank.

The functional boundaries for the LAW feed delivery process are shown in Figure 2-6. This figure shows the expected activities to accomplish the various feed delivery functions. Table 2-2 shows the activities with their associated no-problem/no-failure times and how they are modeled within the RAM model. A description of the basic activities follows.

Degassing

Degassing involves the use of the mixer pumps to disturb the settled solids enough to release retained flammable gasses. The mixer pumps are operated sequentially for a short duration over the course of days in order to induce the release of limited quantities of flammable gasses at any one time, and to limit the disturbance of the settled solid materials. This is extremely important because the resettling time of solids in the tank is uncertain.

Settling

Following degassing, the disturbed solids in the tank are allowed to settle for 30 days. Settling of undissolved and insoluble solids is required after the degassing operation to minimize the amount of solids included with the LAW transfers. This is consistent with feed delivery specifications within the BNFL ICDs and the need to prevent line plugging due to solids collection in transfer lines. The settling operation requires only the functioning of safe storage components such as HVAC and support systems. Failures that occur during the later part of the 30-day settling period could delay the scheduled decanting. The dynamic modeling of exposure discussed in Section 2.3.3 accounts for these potential delays.

Decanting

Decanting the waste involves transferring the supernatant from tank 241-AN-105 to tank 241-AP-102 using in-line dilution. Tank 241-AP-102 serves as an interim waste staging tank, where samples are taken for final qualification to meet delivery specifications. Appendix F, Table F-1, shows estimates of waste volumes involved in the decanting operations, based on the process flowsheet (Orme, 1999b). Based on the flowsheet, approximately 790,000 gallons are decanted to 241-AP-102. The exact amount of waste that can be transferred will ultimately depend on the level of the resulting sludge layer after the degassing operation.

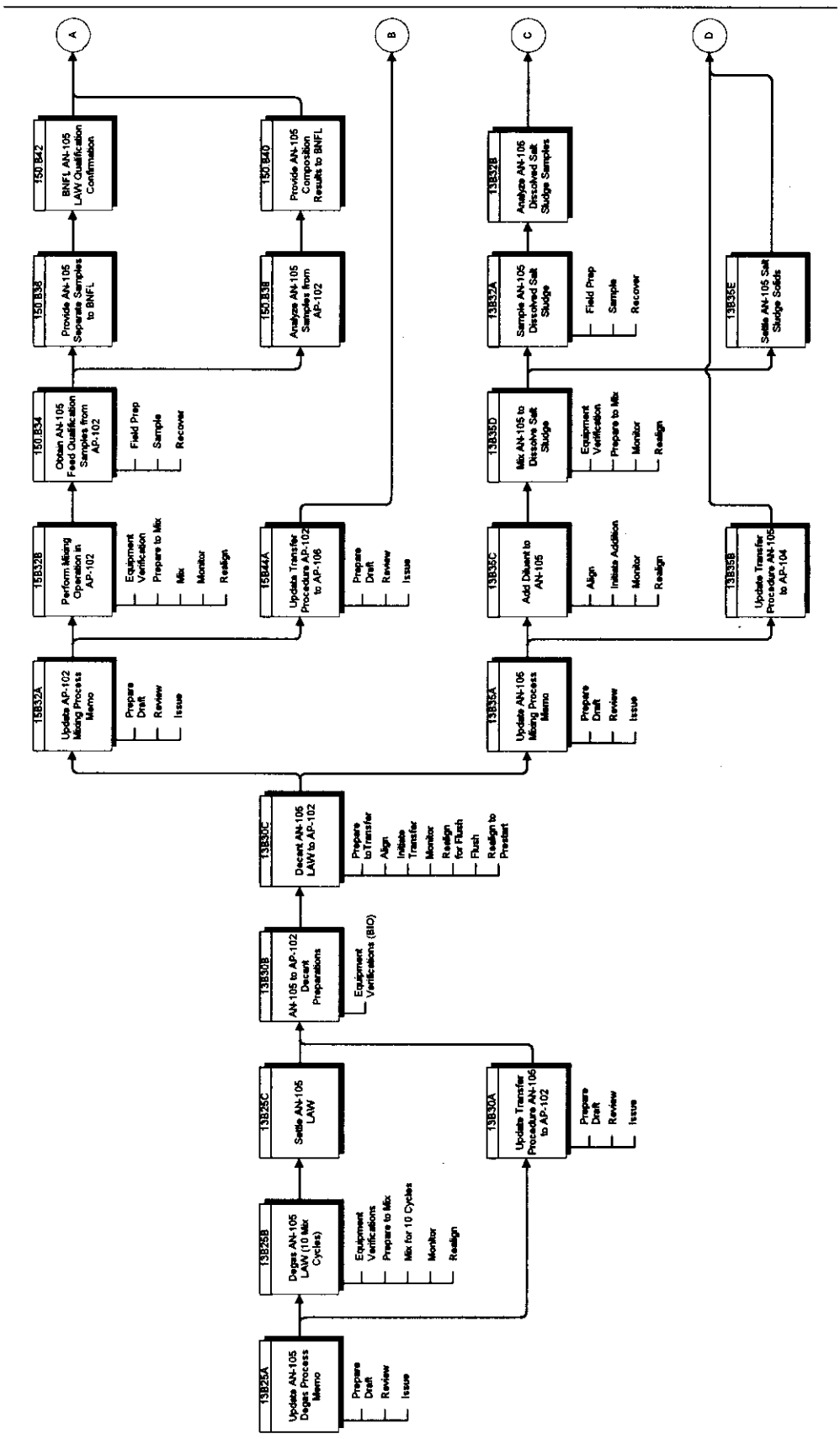

Figure 2-6. 241-AZ-101 LAW Activity Logic Diagram

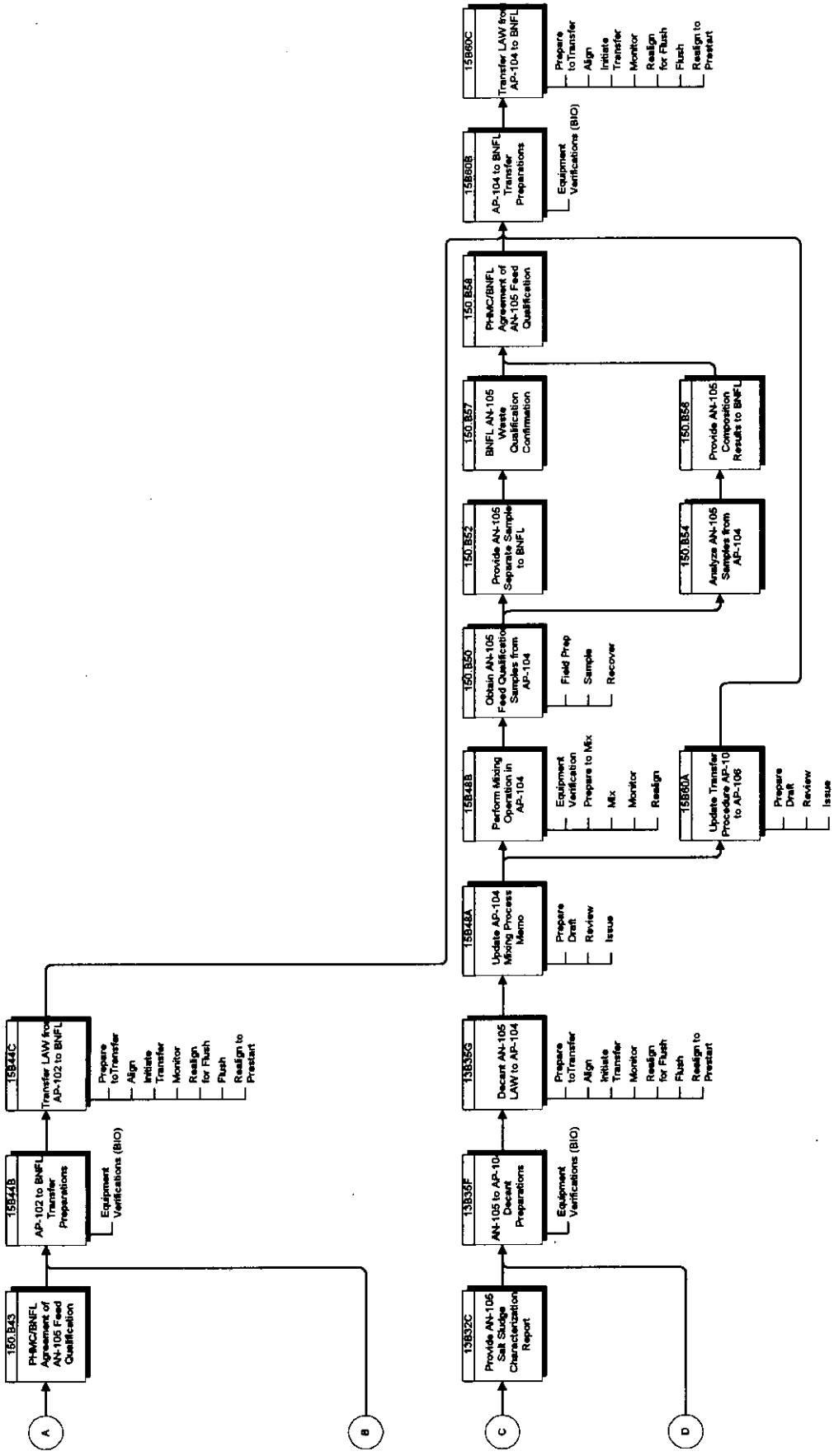

Figure 2-6. 241-AZ-101 LAW Activity Logic Diagram (continued)

Table 2-2. RAM Mission Profile for LAW Feed Delivery Operations

ACTIVITY CODE	ACTIVITY TITLE	P3 SCHEDULE DURATION (days)	RAM NPNF DURATION (hours)	Tank Farm Safety & Support Function (SA1 & SP1) Hours / Comments	RAM Delay Contributor?	Active NPNF Time (hours)	Active NPNF Pump Demands	NPNF Valve Demands	Remarks
Activities Common to Both AP-102 and AP-104 Batches									
13B25A	Update AN-105 Degas Process Memo	3	72	Partial, Depending on Failure Mode Recovery Duration	Safety/ Support System Carryover				Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity
13B25B	Degas AN-105 LAW (10 Cycles)	11	264	264	YES	2.94 per pump	5 per pump		10 individual pump demands, 5 for each mixer pump: 8 for 24 minutes each and 2 for 80 minutes each for a total exposure time of 5.87 hours
13B25C	Settle AN-105 LAW	30	720	Safety and support failures during this activity can be recovered without impacting schedule					
13B30A	Update Transfer Procedure AN-105 to AP-102	8	0	Do not include in duration - in parallel with 13B25C					
13B30B	AN-105 to AP-102 Decant Preparations	5	120	Partial, Depending on Failure Mode Recovery Duration	Safety/ Support System Carryover				Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity
13B30C.1	Decant AN-105 LAW to AP-102	5	94	Supernate and Diluent	YES	94	1	2	
13B30C	Flush	0	1	Included w/transfer	YES	1	1	2	
		5/29/07	53.0	7/20/07					
		Schedule Start Date	NPNF days	Early Finish Date					
AP-102 Qualification for Batch Transfer to BNF									
15B32A	Update AP-102 Mixing Process Memo	3	72	Partial, Depending on Failure Mode Recovery Duration	Safety/ Support System Carryover				Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity
15B32B	Perform Mixing Operation in AP-102	1	24	24	YES	24	1		
150.B34	Obtain AN-105 Feed Qual Samples from AP-102	5	24	24	YES				All samples can be obtained in 1 day. SASP failures can stop sampling activities
150.B36	Provide AN-105/AP-102 Separate Samples to BNFL	7	0	Do not include in duration - in parallel with analysis					
150.B38	Analyze AN-105 Samples from AP-102	60	1440	RAM Failures do not impact Schedule					
150.B40	Provide AN-105/AP-102 Composition Results to BNFL	14	336	RAM Failures do not impact Schedule					
150.B42	BNFL AN-105/AP-102 LAW Qualification Confirmation	60	0	Do not include in duration - in parallel with analysis					
150.B43	PHMC/BNFL Agreement of AN-105/AP-102 Feed Qualification	14	336	RAM Failures do not impact Schedule					
		7/22/07	93.0	10/23/07	Wait for BNFL to request batch delivery				
		Schedule Start Date	NPNF days	Early Finish Date					

Table 2-2. RAM Mission Profile for LAW Feed Delivery Operations (continued)

ACTIVITY CODE	ACTIVITY TITLE	P3 SCHEDULE DURATION (days)	RAM NPNF DURATION (hours)	Tank Farm Safety & Support Function (SA1 & SP1) Hours / Comments	RAM Delay Contributor?	Active NPNF Time (hours)	Active NPNF Pump Demands	NPNF Valve Demands	Remarks
Dissolution of Salt Sludges in AN-105 Prior to Transfer to AP-104 (Can follow immediately after common activities)									
13B35A	Update AN-105 Mixing Process Memo	3	72	Partial, Depending on Failure Mode Recovery Duration	Safety/ Support System Carryover				Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity
13B35B	Update Transfer Procedure AN-105 to AP-104	8	0	Do not include in duration - in parallel with sludge preparation and charectenzation activities, which are longer					
13B35C	Add Diluent to AN-105	2	31	31	YES	31	1	2	
13B35D	Mix AN-105 to Dissolve Salt Sludge	6	144	144	YES	120	1		NPNF Duration includes one day of set up time
13B35E	Settle AN-105 Salt Sludge Solids	30	0	Do not include in duration - in parallel with sludge dissolution characterization activities, which are longer					
13B32A	Sample AN-105 Dissolved Salt Sludge	5	24	24	YES	0	0	0	All samples can be obtained in 1 day. SASP failures can stop sampling activities.
13B32B	Analyze AN-105 Dissolved Salt Sludge Samples	60	1440	RAM Failures do not impact Schedule					
13B32C	Provide AN-105 Salt Sludge Characterization Report	14	336	RAM Failures do not impact Schedule					
	Waiting for availability of AP-104	7/22/07	86.3	10/15/07					
		Schedule Start Date	NPNF days	Early Finish Date					
Transfer to AP-104 and Qualification for Batch Transfer to BNFL									
13B35F	AN-105 to AP-104 Decant Preparations	5	120	Partial, Depending on Failure Mode Recovery Duration	Safety/ Support System Carryover				Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity
13B35G1	Decant AN-105 LAW to AP-104	5	80	80	YES	80	1	2	Begin actual transfer on AP-104 Availability Date
13B35G2	Flush	0	1	Included w/transfer	YES	1	1	2	
15B48A	Update AP-104 Mixing Process Memo	3	72	Partial, Depending on Failure Mode Recovery Duration	Safety/ Support System Carryover				Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity
15B48B	Perform Mixing Operation in AP-104	1	24	24	YES	24	1	0	
150.B50	Obtain AN-105 Feed Qual Samples from AP-104	5	24	24	YES	0	0	0	All samples can be obtained in 1 day. SASP failures can stop sampling activities.
150.B52	Provide AN-105/AP-104 Separate Sample to BNFL	7	0	Do not include in duration - in parallel with analysis					
150.B54	Analyze AN-105/AP-104 Samples from AP-104	60	1440	RAM Failures do not impact Schedule					
150.B56	Provide AN-105/AP-104 Composition Results to BNFL	14	336	RAM Failures do not impact Schedule					
150.B57	BNFL AN-105/AP-104 Waste Qualification Confirmation	60	0	Do not include in duration - in parallel with analysis					
150.B58	PHMC/BNFL Agreement of AN-105/AP-104 Feed Qualification	14	336	RAM Failures do not impact Schedule					
	Waiting for BNFL to request AP-104 batch WTD	4/25/08	101.4	8/4/08	AP-104 assumed to be available on May 1, 2008				
		Schedule Start Date	NPNF days	Early Finish Date					

Table 2-2. RAM Mission Profile for LAW Feed Delivery Operations (continued)

ACTIVITY CODE	ACTIVITY TITLE	P3 SCHEDULE DURATION (days)	RAM NPNF DURATION (hours)	Tank Farm Safety & Support Function (SA1 & SP1) Hours / Comments	RAM Delay Contributor?	Active NPNF Time (hours)	Active NPNF Pump Demands	NPNF Valve Demands	Remarks
Transfer Activities Pinned to the WTD requested by BNFL and agreed to by DOE									
15B44A	Update Transfer Procedure AP-102 to AP-106	8	0	Do not include in duration - in parallel with other activities					
15B44B	AP-102 to BNFL Transfer Preparations	5	6	Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity	Safety/Support Failure Carryover				Last 6 hours of preparation are assumed to occur on the WTD, which reduces pumping time before deadline
15B44C	Transfer LAW from AP-102 to BNFL	5	91	91	YES	91	1	2	Begin actual transfer on WTD (scheduled for 11/1/2008)
15B44C	Flush	0	1	1	YES	1	1	2	
		11/1/08	4.1	11/5/08	Start preparations five days prior to WTD				
		WTD Date	NPNF days	Early Finish Date					
Transfer Activities Pinned to the WTD requested by BNFL and agreed to by DOE									
15B60A	Update Transfer Procedure AP-104 to AP-106	8	0	Do not include in duration - in parallel with other activities					
15B60B	AP-104 to BNFL Transfer Preparations	5	6	Allow for failures of safety and support systems where recovery can delay the start of an O&M field activity	Safety/Support Failure Carryover				Last 6 hours of preparation are assumed to occur on the WTD, which reduces pumping time before deadline
15B60C	Transfer LAW from AP-104 to BNFL	5	77	77	YES	77	1	2	Begin actual transfer on WTD (scheduled for 7/1/2009)
15B60C	Flush	0	1	1	YES	1	1	2	
		7/1/09	3.5	7/4/09	Start preparations five days prior to WTD				
		WTD Date	NPNF days	Early Finish Date					
	NPNF Time after WTD starts	84 hours							

Salt Sludge Dissolution

The remaining salt sludge solids within tank 241-AN-105 are dissolved by the addition of raw water followed by a seven-day mixing period. The preliminary RAM analysis assumes that waste temperature limits as outlined in the Basis for Interim Operations (Jones, 1999) will not be exceeded by this mixing operation. This is also consistent with the current draft of the process flowsheet.

Decanting

This decanting step will transfer the remaining tank volume, minus a designated heel, to tank 241-AP-104, where the waste will be sampled so that it can be analyzed for qualification purposes. Since the waste was previously diluted for the purposes of dissolving the salt sludge, it will not require in-line dilution.

Mixing and Sampling

The waste staged in both tanks 241-AP-102 and 241-AP-104 will be mixed for a short period to ensure complete homogeneity and then sampled for final feed specification qualification.

Feed Delivery

Once the waste has been verified to meet specifications, each tank will be transferred to the BNFL LAW feed tank (241-AP-106) according to the contract requirements and the transfer schedule. This is accomplished in one batch transfer for each tank with no further dilution.

Maintain Safe Storage

Safe storage functional requirements are maintained at all times. This includes monitoring tanks for leaks, level, temperature, pressure, and other parameters. Other safety support items are those components that must function in the background to remain compliant with the safety basis published in the BIO (Jones, 1999). This includes the primary HVAC, the annulus HVAC, continuous air monitors, level instrumentation, and other related components. These components operate at all times, and if they fail, may delay schedule-related activities that are underway.

Support Utilities

Support equipment includes those systems that provide general utilities and services to allow other major items to function but do not necessarily provide a safety function. For this analysis, this includes electrical supply, raw water, process air, instrument air, and nitrogen gas. It is assumed that these systems must operate at all times, similar to safety support equipment.

2.2.3.2 *Hardware Required for LAW Feed Delivery*

This section provides a brief system description for completing LAW feed deliveries, maintaining safe storage, and providing supporting utility needs. Figure 2-7 provides an overview of the system configuration.

Waste Transfer System

The waste transfer system consists of the following:

- *Transfer Pump* – Tank 241-AN-105 is equipped with one 60-hp transfer pump capable of pumping tank waste at 140 gallons per minute through a flexible intake. This pump provides the motive force for transporting waste materials from one tank to another. It is mounted in the central pump pit with a shaft and impeller unit extending into the tank. The pump is equipped with a flexible suction intake that allows positioning of the pump intake at a level that avoids transferring solids during the initial saturated supernatant decanting. The intake is positioned with a winch and cable assembly mounted above the central pump pit. The pump is equipped with a variable frequency drive and performance monitoring equipment. It is also monitored and controlled by the master pump shutdown system. The transfer pump has a connection to the flush/dilution system to support flushing the pump after use, delivering flush solutions into transfer lines after completed transfers, and performing in-line dilution. The pump is supported by the electrical system for motor drive and nitrogen system for pump seal containment. The transfer pump and its related components are modeled in the RAM model as part of the TRANSFER system.
- *Valving* – Transfer system valves provide the means to contain waste and route it to the intended location. They also support the controlled movement of flushing and dilution fluids within the transfer system. Valves are primarily three-inch ball valves and may be either manual or motor-operated. The valves are equipped with position switches and/or indicators mounted above grade. MOVs may also be operated manually if the motor should fail. The transfer system valves are connected to the master pump shutdown system to guard against misrouting of waste should they inadvertently change position. MOVs are supported by the electrical system. Transfer system valves are modeled in the RAM model as part of the TRANSFER system.
- *Piping* – Transfer system piping consists of three-inch carbon steel pipe runs in lengths up to 3,300 feet, and pipe jumper segments within process valve pits. Jumper segments provide the mechanism to connect transfer pipe runs to transfer system components, flush/dilution system components, and other jumper segments through the use of jumper connectors. The piping system provides the confinement and route control mechanism to transport waste materials and flush/dilution fluids throughout the transfer system. Piping outside of valve pits is double contained with leak detection capability. Within valve pits, jumpers are single wall segments with the pit itself acting as the secondary containment. Within jumper segments there are various process control interfaces such as flow meters, pressure sensors, rupture disks, and densitometers. Piping for supporting systems is modeled as belonging to those systems. Transfer system piping is modeled in the RAM model as part of the TRANSFER system.

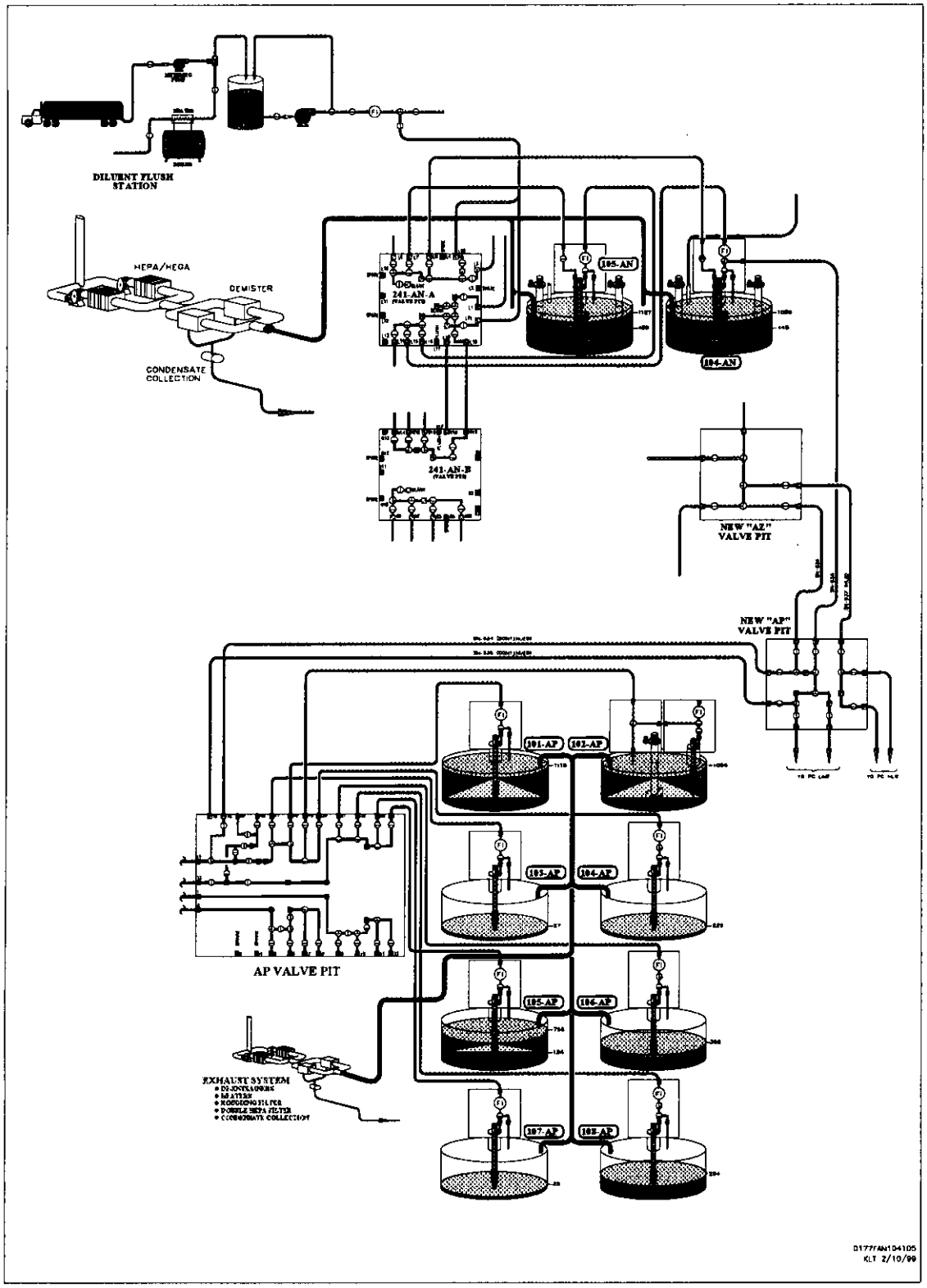

Figure 2-7. Schematic Depiction of the Systems Involved in LAW Feed Delivery Activities

- *Mixer Pumps* – Tank 241-AN-105 is provided with two mixer pumps. The mixer pumps provide the mechanism for mobilizing and dissolving solids within the tanks. Each pump is provided with a 300-hp motor and turntable assembly mounted above the tank in the pump/valve pit. A shaft and impeller unit extends over 40 feet into the waste with the intake just above the tank bottom and the discharge unit approximately one foot above the bottom. The pump has the capacity to discharge at 5,000 gallons per minute through each of two nozzles. The turntable assembly allows the pump to be rotated so that full 360-degree mixing can be achieved. During operations, the mixer pumps are monitored for vibration, bearing temperature, motor speed and amperage, discharge pressure, and nozzle position. The 241-AN-105 mixer pumps are operated and monitored from a remote location in building 241-AZ-156. They do not directly interface with other primary systems and are not connected to the master pump shutdown system. They are supported by the electrical system for motor power and monitoring and the flush dilution system for filling the pump column with filtered water and for seal containment. The mixer pumps are modeled in the RAM model as part of the TRANSFER system.
- *Dilution/Flush* – The AN flush dilution system provides both service water and chemically-adjusted water for waste dilution and transfer system flushing. The system also provides the means to provide caustic delivery in order to adjust the chemical composition of the tank wastes. Adjusting the chemical composition by caustic delivery is not required for decanting 241-AN-105 LAW waste. The system is composed of a service water skid to supply filtered raw water to a local boiler for heating as required. Water is pumped from the boiler to a static mixer for chemical adjustment and then fed into a 5,000-gallon lag storage tank where the required temperature is maintained until the solution is required. If chemicals are needed, they are supplied through a chemical metering pump skid into the static mixer as well. When needed, flush/dilution solutions are delivered with a 40-hp pump. The flush/dilution system is operated from the 241-AZ-156 building and provides flush/dilution support to the AZ, AY, and AN tank farms.

Confinement System (Specific to LAW Feed Delivery)

The confinement system is composed of the 241-AN-105, 241-AP-102, and 241-AP-104 tanks and its associated pump and valve pits. Also included in this system are the valve pits along the transfer path. Within the RAM model, only the waste tank is modeled and is contained in the TRANSFER system. As with the HLW system, the confinement system is meant to address liquid waste confinement and the HVAC system is not included here.

Ventilation System

The ventilation system consists of the following:

- *HVAC Primary* – The 241-AN-105, 241-AP-102, and 241-AP-104 primary HVAC systems maintain a negative air pressure within the tank to control radiological air emissions and serves as the primary motive force for removing heat from the dome space of the tank. The primary ventilation system consists of individual tank air inlets and filters, redundant primary exhaust fans and filter banks, and

exhaust towers with radiological sampling equipment. The fans and filter banks provide a manual switchover redundancy capability in case of a loss of one train of exhaust. The primary HVAC components are modeled in the RAM model as the HVAC PRIMARY system.

- *HVAC Annulus* – The 241-AN-105, 241-AP-102, and 241-AP-104 annulus HVAC systems provide a secondary leak detection function and a radiological emissions function should a leak into the annulus occur. Leak detector probes that serve as the primary leak detection mechanism are available within the tank annulus. However, the backup capability is provided by the annulus HVAC constant air monitor, which requires annulus HVAC flow in order to operate. Annulus HVAC components are modeled in the RAM model as the HVAC ANNULUS system.

Instrumentation and Control

Instrumentation and control consists of the following:

- *Monitoring Instrumentation* – The I&C system provides monitoring capabilities within the tank system for safe storage capabilities. This primarily includes waste temperature and tank pressure, and leak detection, radiation monitors, flammable gas monitors and tank level monitors. All monitors and detectors are monitored from a central control station or farm-specific control building. The leak detection system interface with the transfer system also provides an input to the master pump shutdown system. In most cases, these components are modeled in the RAM model as the MONITORING system.
- *Monitoring and Control (Process)* – The monitoring and control system contains process-related instrumentation related to the transfer of waste materials. This includes flow meters, pressure monitors, rupture disks, and densitometers. These indicators are monitored from either a central control room or a farm-specific control building. In most cases, they are modeled within the RAM model as the INSTRUMENTATION system.

Utility Systems

The following utilities are modeled in the preliminary RAM analysis. When the system is an integral part of a tank system, such as a service water connection to a mixer pump, the individual components were included. The supply of the system product itself was modeled as a system block. For example, the electrical distribution system was modeled as a system block while leak detector relays were modeled individually.

Utility System	Systems Supported
Electric Power	All Systems
Instrument Air	I&C; Ventilation; Monitoring Instrumentation
Nitrogen	Transfer Pump
Process Air	Instrument Air
Raw/Service Water	Flush/Dilution Mixer Pumps

2.2.4 *Definition of Quantitative RAM Model Scope*

2.2.4.1 Activities and Equipment Included

A graded approach is used to focus the quantification on equipment and activities that influence the system's ability to deliver waste to the privatization contractor within the specified contractual window. Activities and equipment that satisfy the following criteria are quantitatively modeled in the preliminary RAM analysis:

- "Front line" equipment in the transfer path that performs specific functions during the transfer process.
- Support systems that must be available in order for the front line equipment to function successfully, as delineated in Section 2.2.3. For systems that provide support to a variety of SSCs within the Tank Farms, the required overall RAM parameters are estimated based on available evidence. Only those subsystems and components that are designated to support solely the three transfer functions are explicitly modeled in the preliminary RAM analysis.
- Process control activities, including equipment, instruments, and operator actions, for which an associated failure or error will lead directly to shutdown of a time-critical function.
- External SSCs and signals that must be verified to be operating in order to justify acceptable conditions for operation. Equipment and activities not directly associated with the transfer, but that are judged to have more than a negligible impact on the schedule and are under the responsibility of the RPP Operations and Maintenance organizations.
- External events that prevent operations and/or recovery activities from proceeding at the planned rate.

The analysis does not explicitly model individual components of systems that are not under the control of RPP Operations and Maintenance organizations. However, it does recognize the potential influence of these systems by assessing their overall availability to provide necessary support to RPP systems.

2.2.4.2 Human Actions Explicitly Modeled in the Preliminary RAM Analysis

Human error rates are explicitly modeled if they can cause the system to be shut down for a significant period. These generally occur if the system transitions into an irretrievable failed state that requires some explicit action outside the normal procedure recovery. The duration of the no problem/no failure scenario accounts for human errors that can be caught and corrected before such a transition occurs.

The exact operational activities have not yet been developed. In their absence an initial draft procedure for LAW transfers was used as the general model for human error impacts. The values obtained during this analysis were also applied to the HLW transfer

since the greater number of activities required for LAW qualification and delivery make it a bounding case.

Examples of errors that are explicitly modeled in the preliminary RAM analysis include:

- Misalignments not corrected before a transfer begins, resulting in waste being transported to the wrong location.
- Actions that cause a limiting condition for operation (LCO) to be violated.
- Actions that cause false alarms when an LCO is not violated, but must be investigated and cleared, if warranted by historical data.
- Actions that cause transfer equipment failure or unavailability.

Those actions retained for quantification are listed in Appendix D, Tables D-2 and D-3 of Appendix D for HLW and LAW, respectively.

2.2.4.3 Activities and Equipment Not Explicitly Quantified

The graded approach identifies activities and equipment for which there is sufficient flexibility and resources built into the organization to handle both normal and anticipated off-normal conditions without impacting the overall mission. Typically, these activities can be performed in advance of a critical operation. If off-normal conditions are detected, resources can be made available to address the situation and complete the task without impacting the schedule or workload requirements of the site. In other words, these activities are not time and resource critical. Therefore, it is assumed that failures and off-normal events during these activities will have insignificant influence on the RAM figures of merit that relate to the risk of schedule delay.

Activities screened from explicit quantification during quantitative analysis are listed in Tables 2-1 and 2-2 for source tanks 241-AZ-101 and 241-AN-105, respectively. They are divided into two groups, (1) those within the responsibility of RPP, which are not time-critical, and (2) those outside the responsibility of RPP.

Many activities within the responsibility of RPP could indirectly impact schedule delay. Even though activities and equipment may be classified as not time-critical, the effort required to accomplish them is identified. In addition, the bounds of failures and off-normal events that are screened from quantitative evaluation are recorded. As the O&M Concept is developed, this information provides justification for resources and also serves as a checklist for verifying that the reasoning for originally considering them not time-critical remain valid. For example, it may be determined that recovery from anticipated off-normal conditions found during preventive maintenance done during long standby periods may not have to be explicitly modeled. However, this assumption is predicated on having spares available and some minimal organizational manning level. If the workforce is reduced below that manning level, the activities may become time-critical and would have to be included in the preliminary RAM analysis.

"Boot strap" transfers to qualify waste for one of the four transfer envelopes are not quantified as part of the preliminary RAM analysis. Opportunities exist for conditioning waste throughout the year and can begin far ahead of the formal transfer activities defined in the O&M Concept. Thus, they are currently judged to fall into the "not

time-critical" category described below. Currently, a wide variety of boot strap transfer strategies are being considered, and as the baseline quantification of the HLW and LAW tank transfers is refined, the influence of the boot strap transfers on the feed availability efficiency will become more evident. If warranted, selected boot strap transfers can be added to the RAM quantification as the O&M Concept matures.

2.3 Implementation of the Preliminary RAM Analysis

This section discusses selected methods developed for this analysis.

2.3.1 *Development of the RAM Computer Model*

The RAM model consists of a number of different tables linked together in the Microsoft® Access relational database and associated Microsoft® Excel spreadsheet tables. Each table of the model focuses on a separate element of the RAM evaluation. The development of these elements is outlined below.

2.3.1.1 Classification of Facility SSCs and Process Activities

The first step involved reviewing the transfer schedule activity logic diagrams developed for the waste transfers of interest in this study (the AN-104/105 waste transfer for LAW, and the AZ-101 waste transfer for HLW). The transfer activities were then discussed with key process engineers involved with the design of the transfer systems to identify those required for waste transfer activity success.

Piping and instrumentation diagrams (P&IDs) for these systems provided the process flowpaths and identified key support system interfaces required for waste transfer success. The P&IDs associated with the target transfers were the primary source of information for the unique components table, which contains basic descriptive data identifying all the unique systems and components associated with the transfers. Selected fields from these tables are reproduced in Appendices E and F as Tables E-6 and F-6 for the 241-AZ-101 and 241-AN-105 transfers, respectively. The content of the data fields are defined in Appendix A, Table A-1.

The next step was to develop tables linking the elements in the unique components table to their respective transfer activity designators (or activity identification codes) developed to identify distinct transfer activities. These tables include key fields such as activity identification code, EIN, and component type designator.

2.3.1.2 Assignment of Failure Modes and Failure Rates

Based on the hardware classification obtained from the process activities and P&IDs, a component type versus failure mode table was developed and imported into the RAM computer model. This table is reproduced in Appendix A as Table A-2. A failure rate distribution was assigned to each component type failure mode based on the evaluation presented in Section 3 and stored in a separate database table.

The activity designator component tables, the unique components table, and the component type versus failure mode table, provided the information needed to create failure modes and effects analysis tables for the process activities. These tables were then used to eliminate failure modes with insignificant effects, and assign recovery time and exposure designators to each potentially significant failure mode basic event.

2.3.1.3 Generation of Quantification Tables

Tables were then developed relating failure mode designators to failure rate distributions, exposure codes to initial exposure values, and associate mean failure rates and recovery time designators to recovery time distributions and associated mean recovery times. The basic off-normal events for individual schedule activities were combined in accordance with the groupings in Table 2-1 and 2-2 for HLW and LAW respectively. The off-normal event tables were then linked to other tables within the relational database to assign failure rates, exposure parameters, and recovery time data to the significant failure mode RAM model basic events to produce spreadsheet tables for RAM model quantification.

The spreadsheets were quantified to determine individual off-normal (basic) event failure frequencies and associated expected transfer time delays. The individual basic event frequencies and expected time delays were then summed to create overall transfer delay frequencies and expected total delay time. These basic event quantification results tables in Microsoft® Excel were then imported into the Microsoft® Access databases to facilitate easy analysis of grouped results (i.e., the activity type, system type, component type, and EIN group results) for custom CIL development.

2.3.1.4 Simulation of Qualification and Transfer Activities

The completed quantification tables formed the basis for the simulation of schedule delay. The failure frequency, fraction of failures impacting schedule delay (see Section 2.3.3), and restoration time distribution associated with every off-normal event were exported to a spreadsheet for simulation. The simulation process is discussed in detail in Section 2.4. This section provides the tie back to the simulation files in the RAM computer model.

Two simulations were accomplished to address the qualification and batch transfer activities of HLW in source tank 241-AZ-101. The simulations addressed the sets of activities identified in Table 2-1, as indicated below:

Simulation ID	Description (See Table 2-1 for a Breakout of Activities)
HLW A	241-AZ-101 batch qualification activities
HLW B	Batch transfer activities pinned to the WTD and agreed to by BNFL (First batch used to determine mission duration, since it is the largest batch).

The schedule delays produced by trial simulations HLW A and HLW B were added directly to the no-problem/no-failure duration of their simulated activities to obtain the distribution of the duration of qualification and batch transfer activities, respectively.

Five simulations were accomplished to address the qualification and batch transfer activities of LAW in source tank 241-AN-105. The simulations addressed the sets of activities identified in Table 2-2, as indicated below:

Simulation ID	Description (See Table 2-2 for a Breakout of Activities)
LAW A	Activities in 241-AN-105 common to both 241-AP-102 and 241-AP-104 batch transfers, including transfer of supernatant to 241-AP-102
LAW B	Qualification of LAW transferred to 241-AP-102 for batch transfer to BNFL
LAW C	Dissolution of salt sludge remaining in 251-AN-105 and characterization resulting liquid LAW for transfer to 241-AP-104.
LAW D	Transfer of dissolved salt sludge LAW to 241-AP-104 and qualification for batch transfer to BNFL
LAW E	Batch transfer activities pinned to the WTD requested by BNFL and agreed to by DOE (Model for 241-AP-102 used for both transfers, as it involves a larger quantity of LAW)

Since LAW in source tank 241-AN-105 is pumped to two separate intermediate waste feed storage tanks (IWFST), which are individually qualified and transferred, the LAW activities must be combined to estimate schedule delay as follows:

Description of Activities (See Figure 5-2)	LAW Simulation ID
Degassing of 241-AN-105, transfer of supernatant to 241-AP-102 and qualification for batch transfer	A + B
Degassing of 241-AN-105 through dissolution of salts in 241-AN-105	A + C
Transfer of dissolved salts to 241-AP-104 and qualification for delivery	D
Batch transfer from 241-AP-102 or 241-AP-104 to BNFL	E

Since activity group LAW A is common to the first two activity sequences, simulations LAW A, B, and C were executed simultaneously, and the delays from A, B, and C were added, as indicated above, after each trial. The resultant delays were added to no-problem/no-failure duration of the appropriate activities to obtain the distributions for the durations of the sequences of LAW qualification and batch transfer activities needed to complete the batch transfers to BNFL.

2.3.2 *Delay Time of Off-Normal Events*

The basic formulation for calculating the delay time of off-normal events is the triplet formulation of risk, which is answered by addressing three questions:

1. What can go wrong? The answer to this question describes an initiating event, the off-normal condition it produces, and the resulting activities needed to recover to an acceptable state. In this preliminary RAM evaluation, the recovery involves returning to a point where progress toward delivery can again move forward. The off-normal condition is described in sufficient detail to estimate the time and effort needed to recover. The most common off-normal events are hardware failure, external events that damage the system or make conditions unacceptable for work, human error, and the discovery of discrepancies between anticipated and actual process performance. For this preliminary RAM analysis, the answer to this question by the FMEA for each transfer activity.

2. What is the likelihood that it could go wrong? The answer to this question depends on the type of event. For hardware, it is answered by determining the exposure of the hardware to potential failure modes and using historical performance data for the type of hardware regarding failure rates to calculate a failure frequency. The estimation of the frequency of other events follows similar reasoning, but the evidence supporting the estimation of occurrence frequency tends to be inferential and more uncertain. These events are usually addressed using risk analysis techniques tailored to the potential events being considered.

3. What are the consequences of it going wrong? Consequences can be expressed in a number of ways, health effects and environmental damage being two common ones. While these are important, the primary measure of consequence used for this O&M Concept is schedule delay resulting from the actions needed to recover so progress toward waste feed delivery can continue. This requires the allocation of resources and time to affect the necessary recovery.

The expected number of hardware failures and the resulting total delay time is calculated directly in the preliminary RAM analysis, based on three parameters that are determined for each failure mode event.

Three quantitative parameters describe a specific off-normal (basic) event:

E — Magnitude of the exposure of a component or person to a given failure mode as they participate in an activity (expressed as either demands or hours).

λ — Rate at which the failure mode can be expected to occur (expressed in units of per-demand or per-hour).

T — Time required to recover from the off-normal event and accomplish the actions necessary to bring the system back to a state at which scheduled transfer operations can resume.

The first two parameters calculate the relative frequency (F) of the off-normal event.

$$F = (\lambda)(E)$$

F is unit-less mathematically, but represents the probability or relative frequency that the failure mode being evaluated is expected to occur per performance of the associated schedule activity evolution. The term "relative" is used because units of λ and E are coupled and depend on the failure mode being analyzed. For example, if we are quantifying the relative frequency of a valve failing to open on demand, then the units of λ are failure events per demand, and the units of E are demands per activity. If we are quantifying the relative frequency of a pump to run for its specified mission time, the units of λ are failure events per operating hour, and the units of E are operating hours per activity.

Depending on the off-normal event and the resulting physical, environmental, and management-related conditions, schedule delays of varying length and uncertainty may occur. The duration of the additional time needed to recover from the off-normal event is influenced by conditions affecting the ability to work productively, availability of spare parts, maintenance resources, etc. For example, if the waste transfer process is interrupted by one type of equipment failure, repair or replacement of that equipment may be required. If it is located in a valve pit, considerable effort is required to gain access and protect personnel during the recovery. For other equipment failures, an option may be available to revert to a backup system or alternate means of delivering the required waste. This can reduce the time needed to resume the process considerably.

Since time will be required to recover from every failure or off-normal event, the expected delay (D) caused by that event is equal to the relative frequency of failures times the associated restoration time. This expected delay time (generally expressed herein in units of hours) is calculated using the following equation:

$$D = (F)(T).$$

The three input parameters for the expected delay time are directly tied to the process definition and system design.

The exposure to failure reflects the hazards associated with the process strategy, the configuration of the system that will accomplish the required activities, and the capability of the SSCs participating in the process.

The failure rate is directly related to the design of the SSC and the conditions under which it will operate.

The time required to restore reflects the response capability that is being provided in the O&M Concept. The primary metric developed by this analysis is the expected delay time due to equipment failure, human error, and external events during the activities required for waste batch transfer. The expected delay time is the amount of time RPP Waste Feed Delivery management can anticipate the minimum transfer time period to be extended beyond the "no-problem/no-failure" time estimated via calculation of waste volume divided by pumping rate, plus any additional required waste transfer evolution time.

2.3.3 *Dynamic Calculation of Exposure and Shadowing Factor*

In practice, in the current preliminary RAM models developed to support the prediction of potential waste transfer delay penalty risk, refinements are made to the exposure of hardware to failure. Specifically, the exposure, E, is dependent not only upon the initial no-problem/no-failure time and equipment demand profiles, but also what happens during recovery. When SSCs must continue to operate during recovery, the delay time adds to their exposure to time-related failure modes. If SSCs are shut down during the recovery, the requirement to restart increases demand-related exposures. Therefore, an iterative calculation must be performed in the RAM model to adjust E based on predicted delaying event occurrence and associated delay time.

An example of this requirement arises when an HVAC fan is required to run continuously to support safe transfer and storage operations, and a failure of another component delays the transfer pumping operation (for instance, a transfer pump failure). Since HVAC continues to operate during recovery, this requires the HVAC fan to run longer than the activity's no-problem/no-failure run time, thus extending its total exposure to run time failure. Similarly, when a spurious leak detector alarm occurs and halts the transfer process while troubleshooting and repairs are performed, the transfer pump is required to be shut down and restarted upon completion of leak detector repairs or recovery, thus increasing the transfer pump demands for that transfer cycle. This iterative impact on modeled exposure, called "dynamic exposure," is taken into account in the current RAM model quantification calculations.

The dynamic exposure for a component failure mode can be characterized by the following equation:

$$E = E_p + E_o + E_a$$

In this equation,

E_o is the exposure directly associated with the original no-problem/no-failure time or demand profile associated with the activity of interest.

E_p is the exposure prior to the start of the activity of interest during which the failures of an SSC can result in a delay of the initiation of the activity. For failure modes with time-based failure rates, E_p is estimated to be equal to that event's mean time to restore time. In cases where a basic event has no exposure other than during the activity of interest, such as for demand-based failures, E_p is zero.

E_a is the additional exposure incurred by SSCs that must continue to operate while the mission activity is being restored, or must be realigned or restarted to resume the mission activity.

Because recovery activities can proceed in parallel, there is also a "shadowing effect" associated with multiple equipment failures during a waste batch transfer process. For example, if a continuously running HVAC fan fails during the recovery from a transfer pump failure, that fan failure does not cause a critical path delay of the transfer process while restoration can be accomplished in parallel with the recovery of the pump. Demand failures are generally associated with pump starts or valve alignment demands directly associated with the waste transfer activity and thus have a direct delaying effect

on the transfer. However, "running" failures may be shadowed by other failure recoveries.

To account for the shadowing effect, the expected delay time per activity variable, D, for time-related basic event is multiplied by the following factor:

$$\text{Fraction of failures impacting schedule delay} = E_o/(E_o+D-D_i)$$

Where

E_o is the exposure imposed on the failure mode directly associated with the original no-problem/no-failure time or demand profile associated with the activity of interest.

D_i Expected delay due to failure mode i = $E_i*\lambda_i*T_i$

D Accumulated delays due to all failure modes in the activity (sum of all $E_i*\lambda_i*T_i$).

The numerator may be interpreted to be the exposure time when the intended mission is being accomplished. The denominator may be interpreted to be the total operational exposure for any individual failure mode. (Its contribution to the total delay must be subtracted from the total expected delay.) Refer to the calculation sheets of the LAW and HLW RAM quantification Microsoft® Excel spreadsheet files for exact reference of each equation variable.

Since additional exposure will result in additional failures, the calculation dynamic exposure is iterative. Failures due to no-problem/no-failure activity exposure produce an expected delay time. This delay time produces additional exposure, resulting in more failures, whose delay times propagate to the next iteration. However, the effect of shadowing allows the increase in total schedule delay to decrease with each iteration. For the calculations herein, the iterations were stopped when schedule delay time changed by less than 0.01 hours between steps.

2.3.4 *Specialized RAM Parameters*

In the current preliminary RAM analysis, some specific refinements were made to the basic FMEA and determination of basic event data required for RAM model quantification.

2.3.4.1 Recovery of Plugged Components

The "plugging" failure mode for all affected components (i.e., pipes, jumpers, valves, etc.) was split into two subset failure modes, one for catastrophic plugging which cannot be recovered via a non-intrusive flushing action, and one which can be recovered via a non-intrusive flushing action. In the absence of evidence, the overall plugging failure rate obtained from the Savanna River Site generic database was split equally among the two new subset failure mode categories.

The recovery time for plugging that can be recovered by flushing reflects the time necessary to plan, set up, and execute the flushing action. Recovery from catastrophic plugging would require replacement of the line, or routing the waste transfer to bypass the plug.

2.3.4.2 *Manual Backup of Motor Operated Valves*

MOV failure modes associated with valve position transition failures (i.e., failure to open on demand, failure to close on demand) were also split into two subset failure modes. The first can be recovered via simple non-intrusive manual positioning of the valve using a manual valve hand-wheel or similar manual valve operator as an installed backup to the valve motor. The second accounts for catastrophic failures, which cannot be recovered via non-intrusive manual positioning of the valve

For the MOV transition failure modes, the original failure rate was split such that 10% of the MOV failure rate was applied to the catastrophic subset, and the remaining 90% of the original failure rate was applied to the non-catastrophic subset. This reflects the ratio of failure modes that would fail the actual valve (which can be manually operated) to those associated with the motor operator. It is assumed that if the motor operator portion of the valve fails, it can still be rotated to the proper position by manual backup. As a result, the delay time associated with 90% of the MOV failure rate is associated with the time necessary to accomplish the alignment manually.

2.3.5 *Generation of Critical Items Lists*

Because the two primary metrics, F and D, are developed for each component failure mode, they can be sorted and/or summed in a wide variety of ways. Summing the relative failure frequencies for all the failure events that might occur in all components participating in all transfer activities produces expected total number of off-normal events per complete transfer evolution, which is the first consolidated RAM metric. Summing the expected delay for all the failure events will produce an estimate of the total expected schedule delay over the complete set of transfer activities, which is the second consolidated RAM metric. From the data used to calculate the expected delay time, one may also categorize the expected delay time by specific component, component type category, or RPP waste transfer schedule activity category. The expected delay time metrics are primarily used to focus management attention on components and component types that contribute significantly to RPP waste transfer schedule delay.

In addition to the "absolute" metrics defined above, the individual basic event metrics are divided by their respective transfer total sums to create two relative metrics: "frequency fraction" and "delay fraction." These metrics provide a measure of the relative importance of each basic event. Other relative importance metrics can similarly be calculated at higher levels of indenture in the model (i.e., for component EINs, component type categories, system type categories, schedule activity categories, etc.). This allows the formation of CILs using a decreasing value FOM ranking of items. The CILs provide valuable decision-making support, and are primary products of this preliminary RAM analysis.

2.4 Idle Facilities FOM

A FOM is a measure selected to evaluate and understand the effectiveness of a system for accomplishing a mission. This section describes the FOM quantified by the preliminary RAM analysis to validate the ability of the O&M Concept (Carlson, 1999) to meet the waste feed delivery schedule for two representative source tanks, 241-AZ-101, 241-AN-105, and 241-AN-104. This FOM is defined to be:

> *"Risk that DOE will incur idle facility penalties for failing to deliver a batch of waste feed to BNFL, Inc., in accordance with Special Contract Requirement H.30 of the TWRS Privatization Contract"*

The metric used to quantify the Idle Facilities FOM is based on a simulation of the batch transfers using the preliminary RAM analysis of WFDS activities for the three tanks. The metric is generated using the estimates of the duration of the planned O&M activities to accomplish the delivery, the likelihood of off-normal events that could interrupt and delay those activities, and the duration of recovery actions needed resume the batch transfer. The specific success criteria are defined in Section 2.4.1, and successive sections show how the FOM is developed.

2.4.1 *Success Criteria for a Waste Feed Batch Transfer*

The success criterion for the Idle Facilities Penalty FOM was established in the System Specification for the Double-Shell Tank System (Grenard, 1998). The criterion is:

> *"The integrated schedule risk associated with reliability, availability, and maintainability of the total hardware and operating and maintenance system used to accomplish preparation and transfer of feed batches shall not exceed 2 days per batch[1]." This criterion is annotated with the acronym TBR (to be refined).*

Waste feed is actually transferred to BNFL in batches keyed to individual Waste Transfer Days (WTD). Table 2-3 identifies and discusses in detail the terms of the TWRS Privatization Contract (DOE, 1998c) and associated ICDs (BNFL, 1998a, 1998b) that define a batch and the success criterion for completing a waste feed batch to BNFL. Based on the contractual documents, a batch is defined to be the quantity of waste feed of a given type and its associated diluent requested by BNFL, Inc., for transfer to its receiving tank at one time. The time is established by the WTD, which is requested in writing by BNFL and agreed to by DOE. A batch has been successfully transferred when (a) the planned quantity[2] of feed has been transferred to BNFL, (b) the transfer line

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[1] The term "batch" as used in PHMC 1998a refers to the quantity of waste prepared in a waste feed cycle. A waste feed cycle consists of (1) preparing feed to meet specifications and (2) pumping prepared feed to the private contractor's facility. In this context, one batch refers to all waste delivered to the private contractor from one source tank. This is *not* the same as the definition of batch used in the contract ICDs.

[2] In general, it is possible to deliver less than the planned quantity of feed for a given batch and still satisfy the requirements in DOE's contract with BNFL and the corresponding interface control documents.

flush has been completed, and (c) agreement has been reached between DOE and BNFL on the volume of waste transferred and received.

The acceptable window for delivery of a feed batch begins[3] on the WTD and ends 30 days later. DOE becomes susceptible to idle facility penalties if BNFL's facilities are idle due solely to DOE not completing the feed delivery transfer within this 30-day window.

The waste in high-level waste source tank 241-AZ-101 will be qualified and delivered to the privatization contractor in a series of nine deliveries. Each of the nine deliveries is considered a batch for the purpose of delivering waste feed to the privatization contractor, and each has the potential of producing idle facility delay penalties. Therefore, the sum of the integrated delay from all nine batches constitutes the metrics of the FOM for one HLW source tank.

The waste in low-activity waste source tanks 241-AN-104 and 241-AN-105 will be retrieved, transferred and staged in Intermediate Waste Feed Staging Tanks (IWFST) (241-AP-102 and 241-AP-104). The waste from each source tank is staged as two separate batches to be qualified and delivered to the privatization contractor. Therefore, the sum of the integrated delay from both batches constitutes the metrics of the FOM for each LAW source tank.

2.4.2 *Development and Interpretation*

The TWRS Privatization Contract, Clause H.30, Idle Facilities, states the privatization contractor is not eligible for idle facilities payments until, (1) 30 days after the WTD specified in the contractors notice, or (2) the date the privatization contractor is ready to receive and process waste, whichever is later. For estimating idle facility penalties, it is assumed that the batch must be successfully transferred to BNFL by the end of a 30-day window that starts on the assumed WTD; the calculation of the FOM does not take credit for potential delays on BNFL's part.

[3] The window actually begins on the later of the WTD or the date on which BNFL is actually ready to receive the feed batch. It is conservatively assumed that BNFL will be ready to receive the feed batch on the WTD.

Table 2-3. Source and Interpretation of Terms Important for Defining Batch Delivery Success Criteria

Term	Definition	Contract Reference and Interpretation
Batch	The quantity of waste feed and its associated diluent requested by BNFL for transfer to its receiving tank at one time.	For LAW and HLW, the contractor shall provide written notice to the DOE Contracting Officer specifying: 1) the type of waste requested, hereinafter referred to as a batch, and 2) the date the Contractor requests the transfer of the batch, hereinafter referred to as the waste transfer day (WTD). The written notice should be provided to the Contracting Officer 60 calendar days prior to the requested WTD. (Privatization Contract, Clause H.9e) The specific boundaries of LAW and HLW batches are not specifically defined, but clauses imply that a batch is the amount of material sent to BNFL at one time. (See citations listed for LAW and HLW.) Since the contractor receives both the waste feed in the staging tank and the flush solution added after transfer, the batch will consist of a mixture of both feed and flush solution. However, the qualification of the batch is certified before the flush solution is added.
LAW Batch	The LAW feed in one source (AN-105 first, AN-104 later) is pumped to two separate IWFST for qualification. LAW supernatant transferred to AP-102 for qualification and further transfer to AP-106 will constitute one batch. LAW dissolved salt sludge transferred to AP-104 for qualification and further transfer to AP-106 will constitute a second batch.	Additional batches (beyond the first feed batch of Envelope C) of LAW feed will be delivered in quantities of no less than 100 units of LAW. (ICD-19, Section 4.1.1, p. 3). The actual size and frequency of transfers will be arranged at the time of delivery. Interpretation: The contract is set up to provide guidance for all transfers. For the purposes of O&M Concept planning we are defining the batch size to be the total quantity of liquid transferred to BNFL in each batch delivered from each IWFST. This results in four batches.
HLW Batch	The HLW in AZ-101 will be transferred directly to the BNFL receiver tanks in 9 batches.	DOE will deliver an initial feed batch (including flush water) of HLW slurry per Specification 8, High-Level Waste Envelope Definition, in a quantity of at least 600,000 liters, but no more than 675,000 liters, with an unwashed solids content of between 10 and 200 grams per liter. (ICD-20, Section 4.1.1) Multiple batch transfers of this certified HLW feed are allowed without re-certifying the feed. (ICD-20, Section 4.3.1, p. 7) Current plans indicate the waste in AZ-101 will be transferred to BNFL in nine batches.
Qualification of a Batch for Transfer	DOE and BNFL must agree that the batch is acceptable for transfer 15 days prior to the WTD.	Both LAW and HLW: DOE provides a certification of conformance to appropriate waste envelope at least 30 days prior to WTD, and BNFL provides a written acceptance and authorization to DOE to transfer the batch within 15 calendar days of receipt of the certification documentation. (ICD-19 and ICD-20, Section 4.1.3, p. 5) LAW: DOE must certify that LAW meets specifications before each batch transfer. BNFL may observe the certification process. (ICD-19, Section 4.3.1, pp. 6-8) HLW: DOE is required to certify that the tank from which the batches will be drawn meet the appropriate waste envelope specification. However, if a batch of HLW is not within specification, BNFL will accept and treat out of specification HLW feed in accordance with contract Specification H.43, Processing Out of Specification Waste. (ICD-20, Section 4.3.2, p. 8)

Table 2-3. Source and Interpretation of Terms Important for Defining Batch Delivery Success Criteria (continued)

Term	Definition	Contract Reference and Interpretation
Waste Transfer Day (WTD)	The WTD is the earliest day that BNFL will accept the transfer of the waste in a given batch into its receiving tank. It is formally agreed to in accordance with the appropriate ICD.	**ICD-19:** In accordance with contract Clause H.9, BNFL Inc. will provide written notice to the DOE Contracting Officer when requesting a transfer of LAW feed. The written request for LAW feed transfer will identify: (a) the type (LAW feed) of waste requested, hereinafter referred to as a batch, and (b) the date BNFL requests the transfer of the batch, hereinafter referred to as the waste transfer day (WTD). (Section 4.1.3, pp. 4-5) **ICD-20:** In accordance with contract Clause H.9, BNFL Inc. will provide written notice to the DOE Contracting Officer when requesting a HLW feed batch transfer. BNFL shall provide to the DOE Contracting Officer a written request that includes the available feed receipt tank volume (200,000 to 600,000 liters) of HLW feed and the desired WTD prior to the requested WTD. BNFL shall promptly notify the DOE Contracting Officer in writing of any changes to the WTD and the reason for the change. (Section 4.1.3, p. 5)
Criteria for Successful Completion of a Batch Transfer	A batch has been successfully transferred when: 1. The following is present in the BNFL receiver tank: a) the entire amount of feed requested by BNFL and agreed upon by DOE, b) the specified amount of diluent added to it during transfer, and c) BNFL's share of the flush water used to clean the transfer line, and 2. Agreement has been reached between DOE and BNFL on the volume of waste transferred and received.	This definition of success criteria for a batch transfer are not defined in the contract documents. The two conditions stated here recognize that 1. Typically BNFL will request only that quantity of waste that it can accept, and that it will expect to get all of the requested quantity. 2. Material balance calculations have been completed and BNFL and DOE have reconciled any differences in the volume of waste transferred and received. The definition assumes that the batch will not be transferred if it does not meet minimum authorization basis and permit requirements established for the BNFL facilities.
Idle Facility Penalties	DOE becomes susceptible to idle facility penalties at the end of 30th day of the window during which BNFL will accept the transfer of the batch into its receiving tank.	*For any given batch, idle facility payment will not start until 30 days after the WTD specified in the contractors notice under H.9.G, or the date the contractor is ready to receive and process waste, whichever is later. (Contract Clause H.30).* For estimating idle facility penalties, it is assumed that the batch must be successfully transferred to BNFL by the end of the 30-day window that is started on the assumed Waste Transfer Day; we do not take any credit for potential delays on BNFL's part.

Figures 2-8 and 2-9 illustrate the process used to develop the idle facility penalty FOM. The heavy lines at the top of Figure 2-8 reflect the nominal duration of the planned O&M activities needed to complete staging, qualification, and transfer activities, given there are no significant problems or failures during the required sequence of waste transfer evolutions. This duration is estimated by considering the tasks that have to be done and the constraints under which they must be accomplished, as described in Section 3.2. This duration is the same as the shortest duration that would be obtained from a project management schedule when the times to complete individual tasks are estimated without providing contingency for potential delays. It can be seen in Figure 2-8 that the nominal or "No-Problem/No-Failure" duration is split into two distinct parts: one for staging and qualification, and one for batch transfer activities. This results from the fact that no matter when waste is certified as a qualified batch, it cannot be transferred until the agreed-upon WTD.

In Figure 2-8, the "Planned Activity Schedule Duration" is shown at the top of the figure. Below that is shown an example "Impact of Off-Normal Events on Schedule" with two events occurring during the staging and batch qualification activities and a third event occurring during the batch transfer activities. Each off-normal event requires the expenditure of resources to recover to the point where progress toward completion of the activity can resume. The "Simulation of Off-Normal Events" can calculate the combined planned activity schedule duration plus the recovery time for the off-normal events associated with the particular trial. This is repeated many times to create a distribution of completion times for the combined planned activity schedule duration and recovery time for off-normal events.

The distribution of total delay that might occur during the qualification and transfer of waste from a given DST is developed by generating delay events based on the preliminary RAM analysis. First, the failure frequency and recovery time estimates of every representative off-normal event in the RAM model for the transfer activities are assembled into a set. Random sampling (Monte Carlo) techniques are then used to generate a group of delay events that might occur during the setup and transfer of one actual batch of waste feed. The sum of the recovery times from those failures produces the total delay for one batch transfer trial scenario. The total delay is then added to the nominal duration to obtain the total duration of the batch transfer, considering both normal and off-normal conditions. As this process is repeated, the simulation produces a series of scenario results that contain different combinations of events and resulting delays, three of which are illustrated in the lower part of Figure 2-8. When the simulation is repeated a sufficient number of times, a probability distribution of the transfer activity duration is produced. This distribution is then compared to the time available to transfer based on the contractual schedule, as illustrated in Figure 2-9.

The development of the FOM used to validate the ability of the O&M Concept to meet the contractual schedule requirements is shown in Table 2-4 and described below:

First, the total delay is obtained from a Monte Carlo simulation of every failure mode that might occur during the activities required to complete the mission. A random number is generated to determine whether each susceptible failure mode occurs during the trial in question. If it does, the recovery distribution associated with that failure mode is then randomly sampled to generate a delay associated with the failure. After all failure modes have been questioned, the delay times generated by the simulation are summed to produce the total delay for that trial scenario.

The total delay is then added to the planned (no problem/no failure) completion date (here expressed as a number of days after the WTD) to obtain a completion date that accounts for delays. This completion date is compared to the WTD plus the 30-day deadline to determine if the trial scenario incurred penalty days.

The number of days of penalty incurred for each trial scenario that resulted in completion of the batch transfer after the deadline date is multiplied by the probability of that scenario. The simulation accomplished for this document contains 10,000 transfer scenarios. If a given scenario produced a delay of 20 days past the delivery deadline, the contribution of that trial scenario to the FOM would be 20 days multiplied by 1/10,000 trials, or 0.002 equivalent "days."

The equivalent "days" of delay past the delivery deadline generated by all the trials are then added together to obtain the integrated days referred to in the definition of the FOM. For example, in Table 2-4, two scenarios that are completed after the deadline combine to produce 0.0023 "days" of integrated penalties. The result is the expected number of penalty days that would be incurred per batch transfer, when averaged over a large number of batch transfers. It reflects the probability-weighted contribution of all delay events of various lengths to the total risk of idle facility penalties.

When more than one waste feed batch must be transferred to empty a source tank, the penalty "days" from all the individual batches are added to obtain the overall FOM for the source tank.

Based on the initial criteria in the System Specification for the Double-Shell Tank System, a FOM of less than two" days" would validate the ability of the O&M Concept to meet the contractual schedule requirements for delivery of the waste contained in one source tank. The use of two days is an initial goal based on a preliminary estimate, which hypothesized that no more than one percent of the budget for Phase 1 (approximately $10 billion) should be paid as idle facility penalties. As a planning tool, the amount allocated for idle facility penalties was divided equally among 15 source tanks.

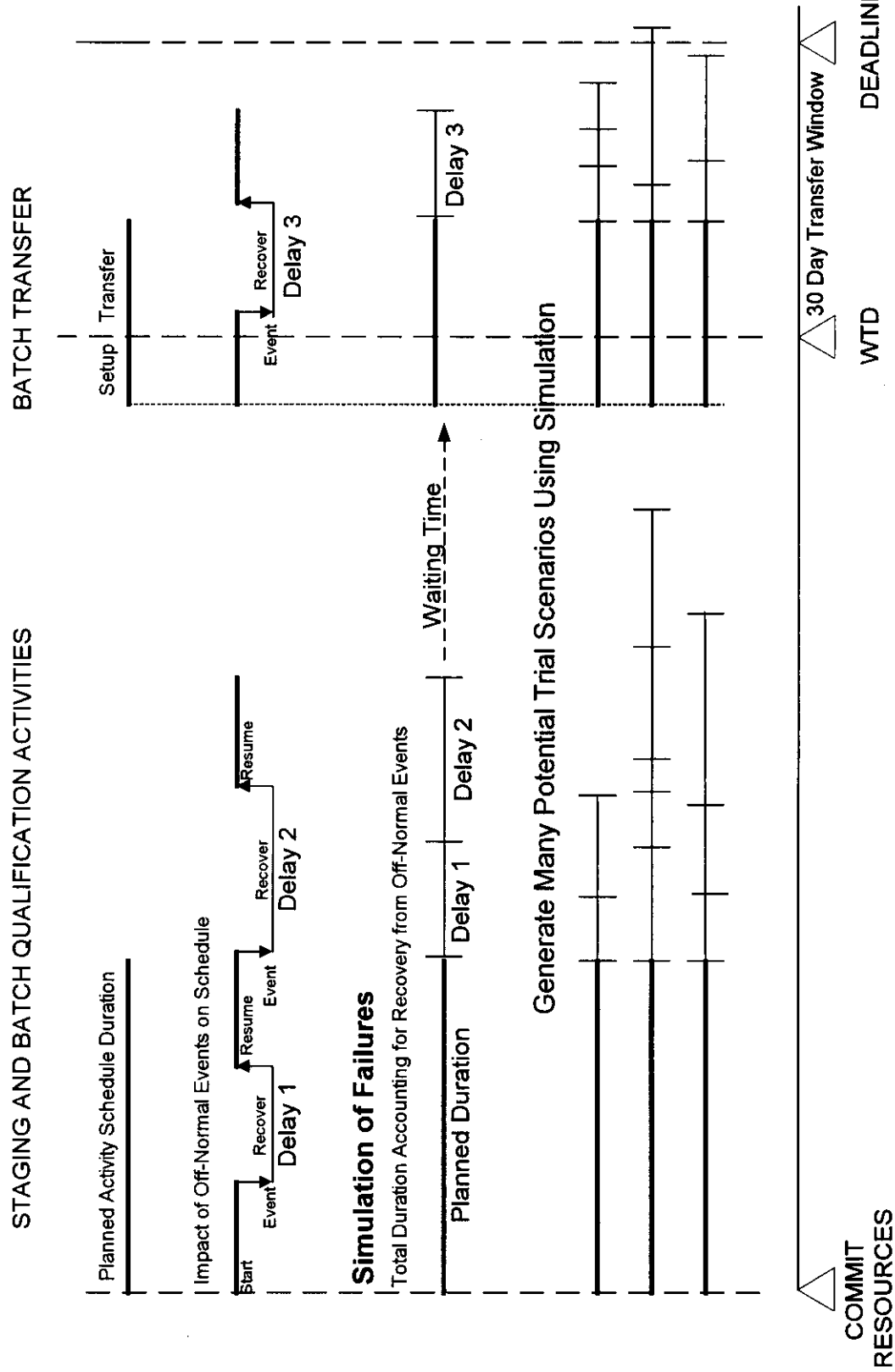

Figure 2-8. Calculation of the Total Duration of Waste Transfer Activities Including Impact of Off-Normal Events

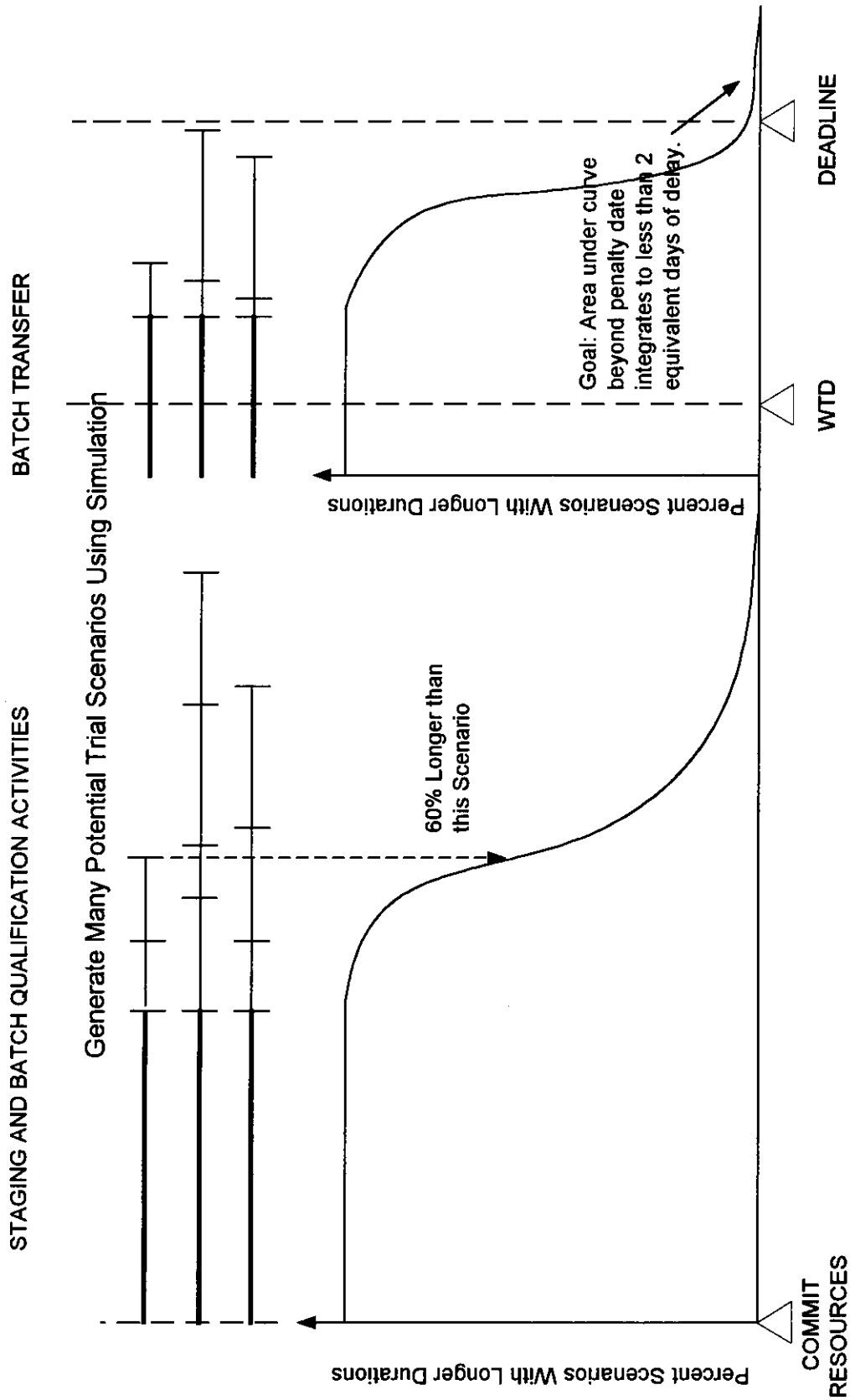

Figure 2-9. Estimation of the Risk of Delays Resulting in Idle Facility Penalties

Table 2-4. Illustration of the Calculation of FOM from Simulation Results for a Waste Feed Delivery Window of 30 Days

Scheduled Completion (days past WTD)	Simulation Delay (days)	Simulated Completion (days past WTD)	Penalty Days	Probability Weighted Penalty Days	Cumulative Risk ("Integrated Days")
3.5	46.5	50.0	20.0	0.0020	0.0020
3.5	6.1	9.6	0.0	0.0	0.0020
3.5	0.5	4.0	0.0	0.0	0.0020
3.5	29.5	33.0	3.0	0.0003	0.0023
3.5	24.0	27.5	0.0	0.0	0.0023
3.5	20.0	23.5	0.0	0.0	0.0023

A $3.5 million penalty per day of idle facilities is assumed and this results in the allocation per source tank of approximately two days of delay.

It should be recognized that delays that could produce idle facilities penalties are anticipated to occur during only a small fraction of the transfers. However, the very few transfers that experience catastrophic failures of non-redundant critical components can lead to long delays. Consequently, the term "two-day delay" does not refer to the maximum acceptable delay, but to the statistical expectation of a vast combination of possibilities. The FOM for the WFD operations and the impact of off-normal events that have been identified are presented in Section 5.

2.5 Summary of RPP Waste Feed Delivery Key Bases and Assumptions

Table 2-5 contains a summary of the key bases and assumptions used in this preliminary RAM analysis. This table is cross-referenced to the appropriate section where the assumption is used. The table discusses the basis for the assumption and, where appropriate, the implications of the assumptions and its basis for the O&M Concept.

Table 2-5. Assumptions Used in the Preliminary RAM Analysis

Category	RAM Doc. Paragraph	Description of Assumption	Basis	Implications for the O&M Concept
Scope, Baseline Date	1.2	This version of the O&M Concept is based upon the technical and programmatic baseline that existed on October 1, 1998, with the exception of the retrieval system design for 241-AN-105, which was completed in January 1999.	Although the design concept is evolving, a freeze point is necessary to establish a structure for developing the O&M concept and supporting RAM analysis.	The baseline evaluates activites that completely empty a specific source tank following one alignment of installed equipment. This approach explicitly excludes fallback options to deliver waste through alternate alignments or from other tanks that might also contain qualified waste. (Insights from the baseline O&M Concept will be useful for confirming the proposed design changes. Future iterations of the O&M Concept will account for the changes to the baseline approach.)
System Functional Capability	1.2	The system as designed is technically capable of performing the physical processes required to achieve the mission requirements of each activity. The system operational envelope is robust enough to respond to credible process transients and perturbations without suffering induced equipment failure.	The RAM relies on the process engineers and system designers to specify the equipment and activities that are capable of performing the required mission. Documented system evaluation and testing is required to demonstrate this capability.	The O&M concept for accomplishing the tasks required to complete the mission activities require that O&M personnel be aware and be given the capability to assure their equipment is operating within its design envelope.
RAM Baseline Boundary	2.2	Batch qualification process can be scheduled far enough in advance of delivery so any off-normal events occurring during qualification do not have an effect on waste feed batch delivery activities.	Potential issues regarding sampling and qualification (e.g., agreement on waste feed qualification between BNFL and DOE) could introduce delays that are beyond the scope of the current RAM analysis	This assumption is especially important for the first batch of each waste envelope, because issues regarding the interpretation of sample results will most likely arise at that time.
RAM Baseline Boundary	2.2	A fully manned and qualified O&M organization will be available to accomplish transfer operations as well as all necessary safe storage and support activities.	The purpose of this iteration of the O&M concept was to define the time and resources that would enable the RPP to complete the tasks in an expeditious manner. Time and resources are actually interdependent, but at this point one has to allow one of the variable to be generated by the other, and time was selected.	Resource allocation will be an important part of meeting the schedule, but can be accomplished only when a more detailed definition of all WFD activities is developed. The P-3 structure developed by this initial O&M concept will assist in the integration process.
RAM Front Line Systems	2.2.2.1 2.2.3.1	No problem / no failureExposures to failure modes are based primarily on the number and duration of the activities obtained from the Primavera schedules.		For components that change state during the activities (e.g., valves opening and closing, pumps starting, etc.) the number of demands considered the number of cycles that might be required during the operation.
RAM Baseline Boundary	2.2.4	Failures associated with operations not directly associated with waste feed delivery, such as unrelated safe storage and other O&M activities that are not schedule sensitive, can be corrected without impacting the transfer operations.	In this initial phase of the WFD O&M concept development, the RAM analysis addressed only the functions and components that could directly impact scheduled activities in the Primavera schedule logic model of the WFDS process for waste transfers.	Actual schedules will be resource driven. As WFD activity planning progresses its resource requirements will have to be integrated into the overall mission. The use of the P-3 program and standard COCS codes for O&M concept development will facilitate this process.
RAM Support Systems	2.2.4.1	The only two support systems modeled in detail were HVAC and dilution/flushing water. All other support systems such as electric power, service water, nitrogen, compressed air, etc., were modeled collectively as composite system blocks.	Allows accounting for potential off-normal events without requiring detailed modeling of those systems.	
RAM Support Systems		The 241-AZ annulus ventilation system will be made operational prior to its required use for waste feed delivery. The existing capacity of the 241-AZ annulus ventilation system will be adequate to maintain waste temperatures below the current TSR limits.	Project W-___ will	

Table 2-5. Assumptions Used in the Preliminary RAM Analysis (continued)

Category	RAM Doc. Paragraph	Description of Assumption	Basis	Implications for the O&M Concept
RAM Scope	2.2.4.3	The preliminary RAM analysis is not intended to be a complete assessment of the risk to the Waste Feed Delivery mission. It only addresses certain hardware, human reliability and external events during the operational phase of the mission. A risk assessment is being performed on the O&M Concept to capture risks associated with the O&M Concept as well as any other risks that could impact the ability to perform the O&M Concept	This assumption was made to limit the initial scope of the RAM so that it could focus on "standard" RAM hardware failure modes common to many operating systems as well as human factors and external events. This forms a baseline for the development process. However, the RAM can be modified in the future to address as needed any other sources of delay, which are being tracked in the risk assessment.	The RAM does not address programmatic risks such as (1) delays in the turnover of systems, structures, and components from projects to operations for beneficial use or delays in completion of readiness activities, (2) the risk that off-specification feed will be not be accepted by the private contractor, (3) the risk that HAZOP or Safety Analysis of the planned operations may identify significant new controls, or (4) the risk of failure to deliver the quantities of waste feed specified in the BNFL, Inc., contract.
RAM Front Line Systems	2.3.1	All failure modes of the components within the front line systems were assumed to produce an off-normal condition that requires the termination of transfer activities unless it was clear that the failure effect was not significant.	In the absence of direct evidence to the contrary, the RAM conservatively assumes that the failure of a component that is performing a design function during an activity will force that function to stop.	As the design is finalized and the procedures for operating the equipment are developed, these failure effects can be defined less conservatively.
HVAC Backup Systems	2.3.1	Many HVAC components were modeled as a two-train system, with one train operating and the other in standby. It was assumed that failure of any single redundant HVAC component would result in a delay in transfer operations until the standby train could be verified to be operating. However, it is not necessary that the failed HVAC be repaired before transfer activities can proceed. It is assumed that the failed HVAC will be repaired while the standby system assumes the load.	See section 2.2.1 of the RAM assessment report for an updated description of the modeling of the HVAC system.	
Backup systems availability	2.3.1	When backup systems can be employed to restore a functional failure during WFD operations, the backup system is assumed to be available. Only the time required to switch to the backup system contributes to schedule delay.	This is a simplification of the model to permit first order estimates. The RAM model includes both systems and produces an off-normal event when either fails, but assumes that common cause failures will not results in both failing at the same time. Independent failures at the same time are rare enough to ignore as a first approximation.	Repair effort to make a failed system is tracked separately from the time required to bring a function back on line.
RAM Failure Rates	2.3.1	The preliminary RAM analysis assumes that all equipment is properly designed for its intended application and environment, and that the technology will function at the assumed levels of performance.	Required to allow use of generic failure rates for the preliminary RAM estimates.	This assumption should be confirmed by testing of equipment during the development process. It should also be evaluated against the results of ongoing system assessments.
Resources, personnel availability	4	Staffing limitations do not impact estimates of either normal or off-normal activities. Specifically, personnel required to support the estimation of recovery times are assumed to be available, or can be readily recalled to duty, whenever an off-normal events occurs that requires their skills.	The initial estimates are being developed to identify requirements. Section 5 shows the peaking of resource requirements to accomplish WFD activities without schedule leveling. The use of P-3 for normal operations identifies CDCS loading peaks for the specific activities being modeled.	Resource requirements for both normal and off-normal WFD activities will have to be superimposed on safe storage activities, as well as RPP mission commitments to ensure that commitments can be met commensurate with their priorities.
RAM Front Line Systems	2.3.3	The RAM analysis accounts for the requirement to restart following failures by increasing the number of demands associated with selected critical equipment, and the additional time of exposure by adding non-overlapping recovery time to components that continue to operate during recovery of other components.	For this quantification, the increase was based on assuming that a new demand is required every time a failure occurs. This conservative approach was considered appropriate given the preliminary state of some of the designs.	

Table 2-5. Assumptions Used in the Preliminary RAM Analysis (continued)

Category	RAM Doc. Paragraph	Description of Assumption	Basis	Implications for the O&M Concept
RAM Failure Rate Development	3	All pipe and jumper segments were assumed to have an equivalent length of 50 feet for purposes of failure probability estimation.	The very low generic passive failure rates for pipe and jumper segments make the accurate estimate of length relatively unimportant. Lacking detailed information on specific piping segments, the analysis team used a graded approach to select a value of 50 feet as representative of the average of all pipes and jumpers.	
RAM Failure Rate Development	3.3	Generic component failure rates are taken primarily from SRS data for chemical systems, since these systems typically exhibit higher failure rates than similar water system. Hanford experts agreed that this was the most realistic approach for this analysis.	Component failure data for Hanford events recorded in the JCS were very difficult to determine, as less than 3% of the corrective maintenance events had clearly encoded target components.	In order for the Hanford data to be used for component failure rate data development, a detailed event by event evaluation would have to be performed, at great expense and duration, far outside the scope of this analysis.
RAM Failure Rates	3.3	All required equipment is in new or "like-new" condition. The equipment has been properly tested or otherwise evaluated and found to satisfy its functional requirements and remains within its useful life span for the duration of its use.	Required to allow use of generic failure rates for the preliminary RAM estimates.	This assumption should be confirmed by testing of equipment during the development process.
RAM Failure Rates	3.3.1	The failure modes and effect data was obtained from the Savannah River Site or other generic databases; only the data for transfer pumps, weather, and external events is specific to Hanford.	Required because of the lack of consistent data from past activities that will be applicable to the WFDS production mode.	
Commonality of Pumps	3.5	It is assumed that one single design (i.e., length) of mixer pump can serve as a replacement for all mixer pumps associated with the transfers analyzed in this study. Likewise, it is assumed that one single design of transfer pump can serve as a replacement for all transfer pumps associated with the transfers analyzed herein.	Pumps of varying lengths are currently in different source tanks.	The impact of unique procurement and replacement requirements for pumps in individual tanks is a subject for more detailed maintenance planning.
Weather Related Delays	3.5	Seasonal variations in the probability of weather related delays were not considered; uniform annual frequencies were used.	At this stage of project development, uncertainty in future scheduled activities make consideration of seasonal variations less important than many other uncertainties.	
Recovery time, Basis for Estimates	4	Recovery from off-normal events is based on task analysis by maintenance personnel rather than historical recovery time evidence.	Hanford historical restoration time data was deemed inappropriate for direct use in this analysis, as it is a result of operating in a "safety-only" environment, where production schedule was not a major concern.	Under the new "production philosophy" environment of the WFD transfer operations, safety will still be paramount, but the O&M Concept will be designed to meet reasonable transfer mission accomplishment goals.
Maintenance, equipment and parts availability	4	The recovery time for corrective maintenance assumes that the required spare parts and special equipment can be made available within the time required to review and coordinate the recovery work package. Specifically, it will not become a critical path source of delay in the recovery.	A risk exists that the availability of parts will extent schedule critical delays.	To be valid, this assumption requires the implementation of a spares program that provides for both spares stockage for likely failures and contingency plans for procurement of equipment that is not stocked.
Maintenance, Corrective	4	Pre-approved "Corrective Maintenance" procedures are in place	Provides a basis for limiting the time required to prepare a corrective maintenance package. Preparation time focuses on final coordination of package.	Generic maintenance categories can be used as a starting point for maintenance planning actives during the next phase of project development

Table 2-5. Assumptions Used in the Preliminary RAM Analysis (continued)

Category	RAM Doc. Paragraph	Description of Assumption	Basis	Implications for the O&M Concept
Maintenance, Corrective	4	Commercial Grade Item (CGI) "Like-For-Like" replacement practice can be accomplished without formal dedication requirements.	Verification that the part or component is a "Like-for-Like" (same OEM with same part/model no.) is all that is required. Verification of components are completed up front through review of existing design documents or in the field during replacement. Alternate components (brand X/brand Y substitutes) still require a design change and would still require formal dedication.	Safety Significant and Safety Class commercial grade items in use and that were part of the original design should NOT require a formal dedication process.
Maintenance, Corrective	4	Replacement component and spare parts fully identified prior to the operations.	Whether the component/part is warehoused on site or not, a full Bill-Of-Material (BOM) for every replacement assembly, component and/or part is available and accessible. This should be completed "up-front".	Each replacement component identified should include the OEM part number, local or OEM sourcing information, lead times and warehousing status.
Maintenance, Corrective	4	Corrective maintenance will be supported by dedicated craft technical (engineering) support	Avoidance of excessive planning delays requires individuals having the authority to implement minor changes to drawings/procedures/engineering files, identify/implement new and coordinate the condition based monitoring routines, insure adequate/appropriate tools and references are available and acts as a liaison between the craft and facility engineering.	An engineering support group that works with the craft on a day-to-day basis and reports directly to the 1st line supervisor can provide the required capability.
Maintenance, Corrective	4	Weather delays were implicitly considered in the estimation of the recovery distributions. The uncertainty range factors account for the potential that weather could influence recovery operations.	The uncertainty range factors account for the potential that weather could influence recovery operations.	
Maintenance, Corrective	4	Corrective maintenance effort can be estimated using generic maintenance categories.	Each RPP WFDS system contains similar components that can be subjected to categories of corrective maintenance.	Generic maintenance categories can be used as a starting point for maintenance planning actives during the next phase of project development
Restoration Time and Schedule Delay	4	All RPP organizations, that is, all organizations that impact transfer time, will be thoroughly trained regarding the importance of timely restoration of transfer operations upon any delaying or potentially delaying event.		This is a very important assumption, requiring support from top management down through the operating and maintenance technicians, as well as laboratory analysts.
Jumper Fabrication	4	The capability to fabricate jumpers as part of site fabrication services and will be available to support corrective maintenance activities during WFD activities.	Assumes a status for a capability that must exist somewhere in order to estimate the time required for recovery activities in valve and pump pits.	Implementation of the maintenance concept should validate this capability
Authorization Basis, Inter-connected Systems	Appendix G.1	Only failures of instrumentation and equipment having a function directly associated with the transfer paths are explicitly modeled as requiring the shutdown of waste feed delivery activities.		Before transfer operations start, the basis for interim operation (BIO) will be revised and approved by appropriate authorities so that failures of leak detectors (i.e., spurious alarms) not associated with the transfer paths will not require an immediate shutdown of the analyzed transfer operations.

3. Frequency of Off-Normal Events

In this section, the frequency of events that could result in a potential delay of waste transfer activities is discussed. These events are called potential schedule-delaying events, or simply "off-normal events."

3.1 Categories of Off-Normal Events

The preliminary RAM analysis accounts for off-normal events of three general types:

- Failures of hardware.
- Human errors that result in conditions that require termination of transfer activities.
- External events that result in conditions that require termination of transfer activities.

3.1.1 Hardware Failures

The boundaries of the preliminary RAM analysis specify the degree to which each type of hardware failure is explicitly modeled, but in order to avoid surprises, all potentially relevant waste transfer schedule delays need to be identified and accounted for. The identification of transfer equipment is straightforward because the functions required to transfer the waste have been a primary focus of the design effort. However, in the case of control or safety instrumentation and equipment, the requirements of the BIO (Jones, 1999) may link some instrumentation to the preliminary RAM model that is not directly related to the transfer function. These instruments monitor conditions that have to be satisfied in order to accomplish transfer functions. Support equipment provides the power, cooling, and operating fluids that the transfer and control equipment require in order to accomplish their functions. Support systems generally provide their services to a variety of equipment, some of which may not be directly related to the WFDS functions. To the extent that other equipment external to the WFDS may influence the availability of support systems, it must also be considered.

3.1.2 Human Actions

Human actions fall into two categories:

1. Mishaps during procedural activities that cause a cessation of progress towards the activity's goal and require recovery activity before work can proceed forward.
2. Accidents or mishaps not directly associated with the ongoing activity that generate a requirement to cease the activity.

Existing and planned waste transfer procedures are examined to identify opportunities for the first category of off-normal events. The frequency of the second category of events is estimated by examining Occurrence Reporting Processing System (ORPS) data and querying experienced RPP personnel to identify concerns. Examples of the second type of off-normal events are requirements to temporarily evacuate an area following an accident not associated with the ongoing activity, or a stand-down for retraining following such an accident. The estimation of the frequency and duration of delays associated with human actions is discussed in Section 3.4.

3.1.3 External Events

External events that result in conditions (other than failed hardware) requiring shutdown account for severe weather and incidents (such as range fires, accidents that interrupt services, etc.) that are not under the control of RPP personnel. Severe weather may include extreme atmospheric temperatures (cold or heat), high winds, or excessive precipitation. The frequency and duration of weather-related events are estimated using weather data supplemented by event reports from ORPS and engineering judgment derived from the experiences of RPP personnel. This evidence and its interpretation are discussed in Section 3.5.

The frequency and impact of incidents outside the control of RPP personnel are of interest to the preliminary RAM analysis only to the extent that RPP management decides that a threat is significant enough to proactively take action to influence conditions that prevent the incident or mitigate its consequences. This action must be taken on a case-by-case basis, and the preliminary RAM analysis does not explicitly address them. However, should a potential problem become known during this evaluation, it will be brought to the attention of responsible RPP personnel.

3.2 Evaluation of RPP Off-Normal Events

Records of the historical performance (Hoitink, 1997) of RPP equipment similar to that which will be used for the WFDS provides the most direct evidence for updating generic failure rates to better reflect those anticipated for WFDS components. However, since the mission is changing from one of safe storage to one of active qualification and transfer of waste to the privatization contractor for vitrification, the experience must be evaluated for applicability to the new operating conditions. Therefore, there are no readily available well-defined rules for the use of the existing historical data. Rather, the historical records are being used to understand the problems that have existed in the past and to provide a sample against which to adjust the generic failure rates as necessary to reflect the anticipated operating conditions for WFDS components.

The initial RAM analysis examined the 757 occurrence reports involving RPP in the DOE Occurrence Reporting and Processing System during the period from the beginning of 1990 to the end of 1997. In addition, it has collected over 5,000 records from the RPP Job Control System to identify trends in maintenance and repair of generic component types and specific components.

Two of the primary component-related measures for the study are failure rate and recovery time. To determine a failure rate, one must consider when the component was installed, under what conditions it operated, and how often it failed during that time.

Success information is not generally available in ORPS, JCS, or any other RPP database and has to be constructed from general knowledge of activities during the period and logs, if available. This labor-intensive effort is restricted to components that are important with respect to commitment of O&M resources.

3.2.1 *ORPS Evaluation Results*

The evaluation of the ORPS events is documented in a Microsoft® Access relational database that is available on the CD-ROM containing this report and the preliminary RAM model. A summary of the results is presented in Appendix C. Tables C-1 and C-2 describe the criteria used for the evaluation and define the fields used in the database to assist in the categorization process. Table C-3 presents a report from the database illustrating the assessments that were accomplished.

The evaluation determined whether the event was related to a component known to be associated with WFDS operations. The failure mode that was exhibited was then assessed and the resulting failed condition was categorized with respect to safety concerns and impact on the primary tank boundary. Differentiation within these two categories provides good correlation to recovery duration. Recovery of safety-related equipment generally involves more formal reporting and quality assurance, while restoration activities that are intrusive to the primary tank boundary require more training, preparation, and execution time to insure proper worker safety. Finally, if adequate information was available, the evaluation estimated the time to restore operations to a normal condition. A database printout of the entire evaluation is also available in the backup files.

The evaluation sought to identify any discernable pattern that would assist to establish a component's failure rate, but failed to find trends in the database. The ORPS information is reported to different levels of detail, as well as varying degrees of completeness. Examples of the ORPS evaluations are shown in Table C-3.

Except for the valves, the reported delay by component is less than 2.5 hours, which can be translated into repairs manageable within a single shift. The recovery times reported in the ORPS reports do not seem to agree with the opinions of maintenance personnel queried during the update of the component repair and recovery times for the Operations and Maintenance Concept. Based on their experience, it requires at least a shift to coordinate and release a work package to accomplish repairs. Before ORPS data can be used to assist in making site-specific estimates of failure rates and recovery durations, the circumstances and applicability of individual reports would have to be investigated in more detail.

3.2.2 *JCS Evaluation Results*

Corrective maintenance data from the Hanford Job Control System provides useful information about maintenance and repair activities. Over 5,000 Hanford site corrective maintenance actions were reviewed in this study. However, due to its sheer volume and the available format of its records, the evaluation of JCS has been only cursory to this point and is ongoing. Tables C-4 and C-5 provide examples of raw data obtained from the JCS database, and a preliminary effort to evaluate that data.

The JCS is of value in determining recovery times for failed components by providing a good indication of the activities needed to restore the equipment. However, since waste transfers were accomplished only infrequently and there were few external drivers to complete them within a specified time period, many corrective maintenance evolutions could be delayed for months with no appreciable mission impacts. Using this data in the WFDS preliminary RAM analysis would require interpretation to estimate future delay.

3.2.3 *General Observations Regarding JCS and ORPS*

As a result of the review of both the ORPS and JCS databases, the following general observations are offered that could potentially influence the O&M Concept and preliminary RAM analysis of the WFDS:

- Based on the recovery times inferred from the review of the event reports, it appears wise to institute some type of prioritization effort as part of the O&M Concept that guarantees expedient processing for WFDS work packages. There was an instance in ORPS where an Operating Safety Requirement (OSR) related preventive maintenance evolution was missed even though management knew they were approaching the deadline for performance. This was an instance of "failure to prioritize."

- Much of the information needed for identifying and trending problems that might need corrective action is buried in the narratives. Less than 3% of the JCS corrective maintenance event records include a direct link to a specific component or component type. This does not take best advantage of the capabilities of a relational database. A new site-wide database, HANDI 2000, is currently being developed. It is recommended that it be examined to insure that the content and use of each record and field within the database is clearly defined and verified against past and anticipated practices. It is important to avoid requiring the entry of information that is of no use, however, data entry for useful information (i.e., information required to support Hanford strategic resource management throughout the facility life cycle) should be made a firm requirement.

- The JCS has been used as a tool for scheduling and planning corrective maintenance and preventative maintenance work. Although the software is not user-friendly in all its applications, it has significant capabilities that are under-utilized. Those capabilities include tracking and trending tools and the ability to tie into component databases, master equipment lists, drawing databases, and other configuration management tools. However, since its implementation, it has been primarily used in these capacities for preventative maintenance and calibrations and not for corrective maintenance. RPP should consider an integrated maintenance management system that ties together work management and configuration management in a manner that allows for future analysis in improving RPP systems.

- Upon conversion of the JCS to the new integrated work control system within the HANDI 2000 system, RPP should seek to ensure that the historical data within the current Advanced Revelation software-based JCS system is retained in a usable format for future use.

3.3 Hardware Failure Rates

The exposure conditions to which components are subjected in association with the failure modes identified in the preliminary RAM model provide the context for hardware failure rates for the evaluation of potential WFDS delays. It is important that each failure rate be evaluated for the mission that the component must perform. This evaluation considers the nature of the exposure of equipment to failure modes and source of information that can be used to quantify the response of the equipment to these failure modes.

Hardware failure rates are quantified in accordance with two general classes of exposure; namely, time-related and demand-related exposure.

- Time-related failures might occur at any time during a mission when the component of interest must successfully maintain a given state, such as active operation, sensing capability, or structural integrity for a specified duration. The mission time depends on the function being accomplished, and this time may vary between equipment participating in the same activity. For example, safety-monitoring equipment must operate essentially all the time, and calendar time is an appropriate measure of exposure to failure. Transfer pumps actively operate only for the period required to pump the quantity of waste being transferred.

- Demand-related failures generally occur during an activity requiring a change in component state. The challenge occurs when the transition is made and is over once it is successfully completed. The most common transitions are starting, stopping, and changing position. In addition, some short duration operations may be assessed on a per-mission basis.

Historical evidence regarding the performance of similar equipment is the most direct information that can be used to quantify the response of RPP equipment to the failure modes it will be exposed to during WFDS activities. Sufficient site-specific information is not readily available to establish WFDS failure rates based on experience at RPP (see Section 3.2 above). The WFDS will be operating under a schedule for delivery of waste to the privatization contractor, with penalties for delay past the commitment date. In the past, RPP has been operating in a "safe storage" mode. Consequently, it is difficult to correlate the evidence being collected from the ORPS and JCS to the exposure conditions of interest in the WFDS preliminary RAM analysis. Used directly, this information could produce site-specific failure rates and recovery times impractical for the variety of component failure modes identified in the preliminary RAM analysis. Rather, this analysis uses a graded approach to quantify failure rates.

For this preliminary RAM model quantification, the analysis uses primarily generic hardware failure rates. The sources of these rates are described in Section 3.3.1 below. In conjunction with this quantification, the preliminary RAM analysis evaluates and categorizes the evidence available in the ORPS and JCS databases to identify trends in

off-normal events, failures, and faults observed during RPP operations in the past. Where a significant trend is identified, Bayesian methods are used to update the generic failure rates with this site-specific information. This process is described in Section 3.3.2.

3.3.1 *Generic Component Failure Rates*

Table B-1 in Appendix B summarizes the generic data used for the initial quantification. The generic failure rate data applied is taken primarily from component generic failure rates developed for the Savannah River Site (SRS) (Blanton, 1993) and *Loss Prevention in the Process Industries*, by Frank P. Lees (Lees, 1996). The preliminary RAM analysis gives highest weight to the SRS failure rates, because they are generally associated with DOE chemical process operations. The information from Lees supplements the SRS for applications in which a reasonable correspondence cannot be obtained between the equipment descriptions for RPP and descriptions associated with the SRS.

The generic failure rates are expressed as lognormal distributions that may be uniquely specified by a mean value and a range factor (RF). The mean value is the "best estimate" of the failure rate, but the RF relates the fact that the failure rates of actual equipment might vary considerably from the stated mean. The RF is formally defined as:

$$RF = SQRT(95^{th} \text{ Percentile}/5^{th} \text{ Percentile})$$

As a rule of thumb, one may state that there is only a 5% chance that the failure rate might be more than a factor of the RF above the median (that is close to the mean for RF < 5). RF values for generic failure rates are generally greater than or equal to 3. This reflects the potential variability that can exist from site to site and from exposure condition to exposure condition. It also reflects the general in applying the data to specific quantitative RAM models. Continuous updating of the baseline generic data applied in this analysis, using site-specific experience, should narrow this uncertainty throughout the remaining facility life cycle.

3.3.2 *RPP-Specific Component Failure Rates*

This section presents the evidence and reasoning used to generate the site-specific failure rates used in the preliminary RAM quantification.

Bayesian methods are used to update the generic failure rates with this site-specific information. The formal method for accomplishing a Bayesian update requires that a valid sample of component failures over a given exposure duration (either time in hours, or a known quantity of demands) be identified and validated. This sample is then used with Bayes' Theorem to update the uncertainty distribution of the generic failure rate. Bayes' Theorem accounts for size of the sample (and thus its uncertainty in representing the failure rates of the site-specific equipment) and the uncertainty of the generic distribution. This methodology is described fully in a number of sources, three of which are referenced here: *RISKMAN® Release 3.0, PRA Workstation Software, User Manual I: Data Analysis, (Appendix B, Methodology for One-Stage and Two-Stage Bayesian Updating* (PLG, 1991); *On the Use of Bayesian Reasoning in Safety and Reliability Decisions – Three Examples* (Kaplan, 1979); and *Probability Theory: The Logic of Science* (Jaynes, 1994).

The key to a correct estimate is a valid sample of performance that is directly applicable to the anticipated WFDS functions. This requires both a good understanding of the circumstances and effect of the failures and a reasonable knowledge of the operating history under which the failures occurred, such as radiological and thermal cycling and other severe environments. In addition, there should be some confidence that the combination of experience and failures is *complete* for the representative sample. The sample itself need not be a complete history of operations, but it should reflect the conditions expected during WFDS operations. Based on the review of the ORPS and JCS databases and the operating logs from the RPP, it is difficult to establish a valid sample for estimating site-specific failure rates.

Despite the above difficulties, a Bayesian approach can be used to update generic failure rate distributions. In essence, the evaluation performed by the application of Bayes' Theorem can be translated into a discussion that addresses two questions that form the essence of a Bayesian update:

1. Could the events recorded in ORPS and records of maintenance activities listed in JCS for this component type and failure mode have occurred if the generic failure rate is representative of this failure mode?

2. If the answer to this question is "no," by how much should the failure be adjusted to reflect the evidence from the ORPS and the JCS? (This adjustment should not reduce the uncertainty of the failure rate unless a formal update is accomplished.)

When warranted by the importance of the failure mode and the availability of evidence, the formal method of quantitative updating using Bayes' Theorem can be performed. In this case, evidence that supports the establishment of a valid quantitative sample of failures over a defined exposure history is presented.

Based on the review of events reported in the ORPS and JCS databases, the generic failure rates of the failure modes for the waste transfer pumps have been adjusted to better reflect the anticipated operating conditions for the WFDS as follows:

- Waste Transfer Pump, failure to start: documented in Appendix C, Table C-6.

- Waste Transfer Pump, failure to run: documented in Appendix C, Table C-6.

Table C-6 presents the Bayesian update of generic pump failure rates to reflect experience with waste transfer pumps at Hanford. The information is organized into four sub-tables as follows:

1. Presents a summary of the input data used to accomplish the Bayesian update.

2. Contains the characteristic parameters of the resultant probability distributions from the Bayesian update, which was accomplished using the data module of PLG's RISKMAN® program (PLG, 1991).

3. Summarizes available plant-specific data regarding transfer pumps used to generate the input for the Bayesian update. This data was taken from historical records of completed transfer procedures since 1990. Information

on failed pumps was excluded unless it failed since 1990 and logged a transfer in that period. These records are maintained in the Hanford Records Storage Facility in Seattle and were retrieved back to Richland to accomplish this review. Seventeen boxes of records were reviewed to extract the necessary data. The table is sorted by pump number/location and shows the number of transfers attempted, the number of total starts required to complete or finally abandon the transfer, and the calculated or logged pump running time. In many instances, it was not clear exactly when pumps were restarted to complete the transfer after a shutdown occurred. In these cases, we assumed a transfer rate of 140 gallons per minute based on WFDS specifications. The comments section indicates that most of the restarts were driven by leak detection master pump shutdown signals and other various alarm signals. Therefore, these events are not counted as pump failures in the Bayesian update.

4. Provides the complete set of data obtained during the review of relevant plant logs. This sub-table includes information on all transfers including the 204-AR offload facility, catch tanks, PUREX transfers, and other smaller tanks: more than 700 completed transfers in all.

There are a large number of differing models of installed pumps. For this reliability analysis, all models of transfer pumps are assumed to have a similar susceptibility to failure.

This data is significant because it provides sound evidence and justification for updating generic Savannah River Site data with Hanford-specific information. The data is combined with the generic data in a Bayesian updating process. This process allows new information to be considered continuously throughout a component's life cycle, and its significance on overall reliability assessed.

3.4 Reliability of Human Actions

The purpose of the human action analysis is to identify activities in which a human error can lead directly to a delay of the progress of scheduled transfer activities. Human actions fall into two categories:

- Mishaps during procedural activities that cause a cessation of progress toward the activity's goal and require recovery activity before work can proceed forward.
- Accidents or mishaps not directly associated with the ongoing activity that generate a requirement to cease the activity.

3.4.1 Procedural Activities

The preliminary RAM analysis has examined existing and planned waste transfer procedures to identify opportunities for the first category of off-normal events. Draft TO-270-019A0, *Transfer Waste From TK-105-AN To TK-102-AP* (PHMC, 1997), is currently the only procedure that addresses anticipated WFDS operations. Because many human actions are similar for the two transfers addressed in this preliminary RAM

analysis, this procedure was used as a surrogate to evaluate the potential for delays due to mishaps during human activities.

In defining actions for quantification, the evaluation recognizes that not every mishap will lead to a delay in WFDS operations. Operations and maintenance personnel work in teams. Activities are planned with the recognition that individuals within these teams may sometimes make errors or slips that, if left uncorrected, will lead to a delay. Therefore, time is provided for checking and an ability to recognize and correct slips before they produce a condition that requires termination of the WFDS activity.

This analysis accounts for team checking and follow-up by assigning failure effect codes that indicate that a critical path schedule delay will not directly result. It also recognizes that this process will extend over the set of steps focused on achieving a stated goal. Only the combinations of human errors that end up producing a delay are explicitly included in the preliminary RAM quantification. The reasoning for including specific sets of procedural steps in the preliminary RAM quantification is presented in Appendix D, Table D-1. The list of human actions quantified in the preliminary RAM analysis for the HLW transfers is given in Table D-2.

Procedural steps that involve verifying the operability of equipment are an example of one of these special circumstances for RAM evaluations. If the equipment is operable, an error in following the procedural step will have no impact on its performance. If it is not operable, the verification step will reveal that fact during the verification, as opposed to being revealed during actual transfer operations. However, when the equipment is found not operable, it is reported in ORPS and/or JCS. Therefore, the hardware failure rates account for the rate at which equipment is found inoperable.

If the hardware failure is revealed during a verification activity rather than active operation, the delay in critical path activities will most likely be reduced. Access to the failed equipment will most likely be less intrusive, and some of recovery may be able to be done in parallel with other tasks, thus lessening the WFDS schedule delay. This effect has been observed during the review of ORPS data and can be reflected in recovery time distributions of specific equipment if warranted by the O&M Concept justification. However, for this quantification, recovery times are modeled with distributions designed to reflect a range of circumstances under which recovery might be accomplished.

The frequency of mishaps during WFDS activities are estimated using human error rates developed at the SRS (Benhardt, 1994). The application of those error rates is described in Appendix D. The variables defining the error rates are given in Table D-3.

3.4.2 *Accidents or Mishaps Not Directly Associated with the Ongoing Activity*

Human actions not directly associated with the ongoing activity that produce accidents or mishaps that require temporary cessation of transfer activities are currently handled as external events. Appendix D, Table D-5, lists ORPS reports that could potentially cause delays of RPP transfer-related activities. Events that may arise during a broader set of RPP activities can be addressed by either the programmatic risk analysis currently being accomplished in conjunction with the O&M concept, or they can be added to the human action analysis as the scope of the preliminary RAM analysis is broadened throughout the RPP waste feed delivery system life cycle.

3.5 Frequency of External Events Related Delays

The purpose of the external events analysis is to identify those events which significantly contribute to delay in field operations. The set of external events examined in the preliminary RAM analysis includes severe weather and disruptive external events reported in ORPS.

Severe weather may include severe heat, cold, high winds, or excessive precipitation. The frequency and duration of weather-related events are estimated using weather data provided by the Hanford Meteorological Station supplemented by event reports from ORPS and engineering judgment derived from the experience of RPP personnel. The frequencies developed below are the average over a typical year. The average frequency is currently used because scheduling of activities for the waste transfers of interest is still very preliminary. The frequency at which they occur during transfer operations will depend on the duration and timing of the operation. This is addressed in Section 5.

The occurrence of disruptive external events is estimated primarily from incidents reported in ORPS. Because external events occur independent of the activities associated with transfer operations, their frequencies are reported on an annual basis. The data taken from the ORPS include reports made from the beginning of 1991 through the end of 1997, or seven years. Therefore, the frequency of events is estimated by dividing the number of events recorded in the ORPS database by seven.

3.5.1 High Temperature

The ambient temperature has a major influence on work mission duration as it affects the worker. Aside from obvious work place dangers, the frequency of accidents, in general, is higher in hot environments than in more moderate environmental conditions. One reason is that working in a hot environment lowers the mental alertness and physical performance of an individual. In addition, increased body temperature and physical discomfort promote irritability, anger, and other emotional states that sometimes cause workers to overlook safety procedures or to divert attention from hazardous tasks.

Heat stress, which can occur even in relatively moderate temperatures, is a major hazard, especially with workers wearing protective clothing. Reduced work tolerance and the increased risk of excessive heat stress are directly influenced by the amount and type of personal protection equipment (PPE) worn. The PPE adds weight and bulk, severely limits the dissipation of body heat and moisture, and increases energy expenditure. The magnitude of this effect varies considerably, depending on both the individual and the PPE ensemble used. Thus, personal protective clothing can create a hazardous condition that must be evaluated and managed.

Heat stress is caused by a number of factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at hazardous waste sites, regular monitoring and other preventive precautions are vital. Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work. The length of the work cycle will be governed by the frequency of the required physiological monitoring. These conditions should be factored into the normal estimation of task duration for tasks accomplished during the summer.

SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS

Adjusted Temperature	Normal Work Clothing	Impermeable Protective Clothing
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5 – 90°F (30.8 - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5 – 87.5°F (28.1 - 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5 – 82.5°F (25.3 - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5 – 77.5°F (22.5 - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

The maximum temperature days (≥ 100°F) have occurred as early as May 7 and as late as September 6 at the Hanford site. The annual number of days with maximum temperatures ≥ 100°F range from 1 to 28 days. The greatest number of consecutive days with maximum temperatures ≥ 100°F is 11, which has occurred on three occasions. Where feasible, the most stressful tasks should be performed during the cooler parts of the days (i.e., early morning or at night). Double shifts and overtime should be avoided whenever possible during these conditions. Rest periods should also be extended to alleviate the increase in the body heat load.

The frequency and duration of severe heat-related events are estimated by examining the Hanford site-specific data. The results are summarized below. For purposes of estimation, the durations of delay are divided into three groups. The likelihood of delay reflects both the chance that work might be stopped entirely, or that the schedule would have to be extended to compensate for the severe weather. The low likelihoods reflect the fact that many activities might not be sensitive to heat-related problems.

HIGHEST TEMPERATURE, $100° \geq T_{max} \geq 90°F$

Lost Work Time (hours)	Likelihood of Delay Given $90 \leq T_{max} < 100°F$	Number of days Temperature $90 \leq T_{max} < 100°F$	Frequency of Delays per Year
24	0	39	0
12	0	39	0
6	0.05	39	2.0
0	0.95	39	N/A

HIGHEST TEMPERATURE, $T_{max} \geq 100°F$

Lost Work Time (hours)	Likelihood of Delay Given $T_{max} \geq 100°F$	Number of days Temperature $T_{max} \geq 100°F$	Frequency of Delays per Year
24	0	12	0
12	0.01	12	0.1
6	0.19	12	2.3
0	0.8	12	N/A

The estimated frequency of delays is obtained by summing the frequencies of the same duration.

Failure Mode Code	Duration of Delay	Frequency of Delays per Year
EXT.HT.12	12	0.1
EXT.HT.06	6	4.2

Thus, one might expect to see delays of about six hours about four times per year, but longer delays are estimated to occur only once in 10 years.

3.5.2 *Low Temperature*

Environmental conditions that cause cold-related stresses also need to be considered. Cold-related stress is caused by a combination of low temperature, cool high winds, dampness, and/or cold water. Wind chill is an important factor to evaluate when working outside. A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures.

At the Hanford site, the seasonal average of the number of days with minimum temperatures $\leq 32°F$ is 106. However, the seasonal number ranges from 70 to 143 days. The greatest number of consecutive days with minimum temperatures of $\leq 32°F$ has been 93.

On average, three days per winter season have a minimum temperature $\leq 0°F$. Nearly half of all winters, however, have no minimum temperatures $\leq 0°F$. The greatest number of days with temperatures $\leq 0°F$ in any one season was 18, while the greatest number of consecutive days with minimum temperatures $\leq 0°F$ was 11 days.

The frequency and duration of severe cold-related events is estimated by examining the Hanford site specific data. The table below identifies the likelihood of a work delay occurring in any given 24-hour work period. These tables reflect the judgment that the cold temperature will make it too difficult to accomplish some of the out-of-doors tasks required to set up and operate the transfer activities.

LOWEST TEMPERATURE, T < 0°F

Lost Work Time (hours)	Likelihood of Delay Given $T_{min} < 0°F$	Number of days Temperature $T_{min} < 0°F$	Frequency of Delays per Year
24	0.1	2.6	0.3
12	0.2	2.6	0.5
6	0.4	2.6	1.0
0	0.3	2.6	0.8

LOWEST TEMPERATURE, 0°F < T < 32°F

Lost Work Time (hours)	Likelihood of Delay Given $0°F < T_{min} < 32°F$	Number of days Temperature $0°F < T_{min} < 32°F$	Frequency of Delays per Year
24	0	102.4	0.0
12	0.01	102.4	1.0
6	0.04	102.4	4.1
0	0.95	102.4	97.3

Combining these values, the annual frequency of 6-, 12-, and 24-hour delays due to cold temperatures is:

Failure Mode Code	Lost Work Time (hours)	Frequency of Delays per Year
EXT.LT.24	24	0.3
EXT.LT.12	12	1.5
EXT.LT.06	6	5.1

3.5.3 Wind

The highest monthly average wind speeds at the Hanford site occur in June, with the lowest in December. The variability in monthly average wind speeds, however, is greater in the winter months than during the remainder of the year. During an average year, 43% of the days can be expected to produce wind gusts ≥ 25 mph.

For the Hanford site, 25 mph has been established as this threshold limit where all crane work is to be stopped.

For wind speeds between 25 to 40 mph, work may be continued at the discretion of the Shift Supervisor. June and July have the highest number of days (nearly 20 days each) with gusts ≥ 25 mph. The months of January, March, and April have the highest average number of days (i.e., three) with gusts ≥ 40 mph.

In a given year, 2% of the days would be expected to have peak gust speeds ≥ 50 mph. January has the highest average number of gusts ≥ 40 and ≥ 50 mph, at 11 and seven days, respectively. In addition, January has the highest average number of days with gusts ≥ 50 mph. The Tank Farm is to be evacuated when wind speeds reach 50 mph.

The likelihood of work delays of various durations due to high winds is estimated below. When wind gusts to over 50 mph, it is assumed that there will be at least some work stoppage, since the tank farm is to be evacuated. It was judged that work stoppage for gusts between 25 and 50 mph is less likely, being judged to occur on 10% of the days. This reflects the fact that only some activities (such as crane operations and pit work) would be affected by the wind, and cessation of operations may be at the discretion of the shift supervisor. The duration of stoppage depends on the duration of the gusts, and this information was not available in the data. The minimum duration is assumed to be six hours to account for the time that might be required to recover from the disruption. The relative weights of the stoppage times were judgmentally assigned by the RAM analysis team.

Lost Work Time (hours)	Likelihood of Delay Given Wind Gusts ≥ 50 mph	Number of Days Having Wind Gusts ≥ 50 mph	Frequency of Delays per Year
24	0.1	4.7	0.5
12	0.4	4.7	1.9
6	0.5	4.7	2.4
0	0	4.7	N/A

Lost Work Time (hours)	Likelihood of Delay Given Wind Gusts between 40 & 50 mph	Number of Days Having Wind Gusts between 40 & 50 mph	Frequency of Delays per Year
24	0	151	0.0
12	0.01	151	1.5
6	0.09	151	13.6
0	0.9	151	N/A

Failure Mode Code	Lost Work Time (hours)	Frequency of Delays per Year
EXT.WD.24	24	0.5
EXT.WD.12	12	3.4
EXT.WD.06	6	16

3.5.4 *Precipitation*

Normal annual precipitation for the Hanford site is 6.26 inches. The wettest year on record had 12.31 inches. The months of November through February provide 3.35 inches (54%) of the normal annual precipitation. December is the wettest month, receiving 1.03 inches.

Nine periods have been recorded when precipitation has been abnormally high at Hanford. Total precipitation for 1973 was 8.27 inches (132% of normal). During the period of October through December 1973, 6.38 inches of precipitation was recorded (289% of normal for those months). Precipitation of 6.36 inches was received in November and December 1996, representing 328% of the normal precipitation amount for the two months.

Snowfall at Hanford has varied from a seasonal total of 0.3 inches to 56.1 inches. The average date of the first measurable snow is November 29; while the last measurable snowfall date is February 11. The record snow depth at any one time is 15.6 inches, and the record number of days with snow depth $\geq$ 6 inches is 43.

An estimation of the frequency and length of delay associated with precipitation events was not calculated, since it is deemed that these events occur infrequently and will not be of sufficient severity to directly cause a work stoppage. However, flooding of equipment may occur, and its frequency may be estimated by examining reports from the ORPS and JCS databases.

3.5.5 *Thunderstorms*

By definition, a thunderstorm day is one on which thunder is heard at the observing station one or more times during a calendar day. Except for January, thunderstorms occur in every month of the year. The typical thunderstorm season is from April through September. The average number of thunderstorm days per year is 10. However, the total in a given year varies from a low of three days to a high of 23 days. When a thunderstorm is within five miles of the Hanford site, the Tank Farms are to be evacuated.

An estimation of the frequency and length of delay directly associated with thunderstorms was not calculated, since it is deemed that these events occur infrequently and would be of short duration. However, loss of power events due to lightning strikes are accounted for in the loss of power estimate in Section 3.6.1. Delays due to lightning will be reviewed in the next revision of the preliminary RAM analysis. Specifically, it will address the current requirement that tank-intrusive work must stop when lightning is within 50 miles.

3.5.6 *Loss of Power Events*

Table 3-1 lists the loss of power events that have been identified in the ORPS that could cause a delay to transfer operations should they occur during transfer operations. These events include those due to lightning strikes during thunderstorms, accidental disruptions to power due to mishaps not directly associated with transfer operations, and losses of power from the external source. The duration of work stoppage may be greater than the outage produced by the loss of power. Depending on the transfer operations underway, actual loss of work time will depend on the effort needed to reverify that conditions for continued operation remain satisfactory for restart. The delay estimates associated with the loss power events in the ORPS are assumed to account for this additional time.

Failure Mode Code	Number of Events	Lost Work Time (hours)	Frequency of Delays per Year
EXT.LOSP	9	3	1.3

3.5.7 *Other External Events*

Table 3-2 lists other external events from the ORPS that are judged to have the potential to produce delays to transfer operations. These events account for various events, that range from severed cables to evacuations resulting from alarms (that may or may not be valid, but still stop work). The work stoppage time for these events ranged from less than two hours to 11 days, with two long events accounting for most of the average delay. One of those events was related to cold weather that was considered to be sufficiently long and different from delays due to unsuitable work conditions to be included explicitly with this category of events. Since that event directly delayed a transfer event, it is important to explicitly include it here.

Failure Mode Code	Number of Events	Lost Work Time (hours)	Frequency of Delays per Year
EXT.OTHR	9	57	1.3

Table 3-1. Loss of Power Events That Have Been Identified In The ORPS That Could Cause A Delay To Transfer Operations Should They Occur During Transfer Operations

_01_orps _Number	_10a_discovery date	_07_sys/building	_14_Title of Occurrence	Failure_mode_ code	Rationale	Restoration_ Time	Time_Rationale
RL--WHC-TANKFARM-1991-1029	07/20/91	242-A Evaporator	"Loss Of Electrical Power to the 242-A Evaporator"	External – loss of power	Unplanned power outage, back-up ventilation system (steam driven) could not be put into service due to scheduled steam outage.	4	Time required to troubleshoot and repair primary system.
RL--WHC-TANKFARM-1991-1031	08/06/91	Momentary power loss for 200 E and 200 W Tank Farms	External loss of power lightning strike	External – loss of power lightning strike		0.75	Based on ORPS report to investigate event and restart equipment.
RL--WHC-TANKFARM-1991-1063	11/16/91	200 West	Loss of power to 200 West Tank Farms	External – loss of power	Loss of ventilation possible OSR violation.	3	Power restored within 1 min. System check-out continued for ~3 hrs.
RL--WHC-TANKFARM-1992-0028	03/16/92	Tank Farm Facilities	200 East/200 West power outage	External – loss of power	Power lost to West Tank Farm for ~ 30 min. and East Tank Farm ~ 2 hrs. 242-S Evaporator evacuated due to exhauster shutdown. All Tank Farms put on fresh air.	2	Operations personnel obtained pressure readings from magnehelic gauges in AW, AP, and AN Tank Farms. HP personnel surveyed AW, AP, and AN Farms and take air samples. Primary exhauster in AW, AP, and AN Farms restarted. East Farm unable to restored immediately.

Table 3-2. Loss of Power Events That Have Been Identified In The ORPS That Could Cause A Delay To Transfer Operations Should They Occur During Transfer Operations (continued)

_01_orps_ number	_10a_ discovery date	_07_sys/ building	_14_Title of Occurrence	Failure_mode_ code	Rationale	Restoration _Time	Time_Rationale
RL--WHC-TANKFARM-1992-0051	06/28/92	200 West Area	Electrical storm disrupts 200 West area power, resulting in temporary Tank Farm exhauster and alarm failures.	External – loss of power lightning strike	Loss of ventilation possible OSR violation.	2	Due to the brief power outage, CASS substations de-energized and failed to reset when power was restored. Loss of alarm signals from the substations slowed process of identifying and resetting de-energized equipment.
RL--WHC-TANKFARM-1994-0040	08/05/94	Ventilation/East Area Tank Farms	Loss of ventilation to East Area Tank Farms due to subcontractor severing a power line.	External - loss of power	Electric cable severed by sub-contractor performing excavation work. The loss of power resulted in loss of ventilation in 241-AN, AW, AP, C, 244-BX, and 244-CR. Also lost all remote tank monitoring capabilities.	1.5	Power restored, ventilation restored to all facilities. HPT performed surveys of affected farms, no spread of contamination.
RL--WHC-TANKFARM-1996-0044	07/01/96	241-AN/AW/AP/ AY/ AZ, 272-AW AND 244-AR	Unplanned electrical outage.	External - loss of power	Personnel evacuated from 241-AN, AW, and AP Tank Farms due to loss of ventilation. Personnel evacuated from AZ Tank Farm due to loss of power to pressure alarm circuits.	4.5	Blown line fuses identified and replaced. Normal power restored in approximately 4 hrs. Respective Farms surveyed for contamination release.

Table 3-2. Loss of Power Events That Have Been Identified In The ORPS That Could Cause A Delay To Transfer Operations Should They Occur During Transfer Operations (continued)

_01_orps_number	_10a_discovery date	_07_sys/building	_14_Title of Occurrence	Failure_mode_code	Rationale	Restoration _Time	Time_Rationale
RL--PHMC-TANK FARM-1997-0049	05/31/97	241-SY, 241-SX, 242-T and 244-TX Exhausters 242-S Compressor	Momentary power loss at 200 West Tank Farms causes exhausters to unexpectedly shutdown.	External - loss of power lightning strike	Momentary power loss, resulting in shutdown of 241-SY primary exhauster, 241-SY annulus exhauster, 241-SX exhauster, 242-T building exhauster 244-TX exhauster, and 242-S air compressor.	1	All equipment restarted, no damage noted. No release of contamination.
RL--PHMC-TANK FARM-1997-0064	08/06/97	241-SY, 241-SX, 242-S, 244-TX, 242-T Exhausters	Loss of Tank Farm ventilation power.	External -- loss of power	Vehicle caught utility pole guy wire, severing electrical wires. Disrupted power supply to 241-SY Tank Farm, shutting down 241-SY exhausters, 244-TX exhauster, 244- T exhauster, 241-SX exhauster and "S" and "T" CASS substations.	9	Driver removed from vehicle and electrical hazard eliminated. 241-SY back-up exhauster started using alternate power source. 244-TX exhauster, 242-T exhauster, 241-SX exhauster, and "S" and "T" CASS substations restarted. Power restored to 241-SY Tank Farm.
					Total Number of Events	Average Duration (hours)	Frequency per year
					9	3.1	1.3

Table 3-3. External Events From The ORPS That Are Judged To Have The Potential To Produce Delays To Transfer Operations

_01_orps_number	_10a_discovery date	_07_sys/building	_14_Title of Occurrence	Failure_mode_code	Rationale	Restoration _Time	Time_Rationale
RL-WHC-TANKFARM-1991-0050	01/16/91		Low level contamination (8000 dpm) discovered in 272-AW men's change room.	External	Uncontrolled contamination in an operational area creates delays as the contamination is investigated and brought under control.		Based on ORPS report to clean up the contaminated area.
RL--WHC-TANKFARM-1992-0023	02/28/92	244-TX DCRT LL	Exceeded maximum operating limit in 244-TX double contained receiver Tank and overflowed a small volume to the secondary containment sump.	External	Diesel fuel spill required remediation.	11	Took 5 hrs before steps initiated to locate and position drip pan. Portable compressor shut down 6 hrs later until a more efficient method/ system for fueling obtained.
RL--WHC-TANKFARM-1992-0039	05/11/92	241-AY Tank Farm	Gasoline spill at 241-AY tank farm due to a faulty fuel pump.	External	Fuel leak from faulty fuel pump, gravel and soil required remediation.	2	Time required to remove affected soil/gravel and have van transported to garage.
RL--WHC-TANKFARM-1993-0008	01/15/93	204-AR	Waste transfer delayed because the transfer pump deadheaded; frozen line suspected in AX-B valve pit; no injuries or environmental releases.	External - cold weather	Transfer pump appeared dead-headed, valve line-up verified. Second attempt terminated. Suspected that pipe jumpers in A-B and/or AX-B Valve Pit may be frozen blocking transfer line.	264	PLG estimate based on: three days after the failed transfer attempt, temporary heaters were placed in valve pit to thaw out pipe jumper. The transfer was completed 11 days later. A leak occurred in the AX-B valve pit during the transfer, (which the cold weather is assumed to contribute to).

Table 3-4. External Events From The ORPS That Are Judged To Have The Potential To Produce Delays To Transfer Operations (continued)

_01_orps_number	_10a_discovery date	_07_sys/building	_14_Title of Occurrence	Failure_mode_code	Rationale	Restoration _Time	Time_Rationale
RL--WHC-TANKFARM-1993-0057	06/22/93	Crane\Lifting Block\Wire Rope	KEH crane activities in 241-SY tankfarm result in two-blocking main hoist block, severing wire rope and block falling to ground.	External	Stop work issued, crane necessary transfer operations. While violation resulted from subcontractor crew, RPP personnel also affected.	220	Retraining required subcontractor and RPP personnel, stop work lifted after training completed.
RL--WHC-TANKFARM-1993-0072	08/11/93		Loss of primary AC power to AP, AW, and AN tankfarms resulted in the loss of primary exhaust fans to AP, AW, AN, and C tankfarms.	External	This event could occur during Phase 1 operations with similar effects.		Based on ORPS report time to restart HVAC equipment.
RL--WHC-TANKFARM-1993-0089	09/27/93	Computer Automated Surveillance System (CASS)	Instrument cable severed during contractor excavation work results in loss of remote alarm signals from east tank farm facilities.	External	Computer Automated Surveillance System (CASS) cable severed, resulting in loss of remote alarm signals from East Tank Farm facilities.	2	Continuous monitoring of local alarms was established per CASS contingency backup procedure.
RL--WHC-TANKFARM-1993-0114	12/15/93	Waste Tank 241-C-103	Operations personnel performing liquid sampling of waste tank 241-C-103 on supplied air evacuated due to a carbon monoxide alarm.	External	Personnel directed to evacuate Tank Farm. Source of carbon monoxide was a truck parked to close to breathing air compressor intake.	1.5	Carbon monoxide monitor remained at a reading of 0 PPM for 1 hour, levels were within limits. Personnel were allowed to resume sampling work.

Table 3-5. External Events From The ORPS That Are Judged To Have The Potential To Produce Delays To Transfer Operations (continued)

_01_orps_number	_10a_discovery date	_07_sys/building	_14_Title of Occurrence	Failure_mode_code	Rationale	Restoration _Time	Time_Rationale
RL--WHC-TANKFARM-1995-0044	05/03/95	242-A Evaporator/ AW-Tankfarm	241-AW tankfarm "pressurization alarm" results in evacuation of personnel.	External	In accordance with procedure ALL personnel evacuated from Tank Farm. Prior to returning to work, crews briefed to only perform inspections on one tank at a time.	8	Alarm was cleared with 10 min., however, second alarm an hour later forced a work stoppage until a critique could be held to discuss work options.
					Total Number of Events	Average Duration (hours)	Frequency per year
					9	57	1.3

4. Recovery from Off-Normal Events

This section summarizes the approach used to quantify the time needed to recover from the off-normal events modeled in the preliminary RAM analysis. These include hardware failures, human errors, and external events (i.e., all schedule-delaying events included in the RAM model quantification). The approach makes a distinction between the actions required to resume the scheduled WFD activities and those needed to bring the WFDS back to its normal operating condition. The restoration time associated with each off-normal event is used for calculations of schedule delay and the idle facilities penalty FOM. Section 4.1 defines the term "restoration time" and discusses how it is related to recovery activities that bring the system back to its fully operational configuration. It then summarizes how these times are estimated in the preliminary RAM analysis. Section 4.2 addresses the recovery of system hardware (SSCs) following an off-normal event, while Sections 4.3 and 4.4 present the restoration times associated with human errors and external events.

4.1 Approach for Estimating Recovery

The primary objective of the recovery analysis is the quantification of the time to restore WFD activities after each off-normal event. In this section, recovery analysis terms are defined and the approach used for the waste feed delivery system RAM recovery time analysis is described.

4.1.1 *Definition and Interpretation of Recovery Activities*

The preliminary RAM analysis makes a distinction between the time needed to restore the system functionality so that an interrupted waste transfer activity may be resumed following an off-normal event, and the time needed to repair SSCs that may have failed or been damaged. These concepts are encompassed by the following definitions:

- **Time to Restore.** For the preliminary RAM analysis, the "time to restore" is defined as the total clock time from the occurrence of the off-normal event until the interrupted WFD activity resumes. This term can be applied to both hardware and non-hardware interruptions.
- Hardware recovery options include both manual switchover to a backup and repair of the failed SSC. If an SSC has a redundant backup or an alternate operational mode that can be brought into operation, the time to restore will reflect the time required to complete realignment and startup of the backup. Otherwise, the SSC will have to be repaired to restore the function.
- Non-hardware related restoration time can reflect a number of off-normal events. These include site conditions that are too severe for active operations, need for revision of inadequate procedures, retraining of the workforce, or time required to recover facilities that are not under the control of RPP O&M organizations.

- **Time to Repair** refers to an SSC's downtime until it can be brought back to full operation. In the context described here, the term "repair" includes either actual repair or replacement of the SSC. The operative requirement is that the failed hardware's functional capabilities be fully recovered.
- **Recovery** is the term used to encompass all the actions involved in both restoration and repair.

Figure 4-1 illustrates the recovery actions to resume scheduled waste feed activities that might be required following an off-normal event. As shown in the figure, Operation's first responsibility is to assure the facility has transitioned to a safe state that will enable recovery to proceed. If this condition is not met, emergency response procedures are entered. Design features and controls to minimize the occurrence of off-normal events are addressed in the authorization basis. Because emergency response activities are safety related, and would take immediate precedence over WFD activities, any delays resulting from emergency response are considered to generate special circumstances that are not within the scope of the preliminary RAM analysis.

When hardware failures have caused the off-normal event, recovery actions may restore the system function either by switchover to a backup, or repair of the failed SSC. For most single-train (i.e., non-redundant) components without some type of manual bypass capability, time to restore is the same as time to repair, but for redundant components, time to restore generally differs significantly from the time to repair. In the case of SSCs having manual bypass or secondary manual operation, the time to restore will be the time required to realign the system, in effect, bypassing the failed component function to restore process function. For example, when an HVAC system fan in a one-out-of-two redundant HVAC train system fails, the ventilation can be restored relatively quickly by isolating the failed fan, realigning flow paths as necessary, and placing the failed fan's redundant (standby) fan in operation. After the failed SSC is bypassed, it should be repaired expeditiously to restore the backup capability.

Recovery from human errors and external events does not generally have a fallback option. The issues that produced the off-normal event must be addressed directly and resolved prior to resuming scheduled operations. In the case of human error, recovery involves investigation of the cause of the error and corrective action to assure that the error will not occur again. In the case of external events, it involves waiting for the unfavorable conditions that generated the off-normal event to clear or be corrected. Sections 4.3 and 4.4 briefly discuss the approach used in the preliminary RAM analysis to quantify delays due to human error and external events, respectively.

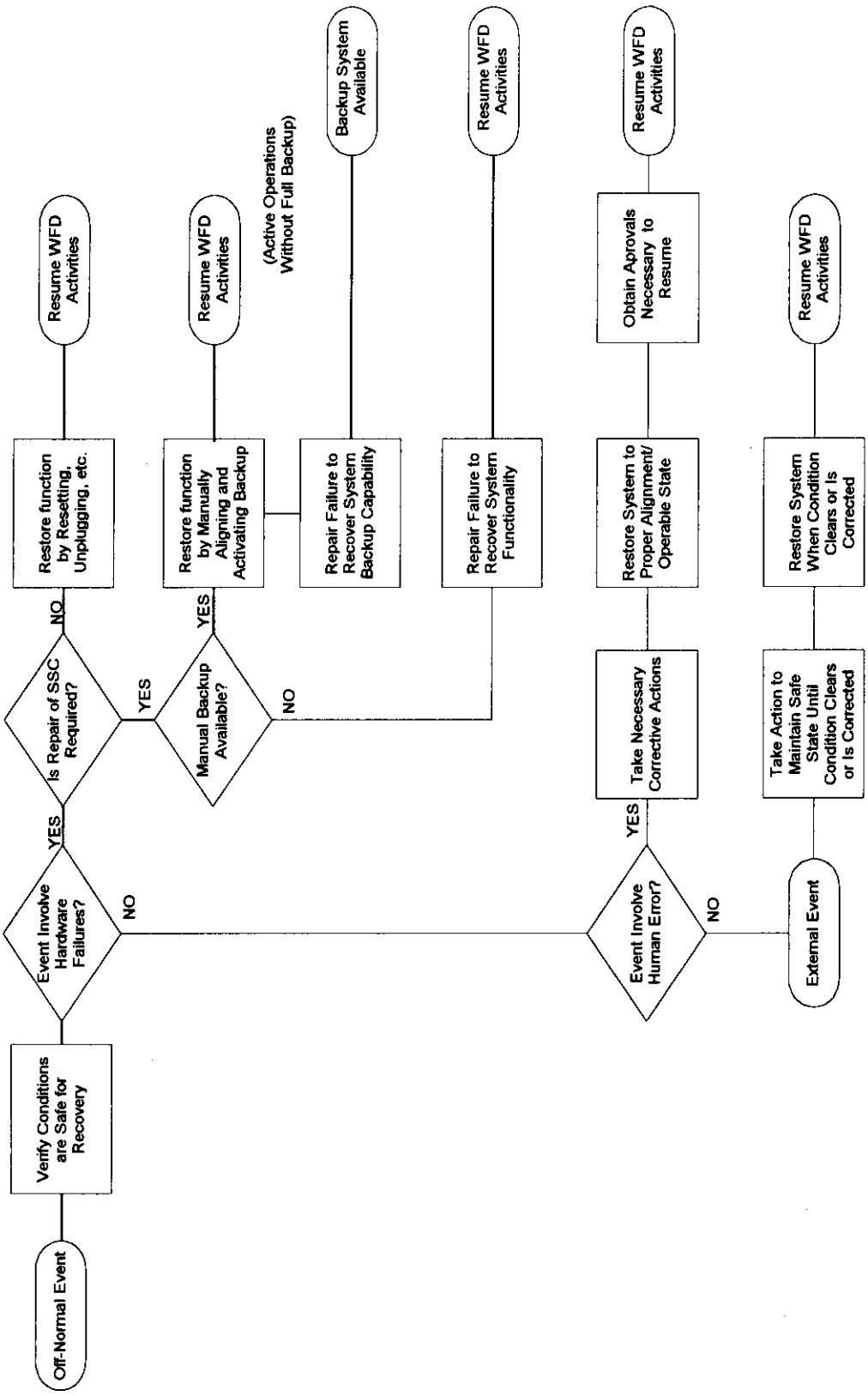

Figure 4-1. Recovery Actions Following an Off-Normal Event

4.1.2 *Approach*

Typical "generic" recovery times for SSCs, available from other sources, do not apply at the Hanford tank farms. Furthermore, the historical evidence of restoration time available from ORPS and JCS data do not reflect the more focused operational environment that is expected to exist when waste transfer activities commence. Therefore, the preliminary RAM analysis used the judgment of personnel familiar with site operations to estimate recovery times based on their knowledge of the location, potential for intrusion, and magnitude of anticipated repair activity.

In general, two sets of estimates were generated for use in the preliminary RAM analysis.

1. The first set provides estimates of restoration times. Section 4.2.1 presents estimates of SSC restoration times for conditions where full repair is not required to regain functionality and resume operations. Restoration times associated with human error and external events are addressed in Sections 4.3 and 4.4, respectively.
2. The second set provides estimates of the repair time and effort for SSCs that have suffered a material failure. These estimates were generated as part of the O&M Concept development and are documented in Appendix H of the "O&M Concept Document" (Carlson, 1999). They provide an estimate of not only the time to plan and complete repair activities, but also the breakdown of engineering and crafts resources needed to accomplish those activities. These are addressed in Section 4.2.2.

Formal elicitation methods were not used to generate the restoration time and repair time distributions used to quantify the preliminary RAM analysis. These methods require a very rigorous methodology and time-consuming approach involving a large group of experts who review multiple data sources and provide expert opinions. The basis and evidence for each opinion and assumption is carefully documented and analyzed. Given the developmental stage of the O&M Concept, it was judged that the structured, but informal discussions that produced the estimates would be adequate to generate further thought regarding the problems associated with the recovery of the WFDS from off-normal events. The generic categorization of recovery actions contained in the preliminary RAM analysis will provide RPP personnel with the capability of reviewing and refining the results to reflect known problems and examine the impact of anticipated delays.

4.2 Recovery from Hardware Failures

This section focuses on the recovery from hardware failures. Hardware failures were addressed using three categories.

1. Restoration from failure modes that do not require repair,
2. Recovery times for large pumps in DST tanks are presented that account for the recent estimates made by Shaw (Shaw, 1998), and

3. Times to repair categories of equipment, grouped by component type and the conditions under which the repair is accomplished.

4.2.1 *Time to Restore Functions Not Requiring SSC Repair*

Active WFD operations are interrupted upon the functional failure of any SSC needed for either the WFD activity underway or continued safe storage. However, some systems do provide for a manual restoration of function prior to repairing the failed SSC. Examples of DST systems that meet this description are:

- The DST HVAC systems have backup that can be manually aligned in time to restore safe conditions IAW the authorization basis and permit resumption of WFD activities.
- MOVs being installed in some valve pits will have the capability for manually changing the valve position if the motor operator fails.
- Some equipment failure modes may be able to be cleared without having to fully repair an item of equipment. Examples are instances of spurious signals from instruments, or minor plugging incidents that can be eliminated by flushing.

The preliminary RAM analysis accounts for these capabilities to manually restore system function by assigning a restoration time that reflects the time required for problem investigation, manual switchover, and resumption of WFD activities. Table 4.1 identifies the restoration time distributions used for manually redundant hardware. They are modeled with a triangular distribution, having a firm minimum and maximum duration, with a point of maximum probability (mode) somewhere between. These distributions represent the judgment that manual switchover to redundant SSCs should not involve large uncertainties. Table 4-2 defines the categories used to assign variable names for the recovery distributions. The objective of the coding is to allow operations and maintenance personnel to identify restoration activities having similar problems.

The preliminary RAM analysis currently assumes that if switchover to a manual backup has been made, the backup component will function without failure until repairs to the failed component are completed. This assumption is based on the judgment that the likelihood of a random failure in the backup component is small during the time required to complete the repairs. Common cause failures and unusual or out-of-envelope operating conditions can precipitate additional failures at a higher rate, but the additional model complexity and the unavailability of evidence to support these evaluations would require effort not warranted by the current state of the system design.

Table 4-1. Distributions Used to Model Restoration Times

Recovery Time ID	Clock Hours (Low)	Clock Hours (Mode)	Clock Hours (High)	Location	Containment Tank Intrusive?	Procure Parts?	Plan Package?	Typical Rationale	Use for Restoration of WFD Function
Recoveries Involving Work Impacting the Primary Tank Boundary								Tasks involving repair/replacement of smaller items.	
RTPTBSML01	2	24	72	Outside Pits	Yes	No	No	Non-maintenance operational response; routine maintenance, no planning required.	This distribution was applied primarily to leak detector response and resetting.
RTPTBSML02	120	144	168	Inside pits/tank enclosures.	Yes	Yes	Yes	Maintenance requiring planning, 2-day package preparation, 2 day coverblock removal and procurement, 1 - 3 day maintenance; outside support; SCBA and waste management required.	This distribution was applied primarily to instrumentation that is contained within valve pits such as valve position switches and leak detectors that only require a manual adjustment to recover a normal operating configuration.
Recoveries Involving Work Inside a Tank Farm Fence								Tasks involving repair/replacement of smaller items	
RTFRMSML01	1	4	12	Farm	No	No	No	Routine maintenance, no planning required; simple troubleshoot and repair, no parts required; routine alarm response; redundant/backed up equipment failure.	
RTFRMSML02	2	6	48	Farm	No	No	No	Routine maintenance, no planning required; simple/moderately complex troubleshoot and repair, parts available; non-routine alarm response; SCA entry required.	
RTFRMSML03	12	24	120	Farm	Maybe	No	Yes	Maintenance requiring planning, spares probably available, 1 day package preparation; SCA entry and waste management required.	This distribution was assigned for plugging events where a flush was likely to recover the failure.
RTFRMLRG01	4	24	168	Farm	No	No	No	Routine maintenance, no planning required; moderately complex troubleshoot and repair, parts available.	
Recoveries Involving Work Outside a Tank Farm Fence								Tasks involving repair/replacement of smaller items	
RTOTHSML01	1	2	6	Outside farm	No	No	No	Routine maintenance, no planning required; simple troubleshoot and repair, no parts required.	This code was applied primarily to redundant components whose recover required a manual restart of the standby system.
RTOTHSML02	6	12	24	Outside farm	No	No	No	Routine maintenance, no planning required; moderately complex troubleshoot and repair, parts available; non-routine alarm response	This code applied primarily to leak detectors in supporting systems such as the flush/ dilution system and to other supporting components that could have a rapid recovery such as a plugging of a flush/dilution system valve.
RTOTHSML03	12	24	72	Outside farm	No	No	Yes	Maintenance requiring planning, spares probably available, 1 day package preparation	This code was applied in error to 9 components in LAW systems. They should have been encoded RTOTHSML02.
RTOTHLRG01	2	60	120	Outside farm	No	No	No	Routine maintenance, no planning required; simple/moderately complex troubleshoot and repair, parts available; routine alarm response	
RTXXXDWN01		10000						Special circumstances in which waste transfer operations would be reevaluated; other programmatic impacts	

Table 4-2. Interpretation of Restoration Time (RT) Variable Names

Restoration Time Variable Definition	
Format: RTAAABBB##	
RT	Restoration Time Identifier
AAA	General Category of Restoration Activity
BBB	Focus of restoration activity
##	Index Number to Differentiate Activities as Necessary for Planning
Current Codes	
AAA	Equipment failures are distinguished by
PTB	Hardware Failure that requires work that affects the Primary Tank Boundary
FRM	Hardware Failure that requires work Inside a Tank Farm Restricted Area Fence
OTH	Hardware Failure outside the tank farm restricted area fence having no potential radiation or contamination problems
HUM	Recovery from human mishaps that cause work stoppage for cause
EXT	Recovery from external events
XXX	Special category of events placeholder. These events are either so severe or so remote that they should be considered individually.
BBB	Focus of restoration activity
LRG	Hardware: Tasks involving repair/replacement of larger items
LRG	Human and External: Unusual events that require special assessments or high-level management involvement to resolve.
SML	Hardware: Tasks involving repair/replacement of smaller items
SML	Human and External: Events that can be resolved within the RPP supervisory/management structure.
##	Index Number
01-04	Generic Distributions from shortest to longest anticipated restoration time.
05, etc.	Identifies a specific restoration time distribution

4.2.2 *Generic Repair Time Distributions for Hardware*

Typical repair times for components available from generic data sources generally do not apply at Hanford. Furthermore, the historical evidence of restoration time available from ORPS and JCS data do not reflect the more focused operational environment that is expected to exist when waste transfer activities commence. Therefore, the preliminary RAM evaluation uses knowledge of the location, potential for intrusion into the primary tank boundary, radiation working conditions, and magnitude of anticipated repair activity to estimate the time required to repair SSCs. This evaluation was recently accomplished in support of the O&M Concept. It is documented in Section 4 and Appendix H of the O&M Concept document (Carlson, 1999).

4.2.2.1 *Assumptions Used for the Repair Time Estimate*

Table 2-5, "Assumptions Used in the RAM Analysis," contains a number of the assumptions relating to the conduct of corrective maintenance and recovery actions

extracted from the O&M Concept Document (Carlson, 1999). The recovery durations reflect two important assumptions that have been made regarding the availability of personnel and spares that should be emphasized here.

Staffing limitations are not assumed to be controlling factors in time/effort estimates for either normal or off-normal activities in this analysis. Specifically, personnel required to support the estimation of recovery times are assumed to be available, or can be readily recalled to duty, whenever an off-normal event occurs that requires their skills. Initial estimates of required skills are being developed within the O&M Concept to identify requirements. It is recognized that resource requirements for both normal and off-normal WFD activities will have to be superimposed on safe storage activities, as well as RPP mission commitments to ensure that commitments can be met commensurate with their priorities.

The recovery time estimates for corrective maintenance assume that the required spare parts and special equipment can be made available within the time required to review and coordinate the recovery work packages. Specifically, the lack of spares and specialized equipment will not become a critical path source of delay in the recovery. To be valid, this assumption requires the implementation of a spare parts program that provides for both spares stocking levels for likely failures and contingency plans for procurement of equipment that is not stocked. The specifics of this program will depend on the characteristics of components and equipment that still have to be procured.

The preliminary RAM analysis assumes that the integrated approach being taken within the O&M concept will result in personnel manning levels and a spare parts program that will prevent or optimally mitigate delays due to lack of these critical resources. Uncertainties associated with these programs will be tracked as part of the overall programmatic risk assessment.

4.2.2.2 Repair Time Task Analysis

The execution of repair on an SSC is controlled by use of a maintenance work package. The steps needed to plan and execute a typical work package are summarized in Table 4-4. These nine steps provided the template by which time and effort were estimated by craft to accomplish corrective maintenance for a variety of generic component types and maintenance conditions.

Table 4-3. Task Breakdown for Generic Repair Time Estimation

Recovery Action Step	Recovery Action Description
Troubleshoot Work Release	Provides a quick work release to perform troubleshooting in the field. This step can be more extensive if the troubleshooting requires lock and tag.
Determine Problem Cause	Perform in-field troubleshooting to determine the recovery scope
Plan Maintenance Package	Perform work planning to the required level of detail for the complexity of the job. Assemble work package.
Establish Administrative and Physical Boundaries	Establish lock and tag boundaries and other administrative boundaries.
Establish Access to Component	As applicable, take those actions necessary to gain direct access to component (e.g., remove cover blocks, perform excavation, remove barriers).
Repair or Replace Component	Prepare for and perform the required maintenance activity.
Restore Access	Re-establish original access conditions.
Preliminary Testing	Perform any necessary preliminary equipment checks to validate key aspects of the maintenance action
Restore System Lineup and Perform Functional Tests	Re-establish original lock and tag boundaries, system lineups and perform the necessary functional testing.

4.2.2.3 Component Categorization for Generic Repair Time Analysis

Recovery performance for corrective maintenance is based on several requirements that affect the mean time to repair values. Because of the large number of individual components comprising the WFDS and several requirements affecting the repair time, it is necessary to combine similar types of actions for similar types of components into a manageable set of generic recovery actions with similar attributes. The most important attributes are as follows:

1. Component types with similar corrective maintenance activities (e.g., general instrumentation and control, specialized instrumentation and control, RPP electrical, non-RPP electrical, minor mechanical, vent and balance, computer control, major mechanical, landlord-related).

2. Component location (e.g., within a pit or enclosure, within a tank farm, in a non-radiation area).

3. Radiation working conditions (e.g., remote or contact operation and/or maintenance).

4. Work relative to the primary tank boundary (intrusive or non-intrusive).

5. Planning involved (simple, moderate, or extensive).

6. Lead time for parts and equipment (e.g., no parts or equipment, spares available, short time, long time).

Figure 4-2 provides the results of the application of the six factors identified above to developing the recovery conditions. This results in 12 categories of recovery conditions. To more easily model the large number and variety of components within the WFDS, they were grouped into similar categories and functions. This grouping is shown in Table 4-5. The 12 categories were combined with the component groupings to derive the overall set of generic recovery actions to be subjected to the task analysis.

4.2.2.4 Results of Generic Repair Time Analysis

The examination of the 12 recovery conditions in combination with the general WFDS component groupings resulted in 39 generic recovery paths for corrective maintenance activities that reflect the range of situations that field personnel can anticipate facing when failures occur. Based on their knowledge of the working conditions that might exist under the conditions established for each generic action, experienced field personnel then estimated the resources, time, and effort that would be typically required for each step. The estimates for the individual steps are then combined to develop a reasonable distribution of resources and time needed to recover from failures falling into each of the 39 categories.

The results of the repair time analysis are illustrated in Figure 4-3 and listed in Table 4-6. Mean repair durations ranged from a low of nine hours for off-site electrical maintenance to a high of 3,097 hours for major mechanical pit work.

4.2.3 Recovery from Failures Associated with Large Pumps in DSTs

A review of the generic repair distributions that would be associated with mixer pumps and waste transfers pumps indicates that the repair times involving complete replacement of a pump could be extremely long. However, the need for being prepared to replace the large pumps in DSTs if one should fail during WFD activities is widely recognized. The problem has been addressed by Shaw for a specific pump configuration in the document, *First Spare Mixer Pump and Installation Equipment System Design Description for 241-SY-101 Waste Tank* (Shaw, 1998). In that document, Shaw discussed in detail the resources necessary for replacement of a pump and developed a schedule for the overall replacement activity. He also developed assumptions that would enable these recovery actions to proceed.

Shaw's estimates are judged to be the best available information for the repair of large pumps following a catastrophic failure. However, the evaluation of the site-specific operating data available for transfer pumps, presented in Table C-6 of Appendix C, has indicated that waste transfer pumps have experienced off-normal events that did not require complex and lengthy repair activities. Therefore, the failure rate associated with large pumps in the DSTs (both the mixer pumps and the transfer pumps) have been broken into two failure modes, non-catastrophic and catastrophic, in order to properly reflect the shorter duration restoration time as well as the longer repair time. This section discusses the recovery times associated with each of these failure modes.

4.2.3.1 Non-Catastrophic Failure Modes

The review of the site-specific data in Table C-6 of Appendix C indicated that recovery from the non-catastrophic failure modes involved restoration tasks, such as clearing signals, rather than repair tasks. Based on discussions with O&M personnel regarding this evidence, the triangular distribution whose properties are shown in Table 4-6 was developed to represent the duration of these restoration activities.

4.2.3.2 Catastrophic Failure Modes

Given that the insights developed in Shaw's report are implemented, the durations reported by Shaw are judged to be more tailored to the situation that would be faced with either mixer or transfer pumps. Consequently, a triangular repair distribution was generated in coordination with the Shaw and other O&M staff to represent that replacement time following a catastrophic failure of the pump. The properties of this distribution are presented in Table 4-3.

Table 4-4. Restoration Time Distributions Used in Lieu of Generic Repair Variables for Mixer and Waste Transfer Pump Failure Modes.

		TRIANGULAR DISTRIBUTION PARAMETERS (hours)			
FAILURE MODE	RECOVERY CODE	LOW	MODE	HIGH	MEAN
Non-Catastrophic	RTTMPSML01	4	72	120	65.3
Catastrophic	RTTMPLRG01	200	1900	2400	1500.0

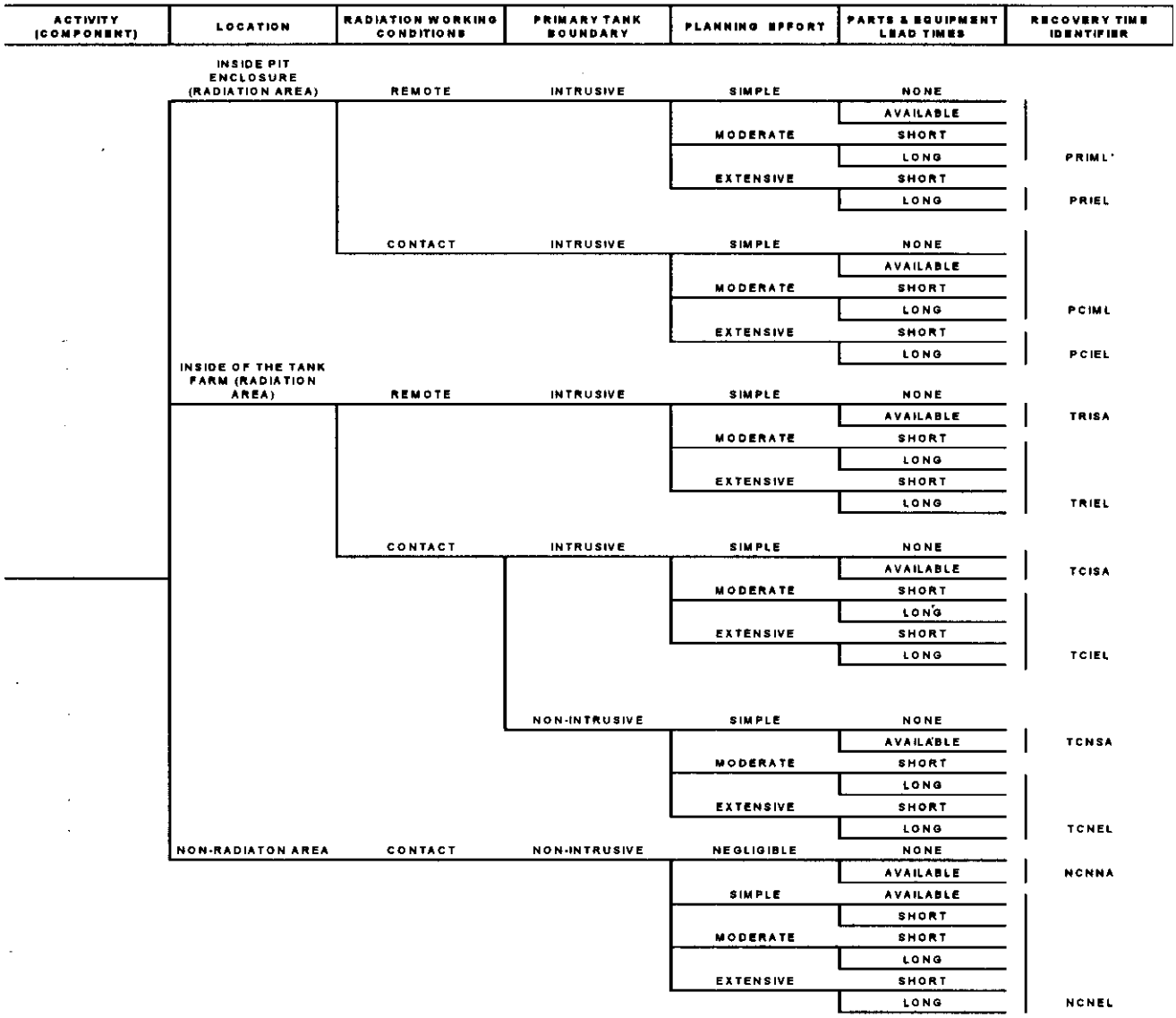

Figure 4-2. Application of Factors to WFDS Recovery Conditions

Table 4-5. General Component Type Groups

COMPONENT TYPES	COMPONENT DESCRIPTION	Component Code
VALVES	REMOTELY OPERATED MOVs AND SOVs	5
	MANUALLY OPERATED VALVES	5
	RELIEF VALVES	5
	VALVE (CONTROL AND INDICATION)	1
PIPING & CONTAINMENT SYSTEMS	PIPES	5
	CONNECTOR HEADS/NOZZLES	5
	JUMPERS	5
	RUPTURE DISKS	5
	TANKS	8
	RISERS	5
	HEAT EXCHANGERS	5
PUMPS	WASTE CONTACTED PUMPS - INTERNAL MOTOR	8
	WASTE CONTACTED PUMPS - EXTERNAL MOTOR	8
	SUPPORT SYSTEM PUMPS	5
	PUMP SPEED CONTROLS	3
SUPPORT SYSTEMS	ELECTRIC POWER - ONSITE (RPP WFDS)	3
	ELECTRIC POWER - OFFSITE	4
	AIR SYSTEMS - COMPRESSORS	5
	AIR SYSTEMS - DRYERS	5
	NITROGEN SUPPLY	5
	SERVICE WATER (RAW)	5
	COMPUTER MONITORING	7
	MISC. SUPPORT FACILITIES	9
INSTRUMENTATION AND CONTROL	MONITORING DEVICE - LEAK	1
	MONITORING DEVICE - LEVEL	1
	MONITORING DEVICE - TEMP	1
	MONITORING DEVICE - PRESSURE	1
	MONITORING DEVICE - FLOW	1
	GAS MONITORING ASSEMBLY	2
	RADIATION MONITORING ASSEMBLY	2
	ALARMS (GENERAL, PANELS, RELAYS, ETC.)	3
	CONTROL LOOPS	2
	CONTROL STATIONS (COMPUTER/AUTOMATED)	7
HVAC (PRIMARY/ANNULUS)	HEATERS	3
	FILTERS	5
	FANS	5
	DAMPERS	6
	ABSORBERS	6
	DUCTING, EXPANSION JOINTS	6
	DE-ENTRAINERS/MIST ELIMINATORS	6
	FAN SPEED CONTROL	3
SPECIAL	SECONDARY/TEMPORARY SPRAY CONTAINMENT	6
	OTHERS AS NECESSARY	

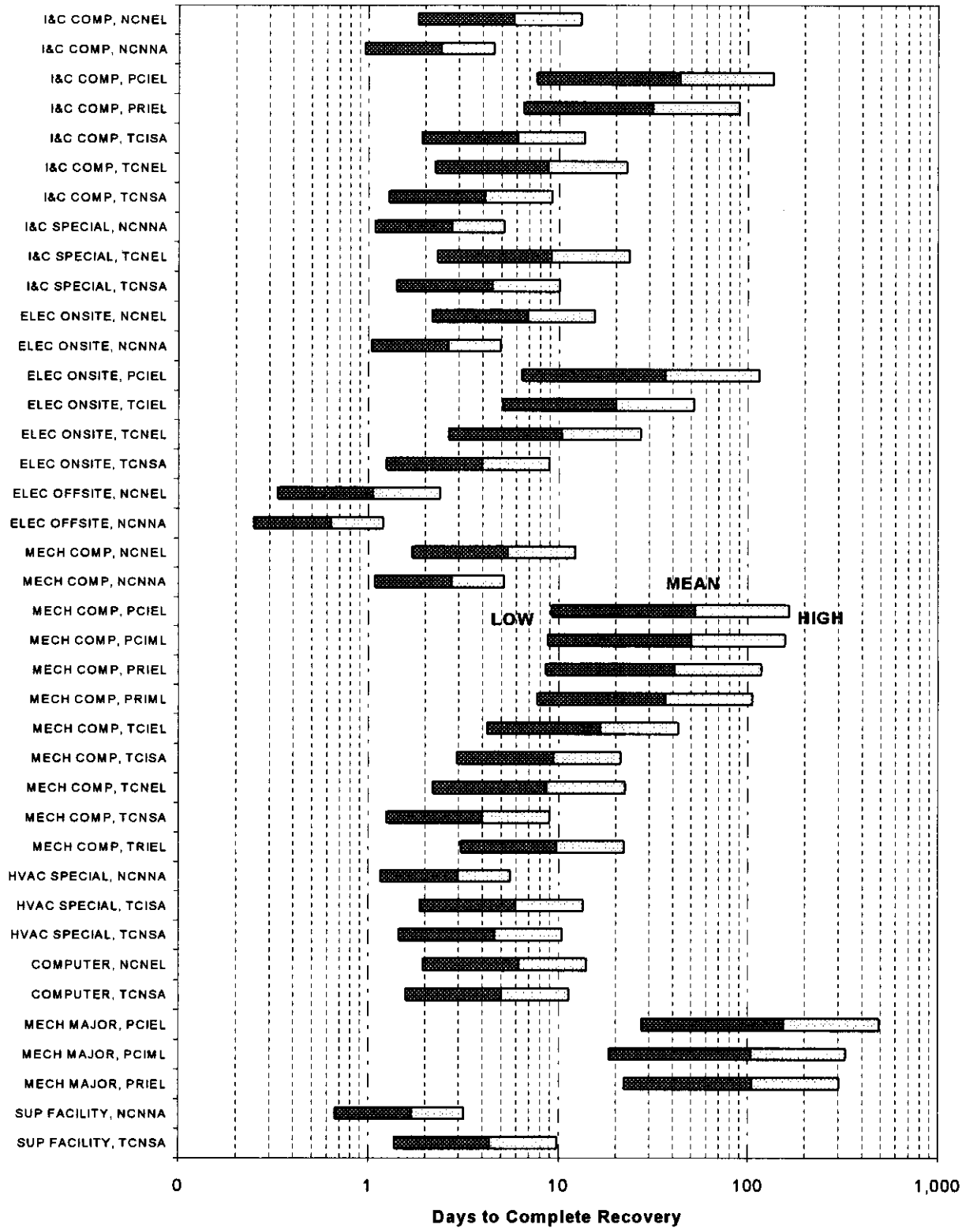

Figure 4-3. Time to Repair Distributions Associated with Generic Component Types and Conditions

4.3 Delays Associated with Human Errors

The purpose of human action analysis is to identify activities in which a human error can lead directly to a delay of the progress of waste feed delivery activities. In defining these human actions, waste transfer procedures, the BIO (Jones 1999), and other standards were reviewed, as illustrated in Appendix D. The estimation of the error rates associated with human errors were discussed in Section 3. To assist in estimating recovery time, the TSRs were also used to identify appropriate off-normal condition response actions and completion times. This information was then assessed to generate restoration times that reflect the total time required to complete all necessary corrective actions, restore the system to proper operating state, and receive approval to resume operations. Table 4-7 provides the resulting distributions of delays that might result from human error. It should be recognized that, prior to the completion of the safety analyses of the planned waste feed delivery activities and the development of procedures based on updated TSRs, estimates of delays due to human error are preliminary.

4.4 Delays Associated with External Events

The delays arising from external events fall into two categories, those resulting from weather-related delays, and those associated with off-normal events that are outside the responsibility and control of the RPP. The duration of delays associated with weather have been hypothesized in conjunction with the estimation of the frequency of weather-related delays in Section 3.5. The duration of delays associated with loss of power and off-normal events that are outside the responsibility and control of the RPP have been estimated from a review of ORPS reports. Both the frequency and duration of these events are summarized in Tables 3-1 and 3-2 with their associated restoration time estimates.

Table 4-6. Distribution Used to Model Delay Times Following Human Error

Recovery Time ID	Clock Hours (Low)	Clock Hours (Mode)	Clock Hours (High)	Location	Primary Tank Boundary Intrusive	Procure Parts	Plan Package	Typical Rationale	Use for Human Error
RTHUMSML01	1	2	6	N/A	No	N/A	N/A	Able to identify and recover transfer without major self evaluation	
RTHUMSML02	6	12	24	N/A	Maybe	N/A	N/A	Shutdown time to reconcile discrepancies in measurements. This estimate assumes that a capability to measure exists on site, but some checking of the first measurement must be accomplished.	Accounts for slips that require recheck and do not involve safety
RTHUMSML03	12	24	48	N/A	Maybe	N/A	N/A	Two-shift stand-down to review why existing procedures and controls did not work in this case.	
RTHUMLRG01	120	240	480	N/A	Maybe	N/A	N/A	Requirement to add one additional mixing cycle for AN-104/105 when sampling error made.	
RTHUMLRG02	168	336	672	N/A	Maybe	N/A	N/A	Two week stand-down to update policies, procedures, and controls. Personnel are retrained on appropriate procedures and an external review is conducted. Requirement to add one additional mixing cycle.	Misaligning transfer path and starting transfer. Waste sampling or processing discrepancy

5. Results of Preliminary RAM Assessment

This section discusses the results of the preliminary RAM assessment for the operations concept for HLW feed delivery from 241-AZ-101 and LAW delivery from 241-AN-105 to BNFL. The HLW feed delivery activities are divided into two distinct sets of activities: (1) qualification of waste feed for delivery, and (2) transfer to BNFL, following a written request by BNFL and agreement by DOE, of a batch of qualified feed on a WTD. Expected total schedule delay relative to both the qualification and batch transfer activities is provided. The LAW feed delivery activities are divided into five distinct sets of activities: (1) degassing waste in the source tank; (2) decanting the supernatant to a staging tank and qualifying the waste feed for delivery; (3) transfer of qualified supernatant to BNFL; (4) dissolving solid salts, transferring the resulting solution to a staging tank, and qualifying the waste feed for delivery; and (5) transfer of qualified dissolute to BNFL. This section presents the FOM for incurring idle facility penalties and also ranks contributors to schedule delay for waste feed batch delivery to BNFL. Insights from the preliminary RAM assessment regarding penalty risk are also presented.

5.1 FOM and Ranking of Contributors to Schedule Delay for Delivery of HLW Feed Batches from 241-AZ-101

The HLW transfers are accomplished in nine batches subsequent to a qualification process. At this stage of planning, the activities required to accomplish the transfers are essentially identical (with the exception of volume transferred). Therefore, the first batch transfer operation (largest batch volume transferred) was evaluated to estimate the idle facility penalty FOM.

Table 2-1 contains the details regarding mission profile for both qualification and batch transfers. The batch volumes upon which the profile is based are summarized in Appendix E, Table E-1. As a conservative assumption, five days of active supplemental cooling are assumed to be required to remove heat added by mixing the previous batch to mobilize the solids. In addition, the maximum volume batch is used to establish the mission duration. Other assumptions used to generate the RAM case for idle facility penalties are discussed in Sections 2.4 and 2.5.

Potential issues regarding sampling and qualification (e.g., agreement on waste feed qualification between BNFL and DOE) could introduce delays that are beyond the scope of the current RAM assessment. The subsequent eight batches are automatically decoupled from the qualification process, because the qualification accomplished prior to the first batch transfer is valid for all batch transfers.

The detailed summary report of the simulation of the RAM model for the qualification and transfer activities is presented in Appendix E. A synopsis of these results is provided below in tabular form. It can be seen that most trial scenarios produce relatively short delays, but there is a small chance of incurring considerable schedule delay.

Activity Set	Total Schedule Delay Produced by Off-Normal Events (Days) During 10,000 Simulation Trials					
	Mean	50th %-ile	80th %-ile	95th %-ile	99th %-ile	Longest Delay
Waste Qualification	11	6.7	17	34	81	269
Batch Transfer to BNFL	14	9.7	21	41	83	311

The total schedule delay produced by the RAM model simulation is added to the NPNF duration in Table 2-1 to produce the duration of each set of activities. These results are shown in Figures 5-1 through 5-3. Figure 5-1 shows the overall duration of the qualification and transfer activities on one timeline, while Figures 5-2 and 5-3 show the qualification and batch transfer activities separately.

Figure 5-2 shows the preliminary RAM simulation results of the qualification activities. The curve plots the probability that combination of the "no-problem/no-failure" schedule duration and summation of the set of delays will result in a completion date earlier than the date indicated on the X-axis. On average, approximately five off-normal events occur during a representative simulation, producing a mean delay of 11 days. The resulting distribution of batch qualification times on Figure 5-2 indicates the following completion dates based on the percentage of the trial scenarios successfully being completed.

Start Date For Qualification	End Date For Qualification	Duration (Days)	Days of Schedule Delay	Percentage Trials (%) With Shorter Durations
7/1/2004	10/06/2004	97	NPNF	0
7/1/2004	10/22/2004	114	17	80%
7/1/2004	11/09/2004	131	34	95%
7/1/2004	7/1/2005	366	269	100%

The estimated minimum duration of the "no-problem/no-failure" activities for qualifying the HLW feed batch is 97 days, as indicated by the first row. If qualification cannot start before July 1, 2004, the scheduled turnover date from construction projects, the "no-problem/no-failure" duration of activities does not allow for qualifying the batch by the end of September 2004, which is the earliest date that feed could be delivered (BNFL, 1998a). However, for this set of the preliminary RAM simulations, all of the qualification activities were completed by July 1, 2005, well before the contractual schedule date to initiate Pretreatment Hot Start, April 1, 2006 (DOE 1998c), which coincides with the latest date for initiating HLW feed batch deliveries.

Figure 5-3 shows the preliminary RAM simulation results for a HLW feed batch delivery to BNFL, Inc. On the average, approximately eight off-normal events are expected to occur during the batch transfer to BNFL resulting in a total schedule delay of about 14 days. It can be seen in Figure 5-3 that, for this simulation, about 11% of the 10,000 trials exceeded the acceptable delivery window: 30 days. However, when the small probability of lengthy delays is taken into account, the overall or integrated delay

risk is 2.2 days. When all nine HLW batches are considered, the integrated schedule risk approaches 20 days.

The longest delay in the batch transfer simulation resulted in 263 days of susceptibility to penalties. Long recovery times are a primary reason for the large integrated delay risk for the source tank. Another primary reason is the large number of waste deliveries that are currently planned for tank 241-AZ-101. Based on the wording in the *Tank Waste Remediation System Privatization Contract* (DOE, 1998c), each delivery would be a potential for realizing idle facility penalties.

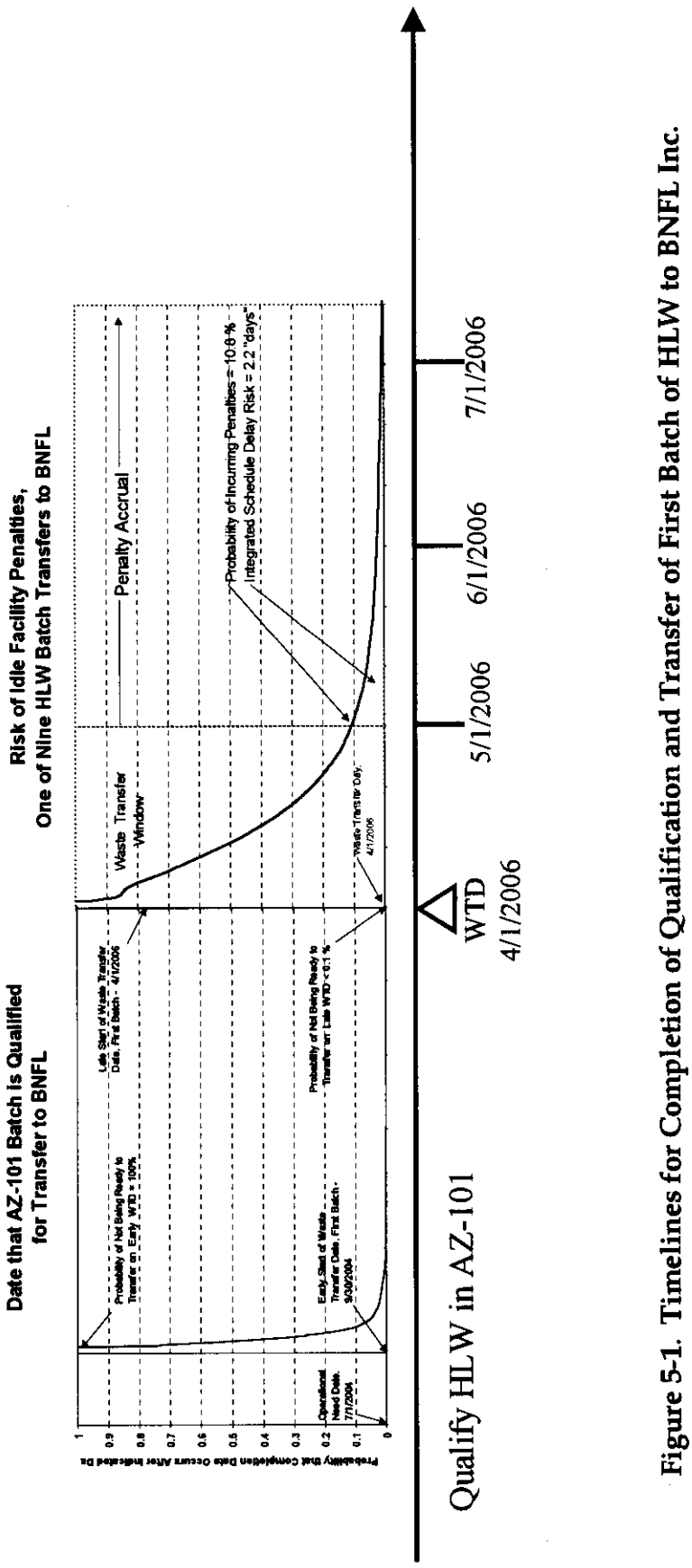

Figure 5-1. Timelines for Completion of Qualification and Transfer of First Batch of HLW to BNFL Inc.

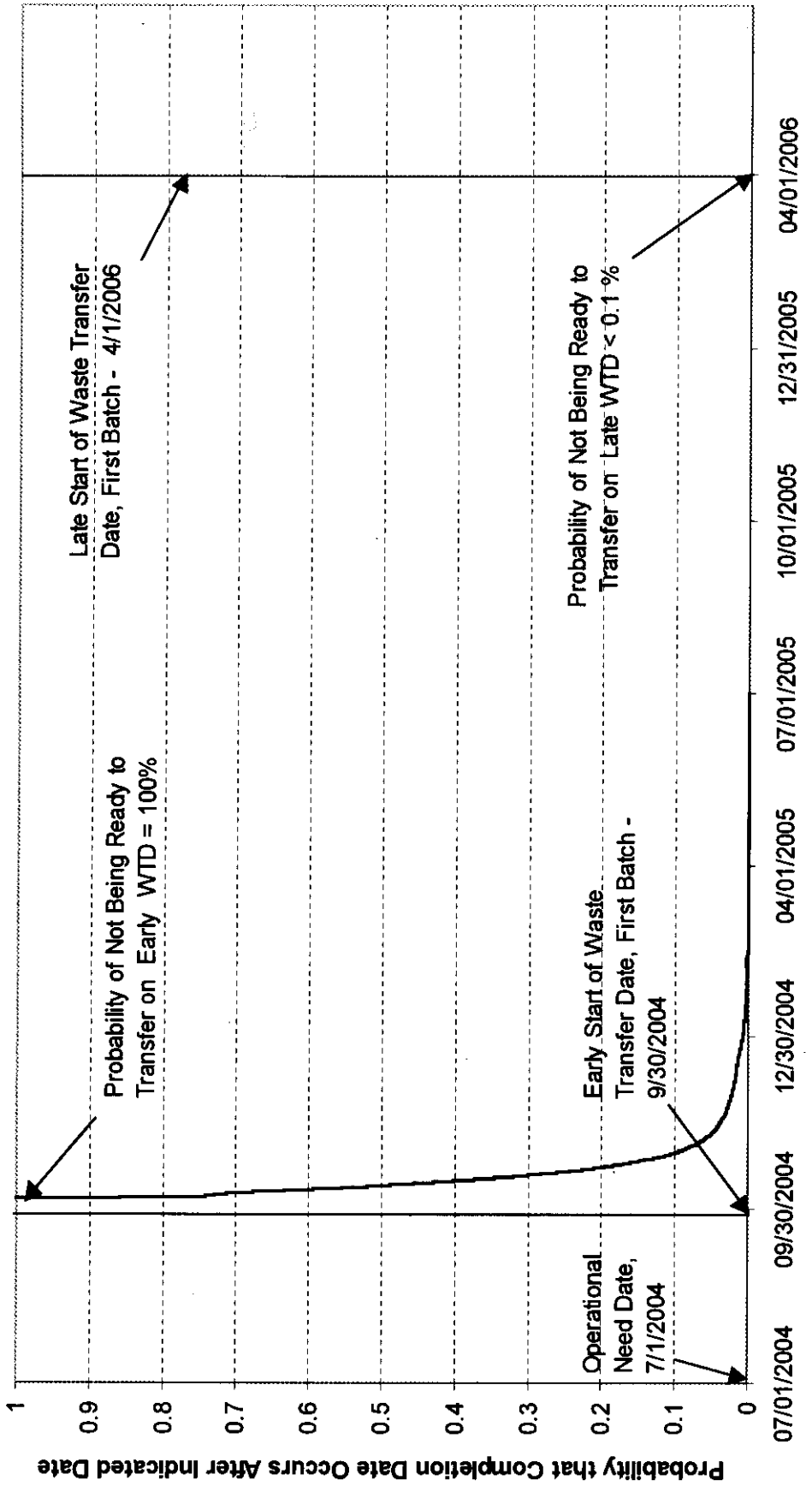

Figure 5-3. Date that 241-AZ-101 HLW is Qualified for Transfer to BNFL, Inc.

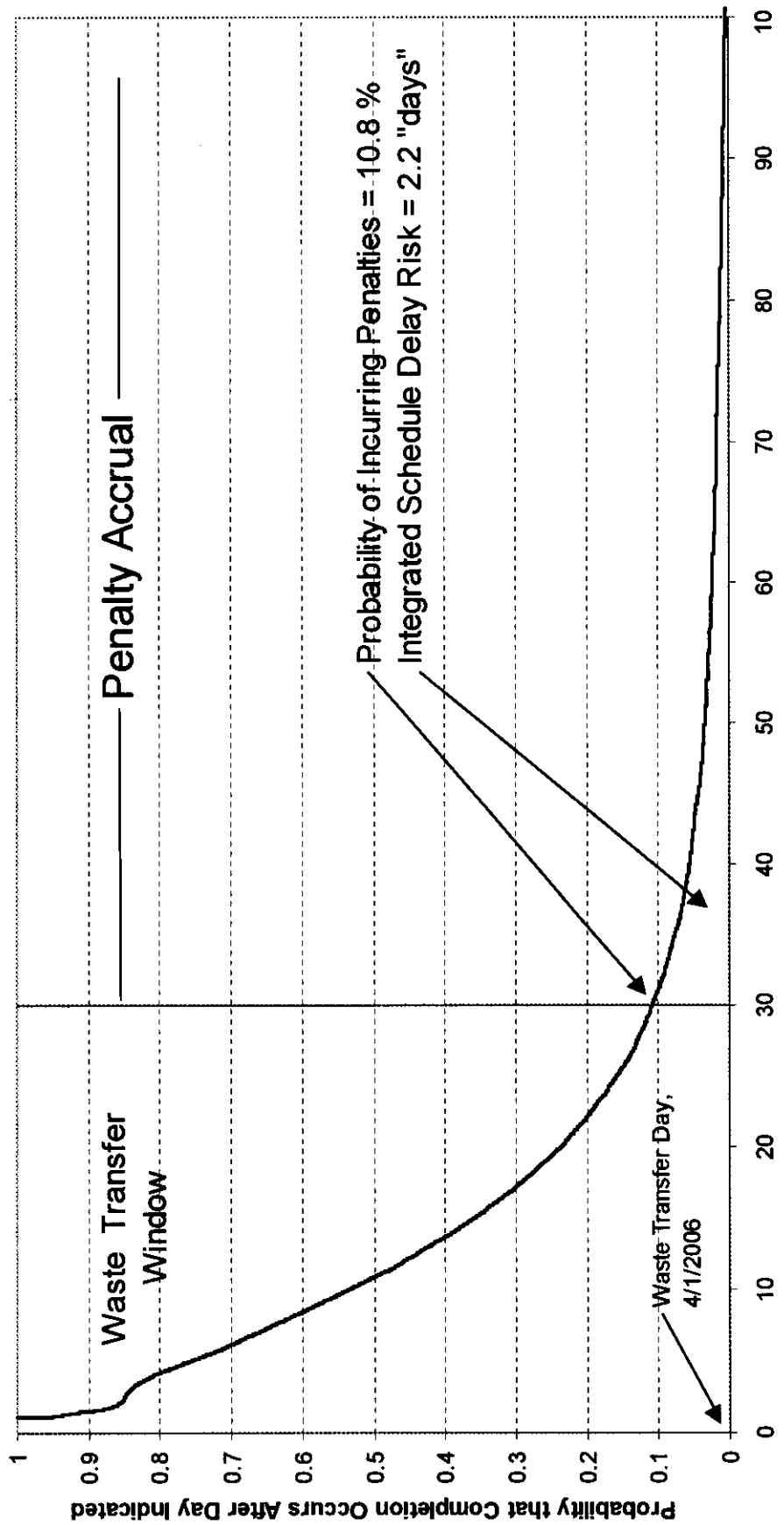

Figure 5-4. Risk of Idle Facility Penalties, One of Nine HLW Batch Transfers to BNFL, Inc.

Figure 5-3 can also provide information regarding the sensitivity of the integrated schedule risk to the duration of the acceptable waste delivery window. The percent of trials successfully being completed within windows of two and three months and the resulting integrated schedule risk are as follows:

Acceptable Window Duration (Days)	Percentage Trials Exceeding Acceptable Delivery Window	Integrated Schedule Risk Per Delivery (Days)	Integrated Schedule Risk For Nine Deliveries (Days)
30 (Current)	10.8 %	2.2	19.8
60	2.4 %	1.4	12.6
90	0.8 %	0.7	6.3

The longer delivery windows would require the privatization contractor to maintain sufficient feed storage capacity to continue uninterrupted operations over those periods of time.

Table 5-1 shows the major system type contributors to the risk of idle facility penalties for the various systems associated with the WFD batch transfer. Table 5-2 shows the major component type contributors to the risk of idle facility penalties with the WFD batch transfer. Tables E-2 through E-5, in Appendix E, show a more complete list of the contributors to the risk of idle facility penalties for unique components, generic component types, and system types. It should be recognized that the order of systems and component types on the CILs are based on the mean values of uncertain failure rates and restoration times. Consequently, systems and component types whose contribution percentages are close should be considered equivalent in importance.

It can be seen in Table 5-1 that the major contributing systems are the various portions of the ventilation system, which include the primary ventilation system, annulus ventilation system, recirculation condenser cooling system, and the ventilation condenser cooling system. Together, these systems contribute approximately 52% of the total schedule delay.

There are several factors that lead to the importance of the ventilation system. The primary reason is the required utilization of the ventilation system during all operations, especially during the relatively long cooling periods. Currently, each of the nine batches is modeled to require five days of cooling between transfers to ensure the waste temperatures remain below BIO limits (Jones, 1999). Given that each transfer is less than 20 hours in length, the ventilation systems must operate five times as long as the transfer system components for each batch. An additional factor is the large number of components that comprise the ventilation systems. In addition, the ventilation system contains standard air handling components as well as a large contingent of flow control and monitoring equipment. The large number of components, combined with the relatively long exposure times, accounts for the ventilation systems being at the top of the critical systems list.

Examination of Table 5-2 indicates that instrumentation, valving, and general pumps are the largest contributors to delay. These three component types are significant portions

of the HLW ventilation systems and are thus correlated with the appearance of the ventilation system at the top of the critical systems list. Although instrumentation generally is very reliable, the large amount of instrumentation within the entire WFDS has an additive effect that forces it to be a significant contributor to expected delay. For example, the HLW ventilation system has a significant amount of this instrumentation. Because most instrumentation provides a safety-related indication or monitoring function, it is required to operate throughout the preparation period and the transfer operation without failure.

Valves are also a significant contributor. This is a result of the relatively large number of valves within the overall high-level waste WFDS. Valves, such as waste transfer valves, are generally modeled as components that are required to change position. Other valves, although not cycled during normal transfer operations, are required to contain and direct flow. Although they may not be required to change position for the transfer, these valves are subjected to passive failure mechanisms that have an additive impact on the overall system. Valves are one of the greatest contributors to ventilation system failure because there are a large number of isolating and damper valves within the system.

Another ventilation system component type that appears as a major contributor is the general pumps. Pumps are active components and generally have higher failure rates than components such as valves or instrumentation. Most of the general pumps modeled within the HLW system are components of the ventilation systems and subsystems and include chemical addition pumps, water make-up pumps, spray pumps, recirculation pumps, and vacuum pumps.

Table 5-1. Major System Type Contributors To Total Schedule Delay for Delivery of HLW Feed Batches from 241-AZ-101

System Type	Percent Contribution to Total Delay
Primary Ventilation System	25%
Annulus Ventilation System	19%
Service Air	16%
Transfer System	12%
Monitoring System	11%
Recirculation Condenser Cooling System	5%
Human Actions	4%
Ventilation Condenser Cooling System	3%
External Events	2%
Other*	3%
Total	100%

* Each system type contributes less than 1%; rounded percentages may not add up to 100%.

Table 5-2. Major Component Type Contributors to Total Schedule Delay for Delivery of HLW Feed Batches from 241-AZ–101

Component Type	Percent Contribution to Total Delay
Instrumentation, other than leak and level	31%
Valves – All	22%
Instrumentation, leak detection	10%
Pumps – other than mixer and transfer	9%
Mixer Pump	7%
Human Actions	4%
Control equipment	4%
Waste Transfer Pump	2%
Instrumentation, level	2%
External Events	2%
Filters	1%
Fans	1%
Other*	4%
Total	100%

* Each component type contributes less than 1%; rounded percentages may not add up to 100%.

5.2 FOM and Ranking of Contributors to Schedule Delay for Delivery of LAW Feed Batches Originating from 241-AN-105

The mission profile used to generate the RAM model case for the qualification and delivery of feed batches originating from 241-AN–105 is shown in Table 2-2. The preliminary RAM assesses the qualification activities to determine the degree to which they are decoupled from the batch transfer operations. This is important in determining a satisfactory level of schedule margin for the operational activities. This is also important because the certification agreement process is not well defined, and the schedule margin provided by the O&M Concept may be an important factor for staying on schedule.

The detailed summary report of the simulation of the RAM model for the transfer activities from 241-AP-102 and 241-AP-104 to the BNFL, Inc., LAW feed tank, 241-AP-106, is presented in Appendix F. A synopsis of these results is provided below in tabular form. It can be seen that delays up to a few months might occur during waste preparation and qualification, but delays during the batch transfer are expected to be relatively short.

Activity Set	Total Schedule Delay Produced by Off-Normal Events (Days)					
	Mean	Median	80th %-ile	95th %-ile	99th %-ile	Longest Trial Scenario
Degassing of AN-105, Transfer of Supernatant to AP-102 and Qualification for Batch Transfer	51	41	72	121	167	588
Degassing of AN-105 Through Dissolution of Salts in AN-105	76	64	108	164	221	632
Transfer of Dissolved Salts to AP-104 and Qualification for Delivery	21	13	31	69	119	409
Batch Transfer from AP-102 or AP-104 to BNFL	9.4	4.5	14	38	83	233

With the above delay distributions factored into the existing waste feed delivery schedule, Figure 5-4 presents the overall timeline for the qualification and transfer of batches derived from source tank 241-AN-105. In addition to the hold points for the WTD, the LAW transfer activities also contain a hold point generated by the use of IWFSTs 241-AP-102 and 241-AP-104 as the staging tanks for other LAW source tanks. For the 241-AN-105 waste, IWFST 241-AP-104 will not become available until waste from 241-AN-107 is delivered to BNFL, Inc. However, as shown on Figure 5-4 for 241-AN-105, the impact of the intermediate hold point is negligible.

Figure 5-5 is a more detailed depiction of the qualification process in 241-AP-102. It shows that 95% of the trial scenarios provide a schedule margin of at least 255 days. The integrated schedule delay risk contribution from pre-WTD activities to the batch delivery from 241-AP-102 is 0.04 days. Figure 5-6 shows a schedule margin of the waste feed in IWFST 241-AP-104 of about 210 days for 95 percent of the trial scenarios. The integrated schedule delay risk contribution to the batch delivery from 241-AP-104 from pre-WTD activities is 0.02 days. These contributions to integrated schedule risk are considered negligible.

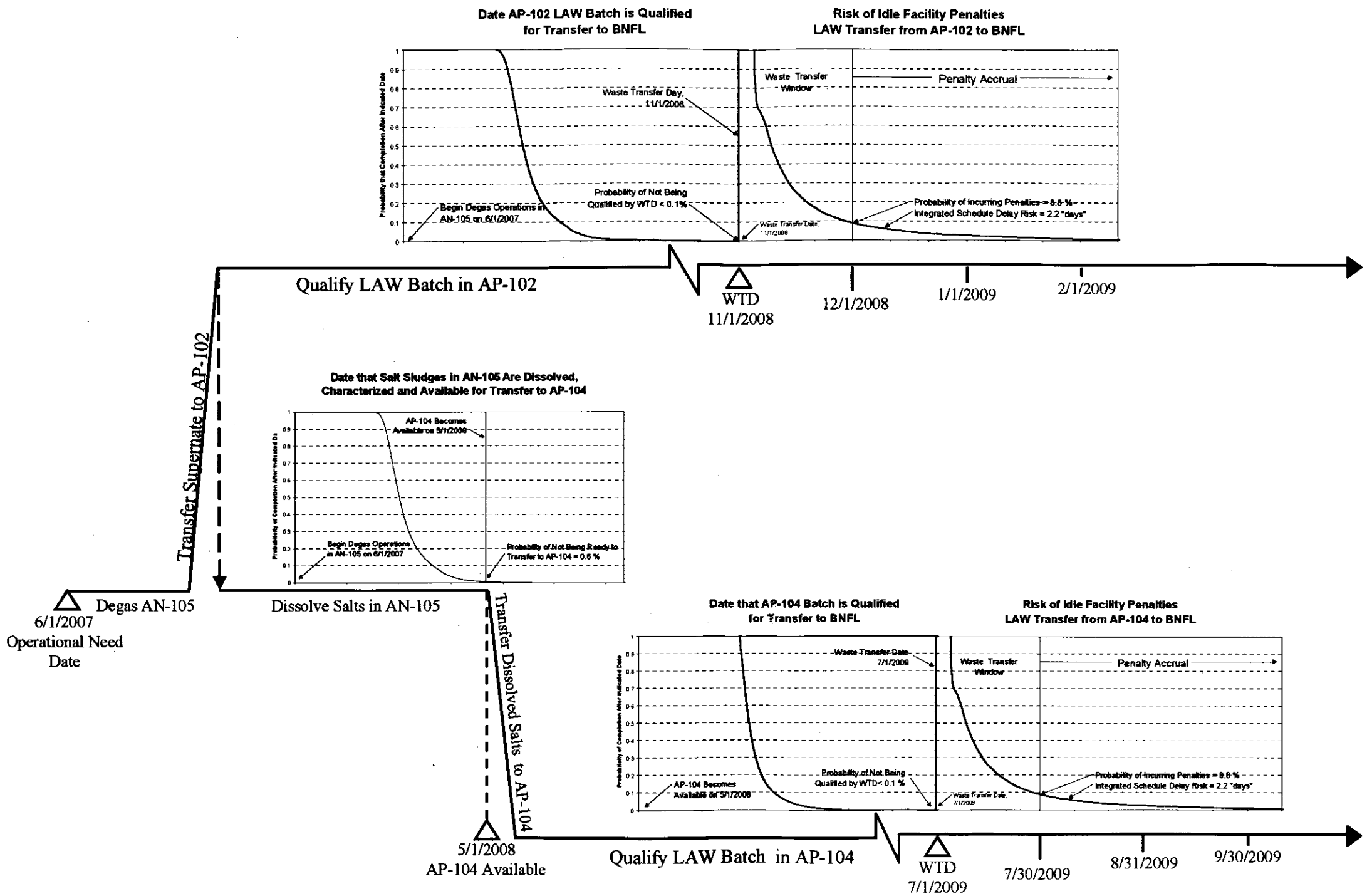

Figure 5-5. Timelines for Completion of Qualification and Transfer of 241-AN-105 LAW Batches to BNFL, Inc.

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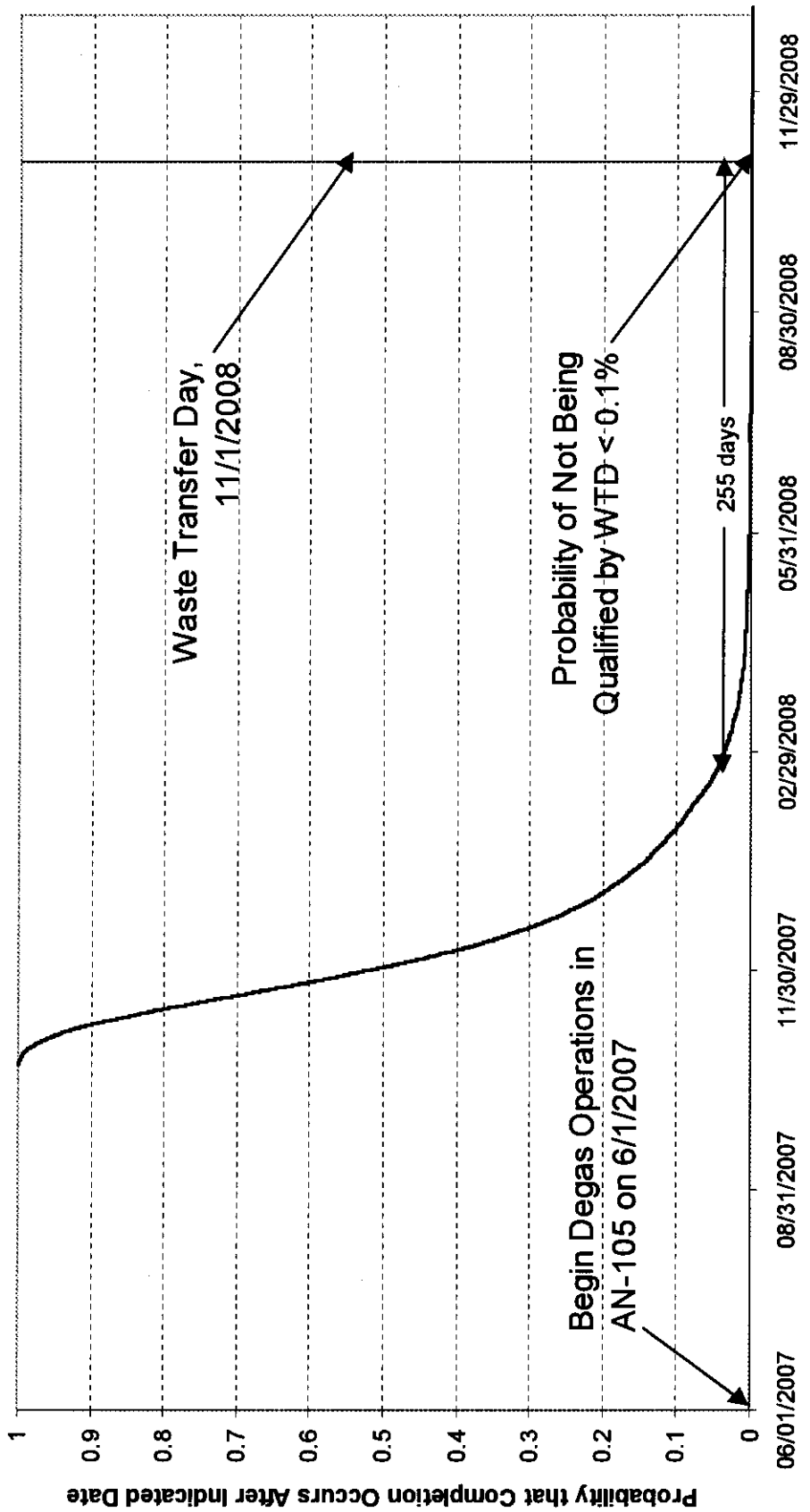

Figure 5-6. Date 241-AP-102 LAW Batch is Qualified for Transfer to BNFL, Inc.

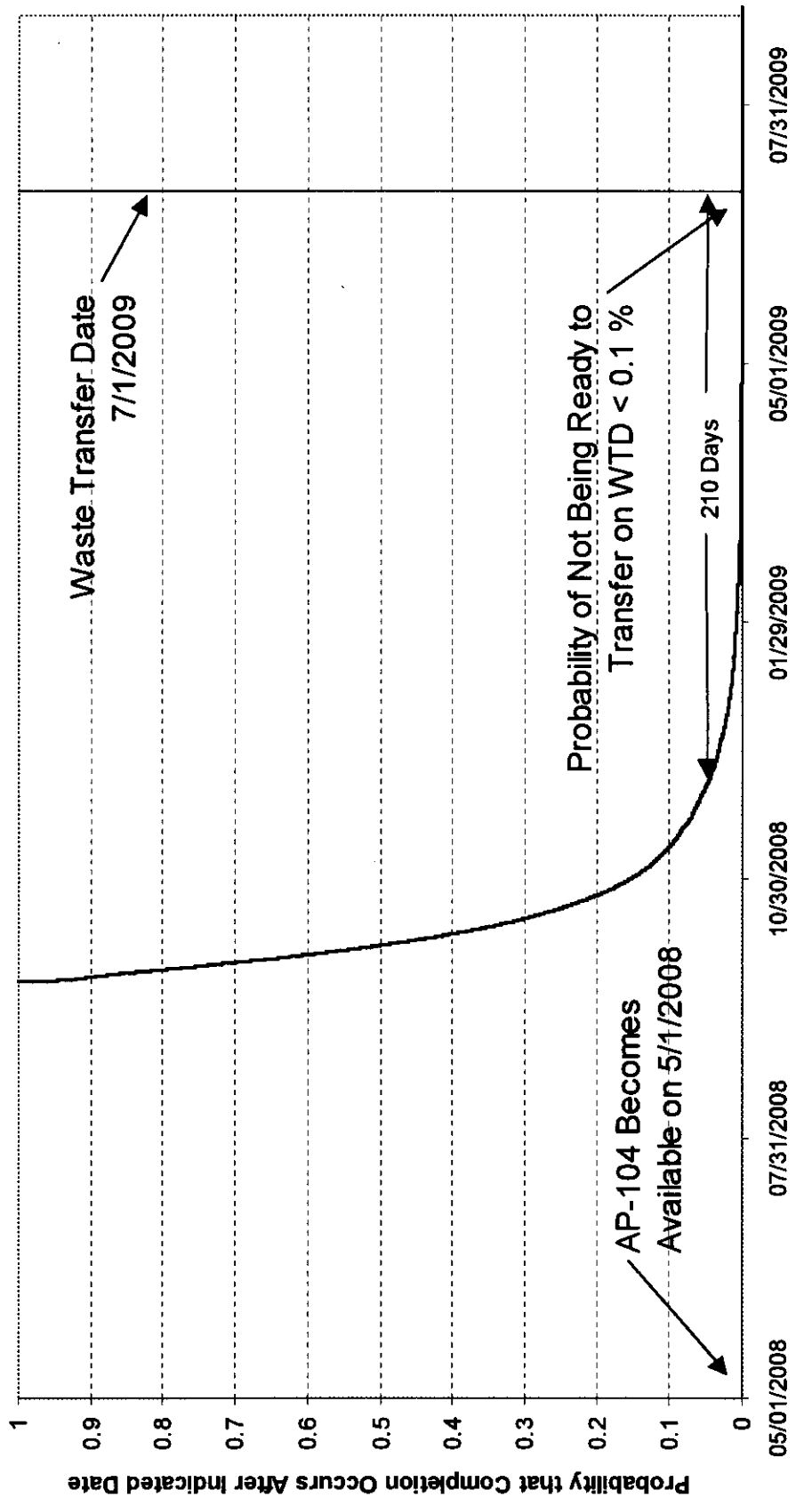

Figure 5-7. Date that 241-AP-104 Batch is Qualified for Transfer to BNFL, Inc.

The penalty risk, previously defined by the FOM success criteria in Section 2.4, arises during the final batch delivery process from either 241-AP-102 or 241-AP-104 to 241-AP-106. Although the transfers involve somewhat different composition and volumes of supernatant, the batch transfers from 241-AP-102 and 241-AP-104 are very similar. For the purposes of evaluating O&M impacts and the current state of design, batch transfers from either tank may be considered equivalent. Since 241-AP-102 involves a higher volume of feed than 241-AP-104, its result is used to draw conclusions regarding the risk of idle facility penalties.

On average, approximately six off-normal events are expected to occur during a batch transfer to BNFL from 241-AP-102, resulting in a total schedule delay of about 10 days. It can be seen in Figure 5-7 that, for this simulation, about 9% of the 10,000 trials exceeded the acceptable delivery window of 30 days. However, when the small probability of lengthy delays is taken into account, the overall or integrated delay risk is 2.2 likelihood-weighted "days" per delivery. When both LAW batches from the two IWFSTs are considered, the integrated schedule risk is 4.4 "days." The percent of trials successfully being completed by a certain duration and the integrated schedule risk are shown below:

Acceptable Window Duration (Days)	Percentage Trials Exceeding Acceptable Delivery Window	Integrated Schedule Risk Per Delivery (Days)	Integrated Schedule Risk For Nine Deliveries (Days)
30 (Current)	8.8%	2.2	4.4
60	2.6%	1.6	3.2
90	0.9%	0.9	1.8

The longest delay resulted in 465 days of susceptibility to penalties. (These extreme values are an anomaly, as compensatory action not addressed by the RAM model would most likely be taken when the RPP is faced with a delay of that length from one tank.) Long recovery times are a primary reason for the large integrated delay risk for the source tank.

Table 5-3 shows the major system type contributors to the risk of idle facility penalties for the various systems associated with the WFD batch transfer. Table 5-4 shows the major component type contributors to the risk of idle facility penalties associated with a WFD batch transfer. Tables F-2 through F-5, in Appendix F, show a more complete list of the contributors to the risk of idle facility penalties for unique components, generic component types, and system types. It should be recognized that the order of systems and component types on the CILs are based on the mean values of uncertain failure rates and restoration times. Consequently, systems and component types whose contribution percentages are close should be considered equivalent in importance.

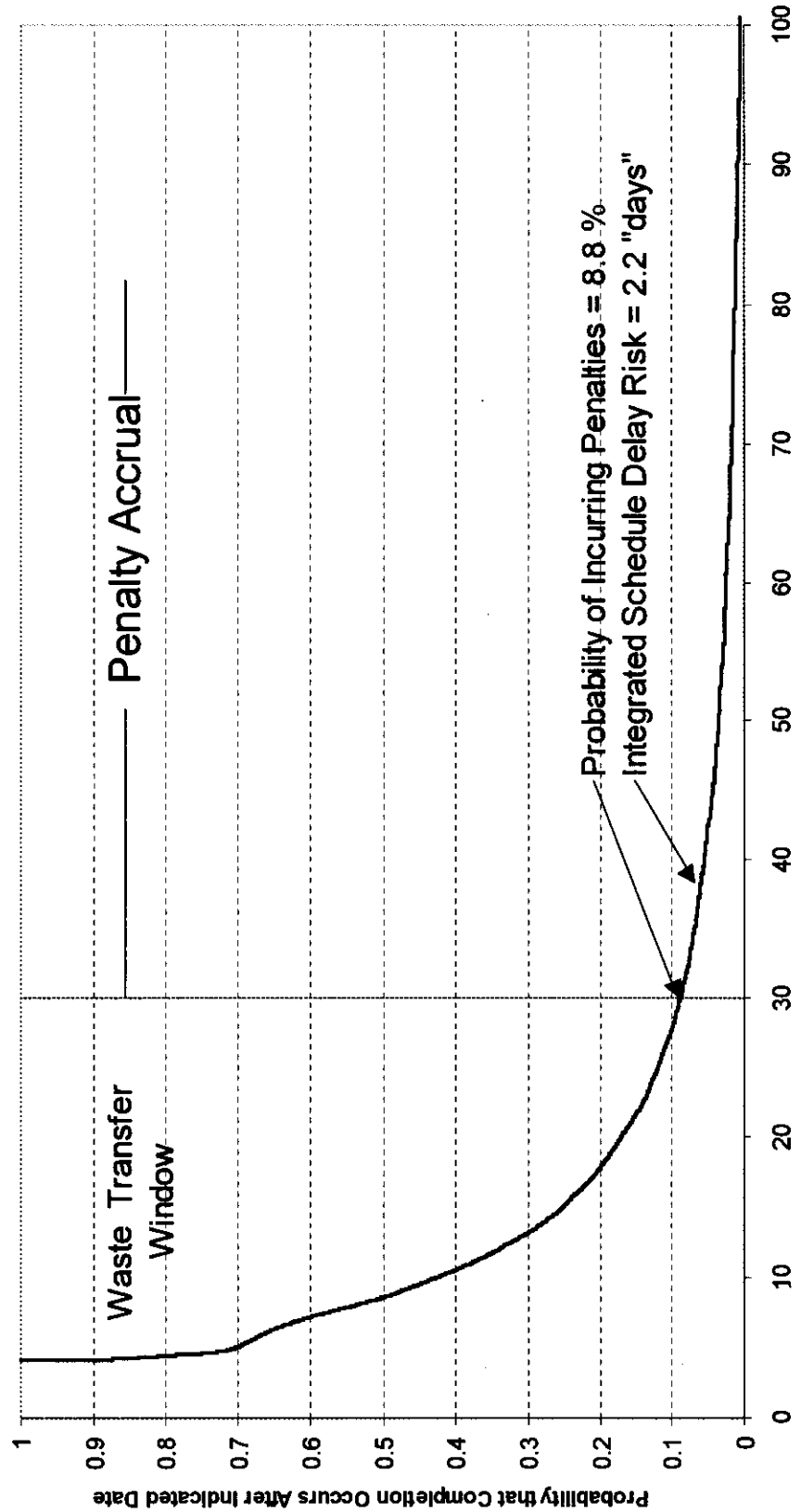

Figure 5-8. Risk of Idle Facility Penalties LAW Transfer from 241-AP-102 to BNFL, Inc.

Table 5-3. Major System Contributors to Total Schedule Delay for Delivery of LAW Feed Batches from IWFST 241-AP-102

System Type	Percent Contribution to Total Delay
Transfer System	43%
Annulus Ventilation System	21%
Dilution/Flush System	9%
Primary Ventilation System	9%
Human Actions	7%
Service Water	7%
External Events	1%
Other*	3%
Total	100%

* Each system type contributes less than 1%; rounded percentages may not add up to 100%.

Table 5-4. Major Component Type Contributors to Total Schedule Delay for Delivery of LAW Feed Batches from IWFST 241-AP-102

Component Type	Percent Contribution to Total Delay
Valves	35%
Instrumentation, other than leak and level	24%
Waste Transfer Pump	9%
Instrumentation, leak detection	9%
Pumps – other than mixer and transfer	8%
Human Actions	7%
Fans	1%
Control Equipment	1%
External Events	1%
Instrumentation, level	1%
Other*	4%
Total	100%

* Each component type contributes less than 1%; rounded percentages may not add up to 100%.

A review of Table 5-3 shows that the major system contributors to overall delay within the LAW delivery system are the transfer system and the HVAC systems, respectively. The transfer system, with dilution and flush added, contributes approximately 52% of the expected delay and the HVAC systems, both primary and annulus, contribute approximately 30%. There are several factors that influence the relative contribution of these systems as well as their differences from the HLW system. The primary driver for ranking the transfer system as the top contributor is the long transfer times involved and the increased valving (both manual and MOVs) along the LAW transfer route. Although the HVAC system is still a significant contributor, the LAW HVAC system is far less complex with much fewer components than the HLW HVAC system. The fewer number of components is attributable to the lack of recirculating condenser cooling and ventilation condenser cooling systems. These two factors combine to drive the transfer system to the top of the critical systems list relative to the other systems for the LAW.

As seen in Table 5-4, valving, instrumentation, and the waste transfer pump are indicated as the largest contributors to delay on a component type basis. Their contributions are 35%, 34%, and 9%, respectively. The valving and the transfer pump are significant components in the LAW transfer system and, when combined with the long transfer times, combine to make the transfer system the most significant delay contributor. The comments in the HLW results section above relating to the contribution of instrumentation apply to the LAW results as well.

As an individual component, the LAW transfer pump is of particular importance. The component type delay contributions are summations of the contributions of many individual components within that group. The transfer pump is an individual component and still ranks above most other component type groups. This indicates a need to mitigate the consequence of failure of this component if the requirements of success remain as defined; i.e., the delivery of the entire contents of a LAW tank as one batch.

5.3 Human Reliability Assessment Results

This revision of the RAM assessment accomplished a screening assignment of human actions identified in the initial version of the RAM study to the activities identified in the recent revisions to the transfer process flowsheets. It should be recognized that, at the current time, the evolutions that the operators will be required to accomplish are still subject to considerable uncertainty, as the system design and operational procedure development processes are still underway. Given this state of flux, the actions identified for quantification are judged to be reasonable for estimating the relative impact of human actions on potential schedule delay.

5.3.1 Procedure-Related Actions During HLW Waste Feed Delivery System Operations

The quantification of procedure-related human actions that can lead directly to delays in HLW qualification and transfer activities is shown in Appendix D, Table D-2. Because there are only mixing and transfer steps, the number of evolutions operators must accomplish to successfully perform the transfer is relatively low, and only six opportunities for potential delays to critical path activities were quantified. Again, errors primarily involved misalignment of equipment for transfers and failure to control process

fluids within required operating limits. This assessment indicates that the frequency of direct delay due to human error involving procedures is about 2%, producing an expected delay time of about six hours for an individual batch transfer. However, a total of nine batch transfers are required, each requiring mixing to mobilize solids just prior to the transfer. Therefore, for the entire source tank transfer, there is about an 18% chance of a schedule-delaying human error, with a total expected cumulative delay of approximately 56 hours.

5.3.2 *Procedure-Related Actions During LAW Waste Feed Delivery System Operations*

The quantification of procedure-related human actions that can lead directly to delays in LAW qualification and transfer activities is shown in Appendix D, Table D-3. A total of 39 opportunities for potential delays to critical path activities were quantified for the AN-105 transfer activities. These errors are very similar to those identified during the initial RAM study, as the LAW process has not changed as significantly as the HLW transfer process. Errors primarily involve misalignment of equipment for transfers and failure to control process fluids within required operating limits. Recall that human errors during maintenance that result in subsequent equipment failure are accounted for in the failure rate of the equipment, and human errors during maintenance that result in delay of the associated equipment function recovery are accounted for in the RAM model basic event recovery time distributions. This assessment indicates that the relative frequency of direct delay due to human error involving procedures is about 12%, producing an expected cumulative delay time of 28 hours for an entire transfer. Based on this assessment, delays caused by human error without failure of equipment will be minor compared to those that require repair and recovery of equipment.

5.3.3 *Mishaps Leading Directly to Cessation of WFDS Operations*

Appendix D, Table D-5, contains an extract of events reported from the ORPS that have been characterized as being able to produce a schedule-delaying event that could impact WFDS activities. This preliminary list contains on the order of 50 events that were judged to be of the type that would require at least a temporary cessation and delay of transfer activities to investigate.

Due to the focus of this revision of the RAM assessment on modeling the WFD processes described in the most recent process flowsheets, this list has not been updated since the initial version of this report was published in 1998. This quantity is judged to be sufficient to further investigate for trends and the impact of any corrective actions. This list can be evaluated in greater detail as necessary, as the transfer procedures are finalized and the preliminary RAM study is refined during the continued development of the O&M Concept.

5.3.4 *Human-Related Delays Excluded from the RAM*

It should again be emphasized that it is currently outside the scope of the RAM assessment to evaluate the frequency of events that could cause delays due to problems with manpower management activities. The adequacy of manning levels and

the resources needed for training and other support of those levels can and should be addressed as the O&M Concept is put into practice. The staffing that is finally authorized will impact both the no-problem/no-failure duration for scheduled activities and the recovery times for schedule-delaying events. This is an iterative process, with the RAM assessment providing much of the input needed for planning.

5.4 Delays Due to External Events

Delays due to external events include those due to weather (primarily temperature and wind) and disruptive incidents that are not directly related to the WFDS transfer operations. The weather related delays are estimated primarily from annual weather reports of temperature extremes and high winds, as stated in Section 3.5. The occurrence of disruptive events is estimated from incidents reported in ORPS, as stated in Section 3.6. Because external events occur independent of the activities associated with transfer operations, their frequencies are reported on an annual basis.

Table 5-5 presents the calculation of the expected delay time due to all external events. This table shows that approximately 34 off-normal external events are expected to occur during a typical calendar year. Most of these events produce a short delay, but some can produce longer delays. For application in the current preliminary RAM model, which focuses on process activities and their associated delays, the frequency of delaying events is expressed for the composite of the events using a single composite frequency and frequency weighted mean delay of 9.1 hours. A triangular distribution is used to express the uncertainty in associated recovery time. This triangular distribution has minimum, mode, and maximum parameters of 4.3, 9.1, and 13.7 hours, respectively. While this distribution truncates some of the longer, less likely delays, it does encompass over 90% of the external events and reflects the frequency-weighted mean delay.

Table 5-5. Summary of Delays Caused by External Events

Failure Mode Code	Description	Mean Activity Cessation Time (Hours)	Frequency of Delaying Events per Year
EXT.WD06	Delays averaging 6 hours due to high wind	6	15.9
EXT.OTHR	Delays caused by other events reported in the ORPS database	57	1.3
EXT.WD12	Delays averaging 12 hours due to high wind	12	3.4
EXT.LT06	Delays averaging 6 hours due to low temperature	6	5.1
EXT.HT06	Delays averaging 6 hours due to high temperature	6	4.2
EXT.LT12	Delays averaging 12 hours due to low temperature	12	1.5
EXT.WD24	Delays averaging 24 hours due to high wind	24	0.5
EXT.LT24	Delays averaging 24 hours due to low temperature	24	0.3
EXT.LOSP	Delays caused by loss of site power	3	1.3
EXT.HT12	Delays averaging 12 hours due to high temperature	12	0.1
ALL EE	Composite of all External Events	9.1	34/year (or 3.9×10^{-3}/hr)

The process activities are modeled to be susceptible to external events at an hourly frequency indicated in Table 5-5 over the duration of the mission. It is important to note that these external events are independent of specific waste transfer activities, and can be expected to occur during periods of waste transfer activity as well as during all other time periods. However, it is true that when focusing only on waste transfer activity, this assessment shows that one can expect about four schedule delays due to external events per 1,000 hours of planned transfer activity (3.9×10^{-3}events/hour). Events that are external to the current RAM assessment boundaries that pose a schedule risk are being addressed in the programmatic risk assessment. As these events become better defined, multiple individual events will be defined to replace the composite event now in the model.

5.5 RAM-Based Insights Regarding Penalty Risk

Specific insights from the RAM assessment regarding penalty risk are discussed below.

5.5.1 Current Authorization Basis Constraints for Physically Connected Systems.

The current RPP authorization basis specifies a physically connected tank as any tank that has a transfer line physically connected to the transfer route. The term "physically connected" applies to any transfer line that is not separated from the active transfer line by a blank flange or air space. Closed valves do not constitute a separation. Following the completion of Project W-314, physically connected tanks in the 200 East Area will include the AN (seven tanks), AW (six tanks), AY (two tanks), AZ (two tanks), and AP (eight tanks) farms, the 204-AR storage tank (TK-01), and the 151-AZ catch tank. In addition, transfer facilities and systems that will no longer be required after completion of the W-314 transfer system upgrade are not currently funded for retirement. Appendix G provides a special case study examining the implications of the physically connected aspect of the current authorization basis associated with the new transfer system design being developed by Project W-314.

The results of the special case study, represented in Figure 5-9, indicate that a spurious alarm shutdown rate of once every two days produces a probability of incurring idle facility penalties of 50%, and that above one per day the model does not converge to a successful transfer. These spurious alarm rates are representative of alarm rates based on a review of tank farm alarm logs. This level of alarm reliability is deemed not acceptable for WFD activities.

The preliminary RAM assessment results in this section assume the authorization basis will be modified to allow continuation of transfer according to the design features being instituted by Project W-314, primarily that transfers are terminated only for leak detector alarms along the primary transfer route. It should be recognized that modification of the authorization basis is not the only available alternative to try to rectify the issues associated with the physically connected systems. Modification to Project W-314 design may be another possible method of solving the problem by eliminating physically connected systems to the extent possible. This may not prove to be globally useful considering that transfers are anticipated between AN, AP, and AW tank farms for LAW feed. However, transfers from the AZ tank farm are direct to BNFL, Inc., and not having

that route physically connected to any other routes would eliminate the physical connection issues. A separate transfer path into the tank farm would be required. Similarly, transfers from the IWFSTs, 241-AP-102 and 241-AP-104, could potentially be isolated as direct transfer routes to 241-AP-106. Again, separate transfer paths into the staging tanks would be required.

5.5.2 *Catastrophic Failures and Qualification of Alternate Staging Tanks.*

The mixer pumps and transfer pumps are major contributors to batch transfer risk. The inherent reliability of mixer and transfer pumps will prevent a risk of a lengthy delay. Although the chance of a catastrophic pump failure can be made small through design, a catastrophic pump failure has the potential for creating a significant delay (Shaw, 1998) beyond the 30-day transfer window for batch delivery. A method to reduce risk would be to ensure that a second source of qualified waste feed is available for delivery from an alternate tank.

Although this is not a significant contributor to batch transfer risk, another potential catastrophic failure would be transfer line failure (e.g., line plugging). For example, redundant transfer paths do not exist between 241-AZ tank farm and the new AZ valve pit being installed by Project W-314. A transfer line failure of this single path could result in a potentially significant delay and eliminate the ability to deliver feed batches from 241-AZ tank farm until the path was re-established. Again, providing a second source of qualified waste feed from an alternate tank in a different tank farm would provide a method to reduce the risk.

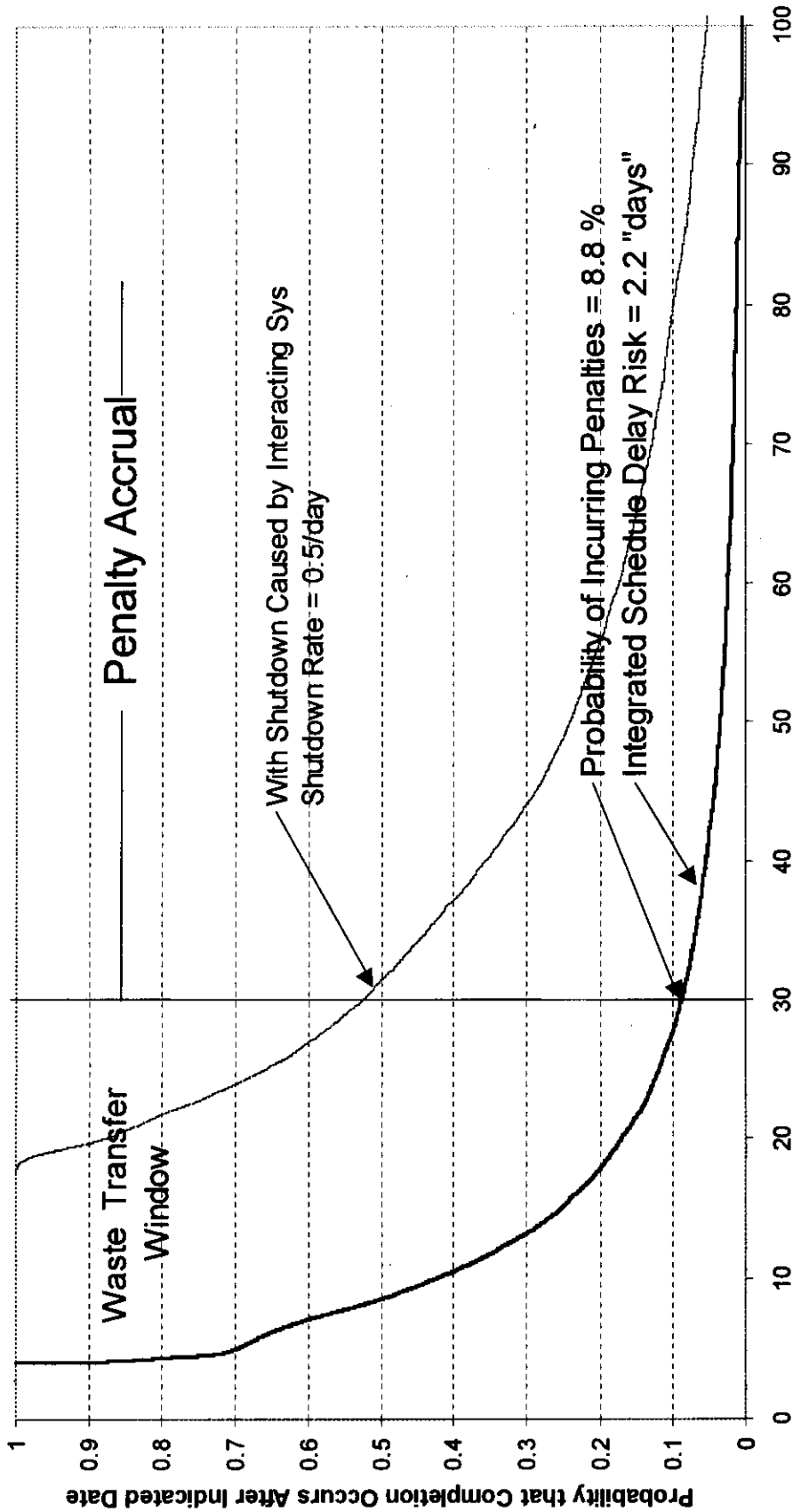

Figure 5-9. Comparison of Risk of Idle Facility Penalties With and Without Physically Connected Systems (for LAW Transfer from 241-AP-102 to BNFL, Inc.)

5.5.3 *Evaluation of the Requirements for Motor-Operated Valves.*

The need for using MOVs in waste transfer paths should be evaluated carefully. In general, valves within the WFDS will be operated relatively infrequently, so the efficiency provided by remote operation should be evaluated against the increased maintenance requirements and unreliability of MOVs. Although the MOVs are being designed to be manually positioned in the event of operator failure, manual valves generally have lower failure rates and less maintenance demand. For those paths that will not be subjected to frequent routing changes, manual valves provide a straightforward means of both aligning and controlling the waste transfer path. Valve position indicators can provide direct indication to the operators for verification of positioning, and the valves can be locked in place.

5.5.5 *Reduction of Recovery Times.*

Reduction of recovery times provides an opportunity to reduce penalty risk and overall schedule delay. Effort to reduce recovery times for specific failures should be focused on those items identified as the largest contributors to schedule delay and penalty risk. Two areas to consider are large pump replacement actions and valve and pump pit jumper replacements. Pump replacement activities are complex, intensive activities that require extensive planning. In general, waste transfer valves in valve pits and/or pump pits are components within jumper assemblies, and their failure necessitates a replacement of the entire jumper assembly. This effort is also labor intensive, requiring the removal of cover blocks, and can result in radiation exposure to workers. Suggestions to reduce the recovery times include: (1) preplanning and expedited review of work packages to the greatest extent possible; (2) organizing specific recovery teams and providing hands-on certification training for accomplishing recovery actions; (3) constructing mock-ups of critical facilities and locations so that recovery actions can be rehearsed and evaluated before they are performed in the field; and (4) ensuring spares are readily obtainable so that recovery action and associated delay time will not be controlled by spares procurement.

5.6 Recommendations

The following recommendations, most of which were also made in the O&M Concept document (Carlson, 1999), apply as a result of this updated analysis:

1. Evaluate options to reduce the integrated schedule delay risk so that the success criteria are satisfied. Some of the options that should be considered are as follows:

    - Ensure that a second source of qualified waste feed is available for delivery from an alternate tank or provide redundant capability for critical components with long recovery times (e.g., have redundant transfer pumps within the staging tank).

- Increase the delivered HLW feed batch size, thus reducing the number of batches to be delivered from the source tank. This both reduces the number of opportunities to incur idle facilities penalties and provides additional time for recovery.

- Increase the duration of the contractual 30-day feed delivery window.

- Reduce recovery times for components on the critical item lists or use components with greater reliability.

- Reduce the number of components of concern.

2. Perform a study to determine the proper system configuration to reduce the overall schedule risk to the WFD program. The study should determine the number of staging tanks, their need dates and location (one or more farms); the number of transfer pumps in each staging tank; when and how backup and contingency feed sources will be made available; the transfer system topology for routing of waste between the source tanks, staging tanks, and BNFL; and other factors that impact system reliability. The study should consider interactions with other programs such as single-shell tank retrieval.

3. From a preliminary RAM perspective, during the Project W-151 mixer pump test, additional information should be collected on the number of starts and run times made, the conditions of the waste for each run, pump motor parameters during each run, and any problems encountered that might assist in performing a failure analysis in the future.

4. Ensure support facilities are available for fabrication of jumpers, run-in testing of large pumps, training areas for specialized maintenance crews, and storage for large pumps and prefabricated jumpers.

5. Because of the high penalty cost associated with not delivering waste feed batches on time, tank farm operations should be planned to minimize potential impacts on starting WFD batch transfers. Maintenance activities to support waste transfers should focus on ensuring all mandatory maintenance is completed before the WTD for the required components, and the swift correction of deficiencies discovered during pre-transfer equipment verifications.

6. All activities associated with retrieval, transfer, staging, and qualification of the waste need to be accomplished well enough in advance of the WTD so waste feed batch delivery activities are not delayed. The schedule should provide sufficient slack time between qualification and delivery to insure that any off-normal events during field operations and maintenance occurring during qualification will not extend beyond the scheduled WTD.

7. Identify those specific items on the critical item lists whose recovery time estimates assumed the use of preplanned work packages. Include the development of these packages in the appropriate TBRs.

8. Identify those specific items on the critical items lists whose recovery time estimates assumed the use of mock-up training. Include the procurement of the mock-up facility and development of the training in the appropriate TBRs.

9. Components should be standardized to the extent possible to preclude the need to maintain numerous vendor files, procedures, and training. Replacement of components after failure should be of like kind, except where upgrades are desired, to preclude the need to update vendor files, procedures, and training.

10. Components within high radiation areas or inaccessible areas should be designed to operate without hands-on preventive maintenance, testing, or calibration.

11. For some components, such as waste mixer pumps and waste transfer pumps, the technical feasibility and overall cost benefit of a predictive maintenance program should be considered. If such a predictive maintenance program is elected, it should be implemented from the point the pump has gone through run-in testing throughout its operational history.

12. Certain recovery actions (mixer pump, transfer pump or jumper replacement) have been identified as long evolutions requiring significant planning and careful execution. The recovery durations in the preliminary RAM assessment assume that operations and maintenance personnel have been trained and qualified together for these critical recovery actions. Special qualification for this training, including performance demonstrations at a mock-up facility, should be considered.

13. The success criteria for the Idle Facilities Penalty FOM established in the System Specification for the Double-Shell Tank System should be refined to reflect a basis consistent with the terms of the privatization contract in terms of definition of batch. A possible example of a refinement to the FOM would be to allocate the integrated schedule risk per unit of LAW feed delivered or canister of HLW produced.

14. The preliminary RAM assessment should be updated next year to reflect new fiscal year 2000 baseline planning guidance and emerging changes to the technical baseline. The revised preliminary RAM assessment should address all categories of waste tanks that will be involved with Phase 1 waste retrieval, staging, and delivery. Examine in greater detail the exposure rates and the failure modes of the various components and systems identified on the critical items lists. Determine methods to reduce the expected delay time associated with these critical items.

15. Consider using the preliminary RAM assessment as key input to other new, broadly encompassing project performance FOM analyses, such as lowest life cycle cost analysis, with specific goals, requirements, or constraints on safety, reliability (including schedule risk), and transferred waste quality.

16. Update the preliminary RAM analyses continuously throughout the waste transfer design, development, construction, and implementation phases. Use these analyses to help guide prudent decision-making.

17. Upgrade the RAM model human reliability analysis after better resolution of specific operations and maintenance procedures for the WFD processes have been defined and documented.

18. Investigate potential alternate success paths for waste transfer, in addition to those already defined in the formally scheduled waste transfer activities. Incorporate these potential alternate success paths into a refined RAM assessment.

19. Perform alternate design option RAM case studies.

20. Perform more Hanford site-specific data analysis to support refining component failure rates and restoration times applied in the RAM assessment.

21. Review and refine the preliminary RAM assessment FMEAs to reduce potential conservatism.

22. Use the preliminary RAM assessment to provide key input to the development and improvement processes associated with configuration management for the WFDS design and implementation (i.e., as an aid to HANDI 2000 database development and implementation).

Other recommendations can and should be developed throughout the WFDS design, development, and implementation life cycle via continuous updating of these and other supporting RAM analyses.

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This document was too large to scan as a single document. It has been divided into smaller sections.

Section 2 of 2

Document Information			
Document #	**HNF-2863**	**Revision**	**1**
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RAM MODEL DEFINITIONS

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A-1 Component Data Field Descriptions

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A-3 Example Printout of Failure Modes and Effects Analysis

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TABLE A-1. COMPONENT DATA FIELD DESCRIPTIONS

DATA FIELD NAME	EXAMPLE DATA ENTRY	DATA FIELD DESCRIPTION	FIELD INCLUDED IN RPP COMPONENT DATABASE
Index Number	10631	Updated Component Index Number from RPP Component Database	YES
Farm-Tank	AZ Farm	Hanford Tank Farm - Tank Number Designator (Note: to be consolidated with "FARM")	YES
Equipment Location/Transfer from	Instrument Bldg 241-AZ-801A	Component or Equipment Location Designator (Note: to be consolidated with "Tank/Pit/Bldg")	YES
System Type	Raw Water	System Type Designator as identified by the RAM team	YES
Drawing Number	H-2-68335	Drawing Number for the Component Information Source Drawing	YES
Sheet No	5	Drawing Sheet Number for the Component Information Source Drawing	YES
Revision	6	Drawing Revision Number for the Component Information Source Drawing	YES
Farm	AZ	Hanford Waste Tank Farm Designator	YES
Tank/Pit/Bldg	801A	Hanford Waste Tank, Pump or Valve Pit, or Building Designator	YES
System	SW	Hanford System Designator	YES
Equipment Identification Number	FI-750	Abbreviated Equipment Identification Number (a concatenation of four fields from the RPP Component Database Separated by Dashes)	YES
COMPLETE EIN	AZ-801A-SW-FI-750 (Example for illustration)	Complete Equipment Identification Number (a concatenation of four fields from the RPP Component Database Separated by Dashes) NOTE: The "complete EIN" are not yet generated within the RPP database. The EIN shown here is for illustration.)	YES
Component Type	FI	Component Type Designator	YES
Component Description	Flow Indicator	Component Description (Text)	YES
2-Train or Short RT (Y or N)	N	Indicator Identifying a Redundant Multi-Train Component, Yes (Y) or No (N)	NO
ACTIVITY ID	MX1	Transfer Activity Identifier	NO
CMPC ID	P	Component Mission Profile Code Identifier	NO
Component Type Legend	Flow Indicator	Component Type Legend Identifier from Generic Component Failure Rate List	NO
FM Identifier	IND-FA-I	Failure Mode Identification Designator	NO
Failure Mode	Failure	Failure Mode	NO
Failure Effect	Potential delay of transfer activities.	Effect of Failure on Transfer Activities	NO
Mean FR	1.00E-05	Mean Failure Rate for Equipment Failure Mode	NO
Units	H	Unit of Measure for Component Failure Rate	NO
Range Factor	10	Failure Rate Uncertainty Distribution Range or Error Factor	NO
Generic Failure Data References	WSRC-TR-93-262, Table 1f	Reference Source of Information for Failure Rate Data	NO
ORIGINAL RT ID	RTOTHSML02	Original Failure Mode Function Restoration Time Identifier	NO
NEW RT ID	1NCNEL	Failure Mode Function Restoration Time Identifier (Note: "NEW" to be removed as database is consolidated)	NO
Repair ID	1NCNEL	Failure Mode Repair Time Identifier	NO

TABLE A-1. COMPONENT DATA FIELD DESCRIPTIONS

MTTR (LOW)	6	Minimum Value of Triangular Time to Restore Distribution (hours)	NO
MTTR (MODE)	12	Most Likely (Mode) Value of Triangular Time to Restore Distribution (hours)	NO
MTTR (HIGH)	24	Maximum Value of Triangular Time to Restore Distribution (hours)	NO
MTTR (MEAN)	14	Calculated Mean Time to Restore of Triangular Time to Restore Distribution (hours)	NO
CLOCK HOURS (MEAN)	96.17	Mean Time to Restore for a Lognormal Uncertainty Distribution	NO
CLOCK HOURS (Std Dev)	42.39	Standard Deviation of the Lognormal Time to Repair Uncertainty Distribution	NO
MTTR (MEAN) FOR QUANT	96.17	Mean Time to Restore Failure Function used for RAM Quantification	NO
EXPOSURE CODE	MX1H	Failure Rate Exposure for Associated Activity; Concatenation of Activity ID and Units Fields	NO
PREVIOUS EXPOSURE	1400	Previous Exposure Value	NO
EXPOSURE DATA	263.18	Current Exposure Value used in RAM Quantification	NO
F(DELAY) PER ACTIVITY	2.63E-03	Total Frequency of Delaying Event for the Associated Failure Mode for the Associated Activity	NO
SCHEDULE SHADOW FRACTION	4.56E-01	Fraction of Frequency of Delaying Event for the Associated Failure Mode for the Associated Activity that Delays Transfer Activity Schedule	NO
F(DELAY) PER ACTIVITY THAT IMPACT SCHEDULE	1.20E-03	Portion of Total Frequency of Delaying Event for the Associated Failure Mode for the Associated Activity that Delays Transfer Activity Schedule	NO
EXPECTED SCHEDULE DELAY TIME PER ACTIVITY (HRS)	1.16E-01	Expected Schedule Delay Time for the Associated Failure Mode for the Associated Activity (Measured in Hours)	NO
EXP DELAY TIME PER ACTIVITY (HRS)	1.16E-01	Expected Repair Time for the Associated Failure Mode for the Associated Activity (Measured in Hours)	NO
FREQ FRAC	5.85E-04	Fraction of Total Transfer Summed F(Delay) Per Activity that Impact Schedule Associated with this Line Item Failure Mode	NO
DELAY FRAC	4.48E-04	Fraction of Total Transfer Summed Expected Schedule Delay Time Per Activity that Impact Schedule Associated with this Line Item Failure Mode	NO

TABLE A-1. COMPONENT DATA FIELD DESCRIPTIONS

Activity ID	Transfer	Definition
CL1	HLW	Supplemental cooling of liquid waste to remove heat added during mixing.
MX1	HLW	Mixing required to mobilize solids and homogenize waste (Since there is no sampling before each batch, it is currently assumed that the mixing time remains the same for all batches.)
TR1	HLW	AZ-101 Batch 1 Transfer
FL1	HLW	Post transfer flushing
SA1	HLW	All SSCs performing safe storage activities (required to be operational at all times)
SP1	HLW	Utility systems that supply power, process air, instrument air, nitrogen, and raw water to WFDS SSCs for the other functions
O	LAW	Degas Operation
2A	LAW	Decant soluble AN-105 LAW to AP-102
2B	LAW	Flush pathway after transfer
X	LAW	All SSCs performing safe storage activities (required to be operational at all times)
Y	LAW	Utility systems that supply power, process air, instrument air, nitrogen, and raw water to WFDS SSCs for the other functions
T	LAW	Mix prior Qualification Sampling
C	LAW	Add Diluent to AN-105
D	LAW	Mix to dissolve salt sludge in AN-105
5A	LAW	Transfer dissolved salt sludge to AP-104
5B	LAW	Flush pathway after transfer
S	LAW	Mix AP-102 for sampling
8A	LAW	Batch transfer to BNFL
8F	LAW	Flush pathway after transfer
	CMPC ID	**Definition**
	A	Component was actively performing its function at the beginning of an activity and continues to perform it throughout the activity. It is subject to active and passive time-related failure mode.
	D	Component required to change state during the activity, but once that is accomplished, only passive failure mechanisms are susceptible to failure.
	O	Component required to both start and activity operate for the duration of the mission. Potential off-normal events will include both demand-related and time-related failure modes.
	P	Only passive functions challenged during the activity (leakage, rupture, etc.)

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TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
AC	Air Conditioning Unit	ACU-FS-H	Fails to start
AC	Air Conditioning Unit	ACU-FR-H	Fails to run
AE	Analysis Element	ANA-FA-I	Failure
AIT	Analysis Indicating Transmitter	TRM-FA-I	Failure
BOILER	Boiler	HTX-FL-W	Fouling (tubes)
BOILER	Boiler	HTX-PG-W	Plugs (tubes)
BOILER	Boiler	HTX-LI-W	Leakage (tubes)
BOILER	Boiler	HTX-RI-W	Rupture (tubes)
BOILER	Boiler	HTX-LE-W	Leakage (shell)
BOILER	Boiler	HTX-RE-W	Rupture (shell)
BTL	Sample Bottle	TKU-LE-C	Leakage (external)
BTL	Sample Bottle	TKU-RE-C	Rupture (external)
CAM	Continuous Air Monitor	GCR-FA-I	Failure
CAN	Canister	TKU-LE-C	Leakage (external)
CAN	Canister	TKU-RE-C	Rupture (external)
CASS	Computer Automated Surveillance Station	PLC-FA-I	Failure
CKT	Circuit (Power Supply)	BUB-FA-E	Failure
COND	Condenser	HTX-FL-C	Fouling (tubes)
COND	Condenser	HTX-PG-C	Plugs (tubes)
COND	Condenser	HTX-LI-C	Leakage (tubes)
COND	Condenser	HTX-RI-C	Rupture (tubes)
COND	Condenser	HTX-LE-C	Leakage (shell)
COND	Condenser	HTX-RE-C	Rupture (shell)
CP	Control Panel	ALR-NR-I	Fails to alarm
CP	Control Panel	ALR-SO-I	Spurious operation
CR	Control Relay	RLC-CC-E	Fails to open
CR	Control Relay	RLC-OO-E	Fails to close
CR	Control Relay	RLC-NR-E	No Response
CR	Control Relay	RLC-CO-E	Spurious operation
CR	Control Relay	RLC-OC-E	Spurious operation
CR	Control Relay	RLC-SO-E	Spurious operation
CRM	Count Rate Monitor	RST-FA-I	Failure
CVT	Converter	SCR-FA-I	Failure
DAMP	Pulse Dampener	PIP-LE-G	Leakage (external)
DAMP	Pulse Dampener	PIP-RE-G	Rupture (external)
DAMP	Pulse Dampener	PIP-PG-G	Plugs

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
DMPR	Damper	CMD-FC-H	Fails Closed
DMPR	Damper	CMD-FO-H	Fails Open
DMPR	Damper	CMD-LE-H	Leakage (external)
DMPR	Damper	CMD-NR-H	Fails to Respond
DMPR	Damper	CMD-PG-H	Plugs
DMPR	Damper	CMD-RE-H	Rupture (external)
DMST	Demister	FLT-LI-H	Leakage (internal)
DMST	Demister	FLT-PG-H	Plugs
DMST	Demister	FLT-RI-H	Rupture (internal)
DPI	Differential Pressure Indicator	IND-FA-I	Failure
DST	Double Shell Tank	TKU-LE-C	Leakage (external)
DST	Double Shell Tank	TKU-RE-C	Rupture (external)
DTC	Delta T Controller	PLC-FA-I	Failure
EB	Intrinsic Barrier	TKU-LE-C	Leakage (external)
EB	Intrinsic Barrier	TKU-RE-C	Rupture (external)
EF	Exhaust Fan	MDF-FR-H	Fails to Run
EF	Exhaust Fan	MDF-FS-H	Fails to Start
EF	Exhaust Fan	MDF-LE-H	Leakage (external)
EF	Exhaust Fan	MDF-NS-H	Fails to Stop
EF	Exhaust Fan	MDF-OS-H	Overspeed
EF	Exhaust Fan	MDF-RE-H	Rupture (external)
ENCL	Enclosure	TKU-LE-C	Leakage (external)
ENCL	Enclosure	TKU-RE-C	Rupture (external)
ES	Voltage Switch	ATS-CC-E	Fails to Open
ES	Voltage Switch	ATS-CO-E	Spurious Operation
ES	Voltage Switch	ATS-NR-E	Fails to Respond
ES	Voltage Switch	ATS-OC-E	Spurious Operation
ES	Voltage Switch	ATS-OO-E	Fails to Close
ES	Voltage Switch	ATS-SO-E	Spurious Operation
EY	Voltage Equipment	TFI-FA-E	Failure
F	Fan	MDF-FR-H	Fails to Run
F	Fan	MDF-FS-H	Fails to Start
F	Fan	MDF-LE-H	Leakage (external)
F	Fan	MDF-NS-H	Fails to Stop
F	Fan	MDF-OS-H	Overspeed
F	Fan	MDF-RE-H	Rupture (external)

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
FA	Flow Alarm	ALR-NR-I	Fails to Alarm
FA	Flow Alarm	ALR-SO-I	Spurious Operation
FAH	Flow Alarm High	ALR-NR-I	Fails to Alarm
FAH	Flow Alarm High	ALR-SO-I	Spurious Operation
FAL	Flow Alarm Low	ALR-NR-I	Fails to Alarm
FAL	Flow Alarm Low	ALR-SO-I	Spurious Operation
FC	Flow Controller	PLC-FA-I	Failure
FCV	Flow Control Valve	CMV-FC-C	Fails Closed
FCV	Flow Control Valve	CMV-FO-C	Fails Open
FCV	Flow Control Valve	CMV-LE-C	Leakage (external)
FCV	Flow Control Valve	CMV-NR-C	Fails to Respond
FCV	Flow Control Valve	CMV-PG-C	Plugs
FCV	Flow Control Valve	CMV-RE-C	Rupture (external)
FE	Flow Element	FST-FA-I	Failure
FI	Flow Indicator	IND-FA-I	Failure
FIC	Flow Indicating Controller	PLC-FA-I	Failure
FIQ	Flow Totalizer Indicator	IND-FA-I	Failure
FIT	Flow Indicating Transmitter	TRM-FA-I	Failure
FIV	Flow Indicator w/Flow Adjust Valve	IND-FA-I	Failure
FIV	Flow Indicator w/Flow Adjust Valve	XVM-OO-C	Fails to close
FIV	Flow Indicator w/Flow Adjust Valve	XVM-PG-C	Plugs
FIV	Flow Indicator w/Flow Adjust Valve	XVM-LI-C	Leakage (internal)
FIV	Flow Indicator w/Flow Adjust Valve	XVM-RI-C	Rupture (internal)
FIV	Flow Indicator w/Flow Adjust Valve	XVM-LE-C	Leakage (external)
FIV	Flow Indicator w/Flow Adjust Valve	XVM-RE-C	Rupture (external)
FLT	Filter	FLT-LI-H	Leakage (internal)
FLT	Filter	FLT-PG-H	Plugs
FLT	Filter	FLT-RI-H	Rupture (internal)
FQI	Flow Totalizer Indicator	IND-FA-I	Failure
FQIC	Flow Totalizer Indicating Switch	FST-FA-I	Failure
FR	Flow Recorder	REC-FA-I	Failure
FR	Flow Recorder	REC-FA-I	Failure
FS	Flow Switch	FST-FA-I	Failure
FSL	Flow Switch Low	FST-FA-I	Failure
FT	Flow Transmitter	TRM-FA-I	Failure
FTP	Flow Test Port	PIP-LE-C	Leakage (external)

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
FTP	Flow Test Port	PIP-RE-C	Rupture (external)
FTP	Flow Test Port	PIP-PG-C	Plugs
FV	Manual Butterfly Valve	XVM-OO-C	Fails to Close
FV	Manual Butterfly Valve	XVM-PG-C	Plugs
FV	Manual Butterfly Valve	XVM-LI-C	Leakage (internal)
FV	Manual Butterfly Valve	XVM-RI-C	Rupture (internal)
FV	Manual Butterfly Valve	XVM-LE-C	Leakage (external)
FV	Manual Butterfly Valve	XVM-RE-C	Rupture (external)
FY	Flow Equipment	TFI-FA-E	Failure
GLY	Glycol	TKU-LE-W	Leakage (external)
GLY	Glycol	TKU-RE-W	Rupture (external)
HC	Hand Controller	PLC-FA-I	Failure
HEME	High Efficiency Mist Eliminator	MTE-FA-H	Failure
HIT	Gas Indicating Transmitter	IND-FA-I	Failure
HM	Hour Meter	IND-FA-I	Failure
HMP	Hydrogen Monitoring Panel	HYC-FA-I	Failure
HS	Hand Switch (Two Position)	XSK-NR-E	Fails to Respond
HS	Hand Switch (Two Position)	XSR-CC-E	Fails to Open
HS	Hand Switch (Two Position)	XSR-CO-E	Spurious Operation
HS	Hand Switch (Two Position)	XSR-OC-E	Spurious Operation
HS	Hand Switch (Two Position)	XSR-OO-E	Fails to Close
HS	Hand Switch (Two Position)	XSR-SO-E	Spurious Operation
HT	Heat Trace	HTE-FH-C	Fails to Heat
HT	Heat Trace	HTE-OH-C	Overheats
HTR	Heater	HTE-FH-H	Fails to Heat
HTR	Heater	HTE-OH-H	Overheats
HV	Valve	XVM-OO-C	Fails to Close
HV	Valve	XVM-PG-C	Plugs
HV	Valve	XVM-LI-C	Leakage (internal)
HV	Valve	XVM-RI-C	Rupture (internal)
HV	Valve	XVM-LE-C	Leakage (external)
HV	Valve	XVM-RE-C	Rupture (external)
I	Interlock	TFI-FA-E	Failure
IA	Instrument Air System	IAS-FA-F	Failure
II	Current Indicator	IND-FA-I	Failure
INT			

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
ISC	Inlet Screen	TRS-PG-W	Plugs
IT	Current Transmitter	TRM-FA-I	Failure
IY	Current Equipment	TFI-FA-E	Failure
JMP	Jumper	JPR-LE-C	Leakage (external)
JMP	Jumper	JPR-RE-C	Rupture (external)
JMP	Jumper	JPR-PG-C	Plugs
JY	Power Equipment	BUB-FA-E	Failure
LAH	Level Alarm High	ALR-NR-I	Fails to Alarm
LAH	Level Alarm High	ALR-SO-I	Spurious operation
LAHH	Level Alarm High High	ALR-NR-I	Fails to Alarm
LAHH	Level Alarm High High	ALR-SO-I	Spurious Operation
LAL	Level Alarm Low	ALR-NR-I	Fails to Alarm
LAL	Level Alarm Low	ALR-SO-I	Spurious Operation
LDA	Leak Detected Alarm	ALR-NR-I	Fails to Alarm
LDA	Leak Detected Alarm	ALR-SO-I	Spurious Operation
LDE	Leak Detector Element (Two-Wire Sensor)	UST-FA-I	Failure
LDK	Leak Detector Relay	BIS-CC-E	Fails to Open
LDK	Leak Detector Relay	BIS-CO-E	Spurious Operation
LDK	Leak Detector Relay	BIS-NR-E	Fails to Respond
LDK	Leak Detector Relay	BIS-OC-E	Spurious Operation
LDK	Leak Detector Relay	BIS-OO-E	Fails to Close
LDK	Leak Detector Relay	BIS-SO-E	Spurious Operation
LDSTA	Leak Detector Station	ALR-NR-I	Fails to Alarm
LDSTA	Leak Detector Station	ALR-SO-I	Spurious Operation
LDXA	Leak Detector Failure Alarm	ALR-NR-I	Fails to Alarm
LDXA	Leak Detector Failure Alarm	ALR-SO-I	Spurious Operation
LDY	Leak Detector Signal Relay	RLC-CC-E	Fails to Open
LDY	Leak Detector Signal Relay	RLC-OO-E	Fails to Close
LDY	Leak Detector Signal Relay	RLC-NR-E	No Response
LDY	Leak Detector Signal Relay	RLC-CO-E	Spurious Operation
LDY	Leak Detector Signal Relay	RLC-OC-E	Spurious Operation
LDY	Leak Detector Signal Relay	RLC-SO-E	Spurious Operation
LE	Level Element	LST-FA-I	Failure
LEK	Level Element Relay	RLC-CC-E	Fails to Open
LEK	Level Element Relay	RLC-OO-E	Fails to Close
LEK	Level Element Relay	RLC-NR-E	No Response

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
LEK	Level Element Relay	RLC-CO-E	Spurious Operation
LEK	Level Element Relay	RLC-OC-E	Spurious Operation
LEK	Level Element Relay	RLC-SO-E	Spurious Operation
LG	Level Glass	IND-FA-I	Failure
LI	Level Indicator	IND-FA-I	Failure
LIS	Level Indicating Switch	LST-FA-I	Failure
LIT	Level Indicating Transmitter	TRM-FA-I	Failure
LS	Level Switch	LST-FA-I	Failure
LSHL	Level Switch High Low	LST-FA-I	Failure
LY	Level Equipment	LST-FA-I	Failure
M	Motor	MRA-FR-E	Fails to Run
M	Motor	MRA-FS-E	Fails to Start
MCC	Motor Control Center	BUM-FA-E	Failure
MK	Louvers, Valves	XDM-OO-H	Fails to Close
MK	Louvers, Valves	XDM-PG-H	Plugs
MK	Louvers, Valves	XDM-LI-H	Leakage (internal)
MK	Louvers, Valves	XDM-RI-H	Rupture (internal)
MK	Louvers, Valves	XDM-LE-H	Leakage (external)
MK	Louvers, Valves	XDM-RE-H	Rupture (external)
MON	Dual Column Gas Chromatograph	GCR-FA-I	Failure
MOSE	Moisture Separator	ADR-FA-G	Failure
MOV	Motor-Operated Valve	MOV-CC-C	Fails to Open
MOV	Motor-Operated Valve	MOV-CO-C	Spurious Operation
MOV	Motor-Operated Valve	MOV-LE-C	Leakage (external)
MOV	Motor-Operated Valve	MOV-LI-C	Leakage (internal)
MOV	Motor-Operated Valve	MOV-OC-C	Spurious Operation
MOV	Motor-Operated Valve	MOV-OO-C	Fails to Close
MOV	Motor-Operated Valve	MOV-PG-C	Plugs
MOV	Motor-Operated Valve	MOV-RE-C	Rupture (external)
MOV	Motor-Operated Valve	MOV-RI-C	Rupture (internal)
MS	Motor Switch	XSP-CC-E	Fails to Open
MS	Motor Switch	XSP-OO-E	Fails to Close
MS	Motor Switch	XSP-NR-E	No Response
MS	Motor Switch	XSP-CO-E	Spurious Operation
MS	Motor Switch	XSP-OC-E	Spurious Operation
MS	Motor Switch	XSP-SO-E	Spurious Operation

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
MT	Static Mixer	MIX-FA-C	Failure
MUX	Multiplexer	SCR-FA-I	Failure
MV	Manual Valve	XMV-RI-C	Rupture (internal)
MV	Manual Valve	XVM-CC-C	Fails to Open
MV	Manual Valve	XVM-LE-C	Leakage (external)
MV	Manual Valve	XVM-LI-C	Leakage (internal)
MV	Manual Valve	XVM-OO-C	Fails to Close
MV	Manual Valve	XVM-PG-C	Plugs
MV	Manual Valve	XVM-RE-C	Rupture (external)
N2	Nitrogen System	N2S-FA-F	Failure
NAH	Gas Alarm High	ALR-NR-I	Fails to alarm
NAH	Gas Alarm High	ALR-SO-I	Spurious Operation
NE	Gas Monitoring Element	GCR-FA-I	Failure
NIT	Gas Indicating Transmitter	GCR-FA-I	Failure
NOZ	Nozzle	PIP-LE-C	Leakage (external)
NOZ	Nozzle	PIP-RE-C	Rupture (external)
NOZ	Nozzle	PIP-PG-C	Plugs
NR	Gas Recorder	REC-FA-I	Failure
NSH	Gas Switch High	HCC-FA-I	Failure
P	Pump	MDP-FR-C	Fails to Run
P	Pump	MDP-FS-C	Fails to Start
P	Pump	MDP-LE-C	Leakage (external)
P	Pump	MDP-NS-C	Fails to Stop
P	Pump	MDP-OS-C	Overspeed
P	Pump	MDP-RE-C	Rupture (external)
PA	Process Air	PAS-FS-O	Supply Fails
PAH	Pressure Alarm High	ALR-NR-I	Fails to Alarm
PAH	Pressure Alarm High	ALR-SO-I	Spurious Operation
PAL	Pressure Alarm Low	ALR-NR-I	Fails to Alarm
PAL	Pressure Alarm Low	ALR-SO-I	Spurious Operation
PB	Push Button	XSP-CC-E	Fails to Open
PB	Push Button	XSP-OO-E	Fails to Close
PB	Push Button	XSP-NR-E	No Response
PB	Push Button	XSP-CO-E	Spurious Operation
PB	Push Button	XSP-OC-E	Spurious Operation
PB	Push Button	XSP-SO-E	Spurious Operation

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
PBL	Push Button Light	IND-FA-I	Failure
PC	Pressure Controller	PLC-FA-I	Failure
PCV	Pressure Control Valve	CMV-FC-C	Fails Closed
PCV	Pressure Control Valve	CMV-FO-C	Fails Open
PCV	Pressure Control Valve	CMV-LE-C	Leakage (external)
PCV	Pressure Control Valve	CMV-NR-C	Fails to Respond
PCV	Pressure Control Valve	CMV-PG-C	Plugs
PCV	Pressure Control Valve	CMV-RE-C	Rupture (external)
PDAH	Pressure Differential Alarm High	ALR-NR-I	Fails to Alarm
PDAH	Pressure Differential Alarm High	ALR-SO-I	Spurious Operation
PDAL	Pressure Differential Alarm Low	ALR-NR-I	Fails to Alarm
PDAL	Pressure Differential Alarm Low	ALR-SO-I	Spurious Operation
PDI	Pressure Differential Indicator	IND-FA-I	Failure
PDIS	Pressure Differential Indicating Switch	IND-FA-I	Failure
PDIT	Pressure Differential Indicating Transmitter	IND-FA-I	Failure
PDS	Pressure Differential Switch	DPS-FA-I	Failure
PDT	Pressure Differential Transmitter	TRM-FA-I	Failure
PE	Pressure Element	PST-FA-I	Failure
PEI	Pressure Element Indicator	IND-FA-I	Failure
PI	Pressure Indicator	IND-FA-I	Failure
PIC	Pressure Indicating Controller	PLC-FA-I	Failure
PIPE	Pipe	PIP-LE-C	Leakage (external)
PIPE	Pipe	PIP-PG-C	Plugs
PIPE	Pipe	PIP-RE-C	Rupture (external)
PIT	Pressure Indicating Transmitter	TRM-FA-I	Failure
PNL	Panel	ALR-NR-I	Fails to Alarm
PNL	Panel	ALR-SO-I	Spurious Operation
PRM	Process Radiation Monitor	RST-FA-I	Failure
PRV	Pressure Relief Valve	SRV-CC-C	Fails to Open
PRV	Pressure Relief Valve	SRV-OO-C	Fails to Reclose
PRV	Pressure Relief Valve	SRV-LI-C	Leakage (internal)
PRV	Pressure Relief Valve	SRV-RI-C	Rupture (internal)
PRV	Pressure Relief Valve	SRV-LE-C	Leakage (external)
PRV	Pressure Relief Valve	SRV-RE-C	Rupture (external)
PS	Pressure Switch	PST-FA-I	Failure
PSE	Rupture Disk	SRV-CC-C	Fails to Open

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
PSE	Rupture Disk	SRV-LE-C	Leakage (external)
PSE	Rupture Disk	SRV-RE-C	Rupture (external)
PSH	Pressure Switch High	PST-FA-I	Failure
PSPY	Power Supply	BUM-FA-E	Failure
PT	Pressure Transmitter	PST-FA-I	Failure
QQ	Timer	TMR-FA-I	Failure
QS	General Alarm	ALR-NR-I	Fails to Alarm
QS	General Alarm	ALR-SO-I	Spurious Operation
QXS			
RA	Radiation Alarm	ALR-NR-I	Fails to Alarm
RA	Radiation Alarm	ALR-SO-I	Spurious Operation
RAH	Radiation Alarm High	ALR-NR-I	Fails to Alarm
RAH	Radiation Alarm High	ALR-SO-I	Spurious Operation
RAIS	Radiation Alarm Indicating Switch	ALR-NR-I	Fails to Alarm
RAIS	Radiation Alarm Indicating Switch	ALR-SO-I	Spurious Operation
RE	Radiation Sensing Element	RST-FA-I	Failure
RIAS	Radiation Indicator Alarm Switch	ALR-NR-I	Fails to Alarm
RIAS	Radiation Indicator Alarm Switch	ALR-SO-I	Spurious Operation
RIS	Radiatin Indicating Swtich	IND-FA-I	Failure
RM	Radiation Monitor	RST-FA-I	Failure
RR	Radiation Recorder	REC-FA-I	Failure
RSH	Radiation Switch High	RST-FA-I	Failure
RT	Radiation Transmitter	TRM-FA-I	Failure
RTD	Resistance Temperature Detector	TST-FA-I	Failure
RV	Relief Valve	SRV-CC-C	Fails to Open
RV	Relief Valve	SRV-OO-C	Fails to Reclose
RV	Relief Valve	SRV-LI-C	Leakage (internal)
RV	Relief Valve	SRV-RI-C	Rupture (internal)
RV	Relief Valve	SRV-LE-C	Leakage (external)
RV	Relief Valve	SRV-RE-C	Rupture (external)
RXA	Radiation Failure Alarm	ALR-NR-I	Fails to Alarm
RXA	Radiation Failure Alarm	ALR-SO-I	Spurious Operation
RXS	Radiation Failure Switch	RST-FA-I	Failure
RY	Radiation Equipment	RST-FA-I	Failure
S	Sampler	SAM-FA-I	Failure
SC	Speed Controller	PLC-FA-I	Failure

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
SCR	Silicon Controller	PLC-FA-I	Failure
SE	Speed/Velocity Element	SST-FA-I	Failure
SG	Sight Glass	IND-FA-I	Failure
SGI	Specific Gravity Indicator	IND-FA-I	Failure
SGT	Specific Gravity Transmitter	TRM-FA-I	Failure
SI	Speed/Velocity Indicator	IND-FA-I	Failure
SIT	Speed/Velocity Indicating Transmitter	IND-FA-I	Failure
SOV	Solenoid Valve	SOV-CC-C	Fails to Open
SOV	Solenoid Valve	SOV-OO-C	Fails to Close
SOV	Solenoid Valve	SOV-CO-C	Spurious Operation
SOV	Solenoid Valve	SOV-OC-C	Spurious Operation
SOV	Solenoid Valve	SOV-PG-C	Plugs
SOV	Solenoid Valve	SOV-LI-C	Leakage (internal)
SOV	Solenoid Valve	SOV-RI-C	Rupture (internal)
SOV	Solenoid Valve	SOV-LE-C	Leakage (external)
SOV	Solenoid Valve	SOV-RE-C	Rupture (external)
SP	Seal Pot	TKU-LE-C	Leakage (external)
SP	Seal Pot	TKU-RE-C	Rupture (external)
SS	Selector Switch (Three or More Positions)	XSK-NR-E	Fails to Respond
SS	Selector Switch (Three or More Positions)	XSR-CC-E	Fails to Open
SS	Selector Switch (Three or More Positions)	XSR-CO-E	Spurious Operation
SS	Selector Switch (Three or More Positions)	XSR-OC-E	Spurious Operation
SS	Selector Switch (Three or More Positions)	XSR-OO-E	Fails to Close
SS	Selector Switch (Three or More Positions)	XSR-SO-E	Spurious Operation
STK	Stack	STK-FA-F	Failure
SV	Sample Valve	XMV-RI-C	Rupture (internal)
SV	Sample Valve	XVM-CC-C	Fails to Open
SV	Sample Valve	XVM-LE-C	Leakage (external)
SV	Sample Valve	XVM-LI-C	Leakage (internal)
SV	Sample Valve	XVM-OO-C	Fails to Close
SV	Sample Valve	XVM-PG-C	Plugs
SV	Sample Valve	XVM-RE-C	Rupture (external)
SWS	Service Water System	SWS-FA-F	Failure
TA	Temperature Alarm	ALR-NR-I	Fails to Alarm
TA	Temperature Alarm	ALR-SO-I	Spurious Operation
TAH	Temperature Alarm High	ALR-NR-I	Fails to Alarm

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
TAH	Temperature Alarm High	ALR-SO-I	Spurious Operation
TAHL	Temperature Alarm High Low	ALR-NR-I	Fails to Alarm
TAHL	Temperature Alarm High Low	ALR-SO-I	Spurious Operation
TAL	Temperature Alarm Low	ALR-NR-I	Fails to Alarm
TAL	Temperature Alarm Low	ALR-SO-I	Spurious Operation
TANK	Catch Tank	TKU-LE-C	Leakage (external)
TANK	Catch Tank	TKU-RE-C	Rupture (external)
TBLB	Temperature Bulb	TST-FA-I	Failure
TC	Temperature Controller	PLC-FA-I	Failure
TDAL	Temperature Differential Alarm Low	ALR-NR-I	Fails to Alarm
TDAL	Temperature Differential Alarm Low	ALR-SO-I	Spurious Operation
TDC	Temperature Differential Controller	PLC-FA-I	Failure
TDIC	Temperature Differential Indicating Controller	PLC-FA-I	Failure
TDR	Temperature Differential Recorder	REC-FA-I	Failure
TDS	Temperature Differential Switch	DPS-FA-I	Failure
TE	Temperature Element	TST-FA-I	Failure
TI	Temperature Indicator	IND-FA-I	Failure
TIC	Temperature Indicating Controller	PLC-FA-I	Failure
TIS	Temperature Indicating Switch	IND-FA-I	Failure
TIT	Temperature Indicating Transmitter	TRM-FA-I	Failure
TK	Tank	TKU-LE-C	Leakage (external)
TK	Tank	TKU-RE-C	Rupture (external)
TS	Temperature Switch	TST-FA-I	Failure
TSH	Temperature Switch High	TST-FA-I	Failure
TS-HFT	High Filter Temperature Controller	PLC-FA-I	Failure
TSHL	Temperature Switch High Low	TST-FA-I	Failure
TS-HST	High Sheath Temperature Controller	PLC-FA-I	Failure
TSL	Temperature Switch Low	TST-FA-I	Failure
TT	Temperature Transmitter	TST-FA-I	Failure
TV	Video Camera	TFI-FA-E	Failure
TY	Temperature Equipment	TST-FA-I	Failure
UC	Multivariable Controller	PLC-FA-I	Failure
UE	Multivariable Element	LOG-FA-I	Failure
V	Valve	XMV-RI-C	Rupture (internal)
V	Valve	XVM-CC-C	Fails to Open
V	Valve	XVM-LE-C	Leakage (external)

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
V	Valve	XVM-LI-C	Leakage (internal)
V	Valve	XVM-OO-C	Fails to Close
V	Valve	XVM-PG-C	Plugs
V	Valve	XVM-RE-C	Rupture (external)
VDF	Variable Frequency Drive	PLC-FA-I	Failure
VFD	Variable Frequency Drive	PLC-FA-I	Failure
VI	Vibration Indicator	IND-FA-I	Failure
VT	Vibration Transmitter	TRM-FA-I	Failure
VTRP	Vent Trap	PIP-LE-C	Leakage (external)
VTRP	Vent Trap	PIP-PG-C	Plugs
VTRP	Vent Trap	PIP-RE-C	Rupture (external)
WFA	Weight Factor Alarm	ALR-NR-I	Fails to Alarm
WFA	Weight Factor Alarm	ALR-SO-I	Spurious Operation
WFAS	Weight Factor Alarm Switch	ALR-NR-I	Fails to Alarm
WFAS	Weight Factor Alarm Switch	ALR-SO-I	Spurious Operation
WFI	Weight Factor Indicator	IND-FA-I	Failure
WFT	Weight Factor Transmitter	TRM-FA-I	Failure
WMP	Waste Mixer Pump	MDP-FR-C	Fails to Run
WMP	Waste Mixer Pump	MDP-FS-C	Fails to Start
WMP	Waste Mixer Pump	MDP-LE-C	Leakage (external)
WMP	Waste Mixer Pump	MDP-NS-C	Fails to Stop
WMP	Waste Mixer Pump	MDP-OS-C	Overspeed
WMP	Waste Mixer Pump	MDP-RE-C	Rupture (external)
WTP	Waste Transfer Pump	MDP-FR-C	Fails to Run
WTP	Waste Transfer Pump	MDP-FS-C	Fails to Start
WTP	Waste Transfer Pump	MDP-LE-C	Leakage (external)
WTP	Waste Transfer Pump	MDP-NS-C	Fails to Stop
WTP	Waste Transfer Pump	MDP-OS-C	Overspeed
WTP	Waste Transfer Pump	MDP-RE-C	Rupture (external)
XA	Failure Alarm	ALR-NR-I	Fails to Alarm
XA	Failure Alarm	ALR-SO-I	Spurious Operation
YAH	Event/State Alarm High	ALR-NR-I	Fails to Alarm
YAH	Event/State Alarm High	ALR-SO-I	Spurious Operation
YAL	Event/State Alarm Low	ALR-NR-I	Fails to Alarm
YAL	Event/State Alarm Low	ALR-SO-I	Spurious Operation
YC	Programmable Logic Controller	PLC-FA-I	Failure

TABLE A-2: DEFINITION OF COMPONENT TYPE / FAILURE MODE COMBINATIONS

Component Type	Component Type Legend	FM Identifier	Failure Mode Description
YL	Event/State Light	IND-FA-I	Failure
YS	Event/State Switch	IND-FA-I	Failure
YYC	Programmable Logic Controller	PLC-FA-I	Failure
ZC	Position Controller	PLC-FA-I	Failure
ZE	Position Element	LMS-CC-E	Fails to Open
ZE	Position Element	LMS-OO-E	Fails to Close
ZE	Position Element	LMS-NR-E	Fails to Close
ZE	Position Element	LMS-CO-E	Spurious Operation
ZE	Position Element	LMS-OC-E	Spurious Operation
ZE	Position Element	LMS-SO-E	Spurious Operation
ZI	Position Indicator	IND-FA-I	Failure
ZIC	Position Indicating Contoller	PLC-FA-I	Failure
ZS	Position Switch	LMS-00-E	Fails to Close
ZS	Position Switch	LMS-CC-E	Fails to Open
ZS	Position Switch	LMS-CO-E	Spurious Operation
ZS	Position Switch	LMS-NR-E	Fails to Respond
ZS	Position Switch	LMS-OC-E	Spurious Operation
ZS	Position Switch	LMS-SO-E	Spurious Operation
ZT	Position Transmitter	TRM-FA-I	Failure

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TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE BN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8501	MK	Louver	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8501	MK	Louver	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8501	MK	Louver	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8501	MK	Louver	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8501	MK	Louver	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-8-1	HTR	Filter	Fails to Heat	HTE-FH-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-8-1	HTR	Filter	Overheats	HTE-OH-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-1-1-1	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-1-1-1	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-1-1-1	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-11-1	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-11-1	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-11-1	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8502	MK	Louver	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8502	MK	Louver	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8502	MK	Louver	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8502	MK	Louver	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MK-8502	MK	Louver	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-8-2	HTR	Filter	Fails to Heat	HTE-FH-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-8-2	HTR	Filter	Overheats	HTE-OH-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-1-2	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-1-2	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-1-2	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-11-2	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-11-2	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-11-2	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-2-1	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-2-1	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-2-1	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TC-K1-1-1	TC	Temperature Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-1-1	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-2-1	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-1	FV	Manual Butterfly Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-1	FV	Manual Butterfly Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-1	FV	Manual Butterfly Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-1	FV	Manual Butterfly Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-1	FV	Manual Butterfly Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-2	FV	Manual Butterfly Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-2	FV	Manual Butterfly Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-2	FV	Manual Butterfly Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-2	FV	Manual Butterfly Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-2	FV	Manual Butterfly Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-101-AZ	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-R-K1-PS-1-2	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PS-K1-1-2	PS	Pressure Switch	Failure.	PST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-R-K1-PS-1-1	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PS-K1-1-1	PS	Pressure Switch	Failure	PST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-3-3	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RTD-K1-1-1	RTD	Resistance Temperature Detector	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TI-K1-1-1	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-1	FV	Manual Butterfly Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-1	FV	Manual Butterfly Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-1	FV	Manual Butterfly Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-1	FV	Manual Butterfly Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-1	FV	Manual Butterfly Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-1	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-1	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-1	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-2	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE EIN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-2	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-2	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-SCR-K1-1-1	SCR	Silicon Controlled Temperature Detector	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-DTC-K1-1-1	DTC	Delta T Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-CVT-K1-1-1	CVT	Converter	Failure	SCR-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TS-HST-K1-1-1	TC	High Sheath Temperature Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TS-HFT-K1-1-1	TC	High Filter Temperature Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TE-K1-1-1	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TE-K1-1-3	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-4-1	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-4-2	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-1	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-1	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-1	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-2	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-2	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-2	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RTD-K1-1-2	RTD	Resistance Temperature Detector	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TI-K1-1-5	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-3-2	PLN	Exhaust Plenum	Leakage (external)	PIP-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-3-2	PLN	Exhaust Plenum	Plugs	PIP-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-3-2	PLN	Exhaust Plenum	Rupture (external)	PIP-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-(EF)-K1-3-2	EF	Exhaust Fan	Fails to Run	MDF-FR-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-(EF)-K1-3-2	EF	Exhaust Fan	Leakage (external)	MDF-LE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-(EF)-K1-3-2	EF	Exhaust Fan	Overspeed	MDF-OS-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-(EF)-K1-3-2	EF	Exhaust Fan	Rupture (external)	MDF-RE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FA-AZ Annulus	FA	Flow Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FA-AZ Annulus	FA	Flow Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FS-K1-1-1	FS	Flow Switch	Failure	FST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Record Sampler Vacuum Pump	P	Pump	Fails to Run	MDP-FR-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Record Sampler Vacuum Pump	P	Pump	Leakage (external)	MDP-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Record Sampler Vacuum Pump	P	Pump	Overspeed	MDP-OS-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Record Sampler Vacuum Pump	P	Pump	Rupture (external)	MDP-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FA-AZ-RS	FA	Flow Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FA-AZ-RS	FA	Flow Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-QQ-RS-AZ	QQ	Timer	Failure	TMR-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FS-RS-AZ	FS	Flow Switch	Failure	FST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-RS-AZ	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FIQ-RS-AZ	FIQ	Flow Totalizer	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FI-RS-AZ	FI	Flow Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-HT-RS-AZ	HT	Heat Trace	Fails to heat	HTE-FH-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-HT-RS-AZ	HT	Heat Trace	Overheats	HTE-OH-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-DPI-RS-41	DPI	Differential Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FI-K1-1-1	FI	Flow Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	AZ-101 Cam Unit Enclosure	HVAC Annulus	Existing	-CAM-101-AZ	CAM	Continuous Air Monitor	Failure	GCR-FA-I	Potential Schedule Delay.
AZ-101	AZ-101 Cam Unit Enclosure	HVAC Annulus	Existing	-FS-CAM-1-101-AZ	FS	Flow Switch	Failure	FST-FA-I	Potential Schedule Delay.
AZ-101	AZ-101 Cam Unit Enclosure	HVAC Annulus	Existing	-RR-101-AZ	RR	Radiation Recorder	Failure	REC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RA-101-AZ	RA	Radiation Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RA-101-AZ	RA	Radiation Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-QQ-CAM-101-AZ	QQ	Timer	Failure	TMR-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TI-K1-1-2	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FA-101/102-AZ	FA	Flow Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FA-101/102-AZ	FA	Flow Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ101 CAM Unit Vacuum Pump	P	Pump	Fails to Run	MDP-FR-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ101 CAM Unit Vacuum Pump	P	Pump	Leakage (external)	MDP-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ101 CAM Unit Vacuum Pump	P	Pump	Overspeed	MDP-OS-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ101 CAM Unit Vacuum Pump	P	Pump	Rupture (external)	MDP-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-13-1	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-13-1	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE EIN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-13-1	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-3	FV	Manual Butterfly Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-3	FV	Manual Butterfly Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-3	FV	Manual Butterfly Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-3	FV	Manual Butterfly Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-3	FV	Manual Butterfly Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-4	FV	Manual Butterfly Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-4	FV	Manual Butterfly Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-4	FV	Manual Butterfly Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-4	FV	Manual Butterfly Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-1-4	FV	Manual Butterfly Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-102-AZ	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-R-K1-PS-1-4	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PS-K1-1-4	PS	Pressure Switch	Failure	PST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K-R-K1-PS-1-3	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PS-K1-1-3	PS	Pressure Switch	Failure	PST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-3-4	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RTD-K1-1-3	RTD	Resistance Temperature Detector	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TI-K1-1-3	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-2	FV	Manual Butterfly Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-2	FV	Manual Butterfly Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-2	FV	Manual Butterfly Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-2	FV	Manual Butterfly Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-FV-2-2	FV	Manual Butterfly Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-3	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-3	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-3	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-4	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-4	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-12-4	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-SCR-K1-1-2	SCR	Silicon Controlled Rectifier Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-DTC-K1-1-2	DTC	Delta T Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-CVT-K1-1-2	CVT	Converter	Failure	SCR-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TS-HST-K1-1-2	TC	High Sheath Temperature Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TS-HFT-K1-1-2	TC	High Filter Temperature Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TE-K1-1-2	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TE-K1-1-4	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-4-3	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-PI-K1-4-4	PI	Pressure Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-3	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-3	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-3	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-4	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-4	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-5-4	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RTD-K1-1-4	RTD	Resistance Temperature Detector	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-CAM-102-AZ	CAM	Continuous Air Monitor	Failure	GCR-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-FS-CAM-1-102-AZ	FS	Flow Switch	Failure	FST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RR-102-AZ	RR	Radiation Recorder	Failure	REC-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RA-102-AZ	RA	Radiation Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-RA-102-AZ	RA	Radiation Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-QQ-CAM-102-AZ	QQ	Timer	Failure	TMR-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-TI-K1-1-4	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ102 CAM Unit Vacuum Pump	P	Pump	Fails to Run	MDP-FR-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ102 CAM Unit Vacuum Pump	P	Pump	Leakage (external)	MDP-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ102 CAM Unit Vacuum Pump	P	Pump	Overspeed	MDP-OS-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ102 CAM Unit Vacuum Pump	P	Pump	Rupture (external)	MDP-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-13-2	FLT	Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-13-2	FLT	Filter	Plugs	FLT-PG-H	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE BIN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ Farm	AZ Farm	HVAC Annulus	Existing	-K1-13-2	FLT	Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Record Sampler Cabinet	ENCL	Enclosure	Leakage (external)	TKU-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Record Sampler Cabinet	ENCL	Enclosure	Rupture (external)	TKU-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-102-AZ Heater Control Enclosure	ENCL	Enclosure	Leakage (external)	TKU-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-102-AZ Heater Control Enclosure	ENCL	Enclosure	Rupture (external)	TKU-RE-C	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-5	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-5	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-5	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-5	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-5	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-5	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-6	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-6	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-6	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-6	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-6	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-6	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-7	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-7	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-7	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-7	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-7	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-7	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-8	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-8	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-8	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-8	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-8	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-HS-1-8	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-K1-8-1	FLT	Enclosure Fan	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-K1-8-1	FLT	Enclosure Fan	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	Existing	-K1-8-1	FLT	Enclosure Fan	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Annulus Instrument Enclosure	ENCL	Enclosure	Leakage (external)	TKU-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-AZ Annulus Instrument Enclosure	ENCL	Enclosure	Rupture (external)	TKU-RE-C	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-1	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-1	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-1	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-1	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-1	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-1	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-2	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-2	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-2	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-2	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-2	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-2	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-3	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-3	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-3	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-3	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-3	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-3	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-4	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-4	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-4	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-4	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-4	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-1-4	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-M	HS	Hand Switch	Fails to Close	XSR-OO-E	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE BIN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-M	HS	Hand Switch	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-M	HS	Hand Switch	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-M	HS	Hand Switch	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-M	HS	Hand Switch	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	Existing	-HS-M	HS	Hand Switch	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MCC #1 AZ Annulus Vent Panel	ENCL	Enclosure	Leakage (external)	TKU-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Annulus	Existing	-MCC #1 AZ Annulus Vent Panel	ENCL	Enclosure	Rupture (external)	TKU-RE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-TA-AZ1K12-1	TA	Temperature Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-TA-AZ1K12-1	TA	Temperature Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-TDIC-AZ101K102-1	TDIC	Temperature Differential Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-2-1	HTR	Heater	Overheats	HTE-OH-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-2-1	HTR	Heater	Fails to Heat	HTE-FH-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-3-1	FLT	Pre-Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-3-1	FLT	Pre-Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-3-1	FLT	Pre-Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-4-1	FLT	HEPA Filter	Rupture (internal)	FLT-RI-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-4-1	FLT	HEPA Filter	Plugs	FLT-PG-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-AZ101-K1-4-1	FLT	HEPA Filter	Leakage (internal)	FLT-LI-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A1	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A1	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A1	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A1	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A1	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A2	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A2	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A2	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A2	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A2	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A3	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A3	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A3	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A3	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-HV-AZ101K104-1A3	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PDS-AZ101K1-1	PDS	Pressure Differential Swtich	Failure	DPS-FA-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PDI-AZ101K103-1	PDI	Pressure Differential Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PDI-AZ101K104-1	PDI	Pressure Differential Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PDAH-AZ1K1-1	PDAH	Pressure Differential Alarm High	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PDAH-AZ1K1-1	PDAH	Pressure Differential Alarm High	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-ZI-AZ1K1-1	ZI	Position Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-ZT-AZ101K1-1	ZT	Position Transmitter	Failure	TRM-FA-I	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PCV-AZ101K1-1	PCV	Pressure Control Valve	Fails Open	CMV-FO-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PCV-AZ101K1-1	PCV	Pressure Control Valve	Rupture (external)	CMV-RE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PCV-AZ101K1-1	PCV	Pressure Control Valve	Plugs	CMV-PG-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PCV-AZ101K1-1	PCV	Pressure Control Valve	Fails Closed	CMV-FC-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PCV-AZ101K1-1	PCV	Pressure Control Valve	Leakage (external)	CMV-LE-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-PCV-AZ101K1-1	PCV	Pressure Control Valve	Fails to Respond	CMV-NR-C	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-MK-AZ101K1-1	MK	Motor Operated Globe Valve	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-MK-AZ101K1-1	MK	Motor Operated Globe Valve	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-MK-AZ101K1-1	MK	Motor Operated Globe Valve	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-MK-AZ101K1-1	MK	Motor Operated Globe Valve	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	New/030	-MK-AZ101K1-1	MK	Motor Operated Globe Valve	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FI-AZ1K1-1	FI	Flow Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FT-AZ101K1-1	FT	Flow Transmitter	Failure	TRM-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PIC-AZ1K1-1	PIC	Pressure Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PI-AZ1K1-2	PIC	Pressure Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PT-AZ101K1-2	PT	Pressure Transmitter	Failure	PST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FIC-AZ101K1-2A	FIC	Flow Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FIC-AZ101K1-1A	FIC	Flow Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PT-AZ101K1-1	PT	Pressure Transmitter	Failure	PST-FA-I	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE IBN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FE-AZ101K1-1	FE	Flow Element	Failure	FST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FE-AZ101K1-2	FE	Flow Element	Failure	FST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FIC-AZ1K1-2	FIC	Flow Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FT-AZ101K1-2	FT	Flow Transmitter	Failure	TRM-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZI-AZ1K1-2	ZI	Position Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZT-AZ101K1-2	ZT	Position Transmitter	Failure	TRM-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A1	MK	Butterfly Valve	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A1	MK	Butterfly Valve	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A1	MK	Butterfly Valve	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A1	MK	Butterfly Valve	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A1	MK	Butterfly Valve	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2	MK	Motor Operated Butterfly Valve	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2	MK	Motor Operated Butterfly Valve	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2	MK	Motor Operated Butterfly Valve	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2	MK	Motor Operated Butterfly Valve	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2	MK	Motor Operated Butterfly Valve	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A2	MK	Butterfly Valve	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A2	MK	Butterfly Valve	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A2	MK	Butterfly Valve	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A2	MK	Butterfly Valve	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A2	MK	Butterfly Valve	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A3	MK	Butterfly Valve	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A3	MK	Butterfly Valve	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A3	MK	Butterfly Valve	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A3	MK	Butterfly Valve	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K1-2A3	MK	Butterfly Valve	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-V0608-1	LDA	Leak Detector Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-V0608-1	LDA	Leak Detector Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-V0608-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-CO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-V0608-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-OC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-V0608-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-SO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDE-V0608-1	LDE	Leak Detector Element	Failure	UST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-AZ2102-1	LDA	Leak Detector Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-AZ2102-1	LDA	Leak Detector Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ2102-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-SO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ2102-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-OC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ2102-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-CO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDE-AZ2102-1	LDE	Leak Detector Element	Failure	UST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-2801-1	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-2801-1	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-2801-1	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-2801-1	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-2801-1	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1A	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1A	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1A	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1A	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1A	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1A	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZ108-1A	MK	Butterfly Valve	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZ108-1A	MK	Butterfly Valve	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZ108-1A	MK	Butterfly Valve	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZ108-1A	MK	Butterfly Valve	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZ108-1A	MK	Butterfly Valve	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TI-AZK18-1A	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TT-AZK108-1A	TT	Temperature Transmitter	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TE-AZK108-1A1	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TE-AZK108-1A2	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-PDI-AZK18-1	PDI	Pressure Differential Indicator	Failure	IND-FA-I	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE BN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ Farm	AZ Farm	HVAC Primary	New/030	-PDT-AZK108-1	PDT	Pressure Differential Transmitter	Failure	TRM-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1	HV	3 Valve Manifold	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1	HV	3 Valve Manifold	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1	HV	3 Valve Manifold	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1	HV	3 Valve Manifold	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1	HV	3 Valve Manifold	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Spurious Operation	XSR-OC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A1	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A1	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A1	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A1	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A1	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A2	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A2	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A2	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A2	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1A2	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-AZ-K1-8-1	COND	Condenser	Leakage (shell)	HTX-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-AZ-K1-8-1	COND	Condenser	Fouling (tubes)	HTX-FL-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-AZ-K1-8-1	COND	Condenser	Leakage (tubes)	HTX-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-AZ-K1-8-1	COND	Condenser	Plugs (tubes)	HTX-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-AZ-K1-8-1	COND	Condenser	Rupture (shell)	HTX-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-AZ-K1-8-1	COND	Condenser	Rupture (tubes)	HTX-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1D	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1D	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1D	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1D	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK108-1D	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TE-AZK108-1B2	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TE-AZK108-1B1	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TT-AZK108-1B	TT	Temperature Transmitter	Failure	TST-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-TI-AZK18-1B	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1B	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1B	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1B	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1B	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1B	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1B	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZK108-1A	MK	Butterfly Valve	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZK108-1A	MK	Butterfly Valve	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZK108-1A	MK	Butterfly Valve	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZK108-1A	MK	Butterfly Valve	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-MK-AZK108-1A	MK	Butterfly Valve	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1A	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1A	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1A	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1A	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1A	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1A	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-AZ-K1-8-1	HEME	High Efficiency Mist Eliminator	Failure	MTE-FA-H	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-PDI-AZK19-1	PDI	Pressure Differential Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Fails to Close	XSR-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Spurious Operation	XSR-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK108-1	HS	Hand Switch (2 position)	Spurious Operation	XSR-OC-E	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE BN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK109-1	HS	Hand Switch (2 position)	Spurious Operation	XSR-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK109-1	HS	Hand Switch (2 position)	Fails to Respond	XSK-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HS-AZK109-1	HS	Hand Switch (2 position)	Fails to Open	XSR-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-PDT-AZK109-1	PDT	Pressure Differential Transmitter	Failure	TRM-FA-I	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1	HV	3-Valve Manifold	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1	HV	3-Valve Manifold	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1	HV	3-Valve Manifold	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1	HV	3-Valve Manifold	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1	HV	3-Valve Manifold	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A1	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A1	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A1	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A1	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A1	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A2	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A2	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A2	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A2	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1A2	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1D	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1D	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1D	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1D	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1D	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1E	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1E	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1E	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1E	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-HV-AZK109-1E	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1B	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1B	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1B	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1B	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1B	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1B	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1C	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1C	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1C	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1C	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1C	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK19-1C	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1C	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1C	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1C	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1C	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1C	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ Farm	AZ Farm	HVAC Primary	New/030	-ZS-AZK18-1C	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-AZ1200-1	LDA	Leak Detector Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-AZ1200-1	LDA	Leak Detector Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ1200-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-OC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ1200-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-CO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ1200-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-SO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDE-AZ1200-1	LDE	Leak Detector Element	Failure	UST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-1	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-1	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-1	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-1	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-1	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-1	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE BN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A1	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A1	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A1	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A1	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A1	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A	HV	3-Valve Manifold	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A	HV	3-Valve Manifold	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A	HV	3-Valve Manifold	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A	HV	3-Valve Manifold	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K408-1A	HV	3-Valve Manifold	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PDT-AZ101K408-1	PDT	Pressure Differential Transmitter	Failure	TRM-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PDI-AZ1K48-1	PDI	Pressure Differential Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TI-AZ1K48-1A	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TE-AZ101K408-1A	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-8-1	COND	Condenser	Leakage (shell)	HTX-LE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-8-1	COND	Condenser	Fouling (tubes)	HTX-FL-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-8-1	COND	Condenser	Leakage (tubes)	HTX-LI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-8-1	COND	Condenser	Plugs (tubes)	HTX-PG-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-8-1	COND	Condenser	Rupture (shell)	HTX-RE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-8-1	COND	Condenser	Rupture (tubes)	HTX-RI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TI-AZ1EWS-1	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TE-AZ101EWS-1	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TI-AZ1EWR-1	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TE-AZ101EWR-1	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-AZ101EWS-1A6	HV	Gate Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-AZ101EWS-1A6	HV	Gate Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-AZ101EWS-1A6	HV	Gate Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-AZ101EWS-1A6	HV	Gate Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-HV-AZ101EWS-1A6	HV	Gate Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-RV-AZ101EWS-1	RV	Relief Valve	Leakage (external)	SRV-LE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-RV-AZ101EWS-1	RV	Relief Valve	Leakage (internal)	SRV-LI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-RV-AZ101EWS-1	RV	Relief Valve	Rupture (external)	SRV-RE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-RV-AZ101EWS-1	RV	Relief Valve	Rupture (internal)	SRV-RI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TE-AZ101K408-1B	TE	Temperature Element	Failure	TST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-TI-AZ1K48-1B	TI	Temperature Indicator	Failure	IND-FA-I	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K4-1	HV	3-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K4-1	HV	3-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K4-1	HV	3-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K4-1	HV	3-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101K4-1	HV	3-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDE-AZ1202-1	LDE	Leak Detector Element	Failure	UST-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ1202-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-CO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ1202-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-OC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDY-AZ1202-1	LDY	Leak Detector Signal Relay	Spurious operation	RLC-SO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-AZ1202-1	LDA	Leak Detector Alarm	Fails to Alarm	ALR-NR-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-LDA-AZ1202-1	LDA	Leak Detector Alarm	Spurious Operation	ALR-SO-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-3	MK	Butterfly Damper Valve w/Limit Switches	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-3	MK	Butterfly Damper Valve w/Limit Switches	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-3	MK	Butterfly Damper Valve w/Limit Switches	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-3	MK	Butterfly Damper Valve w/Limit Switches	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-3	MK	Butterfly Damper Valve w/Limit Switches	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-4	MK	Butterfly Damper Valve w/Limit Switches	Leakage (external)	XDM-LE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-4	MK	Butterfly Damper Valve w/Limit Switches	Rupture (external)	XDM-RE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-4	MK	Butterfly Damper Valve w/Limit Switches	Plugs	XDM-PG-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-4	MK	Butterfly Damper Valve w/Limit Switches	Rupture (internal)	XDM-RI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-MK-AZ101K4-4	MK	Butterfly Damper Valve w/Limit Switches	Leakage (internal)	XDM-LI-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-3	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-3	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-3	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.

TABLE A-3: Example Printout of Failure Modes and Effects Analysis

Farm-Tank	Equipment Location	System Type	Equipment Origin	COMPLETE BIN	Comp. Type	Component Description	Failure Mode	FM Identifier	Failure Effect
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-3	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-3	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-3	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-4	ZS	Position Switch	Fails to Close	LMS-OO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-4	ZS	Position Switch	Fails to Open	LMS-CC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-4	ZS	Position Switch	Fails to Respond	LMS-NR-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-4	ZS	Position Switch	Spurious Operation	LMS-OC-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-4	ZS	Position Switch	Spurious Operation	LMS-CO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-ZS-AZ1K4-4	ZS	Position Switch	Spurious Operation	LMS-SO-E	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-1-1	MOSE	Moisture Separator	Failure	ADR-FA-G	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-6-1	RF	Recirculating Fan	Fails to Run	MDF-FR-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-6-1	RF	Recirculating Fan	Rupture (external)	MDF-RE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-6-1	RF	Recirculating Fan	Overspeed	MDF-OS-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-AZ101-K4-6-1	RF	Recirculating Fan	Leakage (external)	MDF-LE-H	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-FIC-AZ101PA-1	FIC	Flow Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PCV-AZ101PA-2	PCV	Pressure Control Valve	Fails Open	CMV-FO-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PCV-AZ101PA-2	PCV	Pressure Control Valve	Fails to Respond	CMV-NR-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PCV-AZ101PA-2	PCV	Pressure Control Valve	Fails Closed	CMV-FC-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PCV-AZ101PA-2	PCV	Pressure Control Valve	Leakage (external)	CMV-LE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PCV-AZ101PA-2	PCV	Pressure Control Valve	Plugs	CMV-PG-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PCV-AZ101PA-2	PCV	Pressure Control Valve	Rupture (external)	CMV-RE-C	Potential Schedule Delay.
AZ-101	Tank AZ-101	HVAC Primary	New/030	-PI-AZ101PA-2	PIC	Pressure Indicating Controller	Failure	PLC-FA-I	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101PA-3	HV	2-Way Ball Valve	Rupture (external)	XVM-RE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101PA-3	HV	2-Way Ball Valve	Leakage (external)	XVM-LE-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101PA-3	HV	2-Way Ball Valve	Leakage (internal)	XVM-LI-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101PA-3	HV	2-Way Ball Valve	Rupture (internal)	XVM-RI-C	Potential Schedule Delay.
AZ-101	AZ-101	HVAC Primary	New/030	-HV-AZ101PA-3	HV	2-Way Ball Valve	Plugs	XVM-PG-C	Potential Schedule Delay.

APPENDIX B

RAM ANALYSIS GENERIC FAILURE RATES
(FROM WSRC-TR-93-262)

Tables

B-1	Water System Recommended Generic Failure Rates
B-2	Chemical Process System Recommended Generic Failure Rates
B-3	Compressed Gas System Recommended Generic Failure Rates
B-4	HVAC/Exhaust System Recommended Generic Failure Rates
B-5	Electrical Distribution System Recommended Generic Failure Rates
B-6	Instrumentation and Control System Recommended Generic Failure Rates

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Table B-1	Water System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Water	Valve (Standby or Safety)	Manual	Fails to Open/Close	XVM-CC-W	3.00E-04	D	10
Water	Valve (Standby or Safety)	Manual	Fails to Open/Close	XVM-OO-W	3.00E-04	D	10
Water	Valve (Standby or Safety)	Manual	Plugs	XVM-PG-W	5.00E-08	H	10
Water	Valve (Standby or Safety)	Manual	Leakage (internal)	XVM-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Manual	Rupture (internal)	XVM-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Manual	Leakage (external)	XVM-LE-W	1.00E-08	H	10
Water	Valve (Standby or Safety)	Manual	Rupture (external)	XVM-RE-W	5.00E-10	H	30
Water	Valve (Standby or Safety)	Check	Fails to Open/Close	CKV-CC-W	5.00E-05	D	10
Water	Valve (Standby or Safety)	Check	Fails to Open/Close	CKV-00-W	1.00E-03	D	5
Water	Valve (Standby or Safety)	Check	Plugs	CKV-PG-W	5.00E-08	H	10
Water	Valve (Standby or Safety)	Check	Leakage (internal)	CKV-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Check	Rupture (internal)	CKV-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Check	Leakage (external)	CKV-LE-W	1.00E-08	H	10
Water	Valve (Standby or Safety)	Check	Rupture (external)	CKV-RE-W	5.00E-10	H	30
Water	Valve (Standby or Safety)	Motor-Operated	Fails to Open/Close	MOV-CC-W	3.00E-03	D	5
Water	Valve (Standby or Safety)	Motor-Operated	Fails to Open/Close	MOV-OO-W	3.00E-03	D	5
Water	Valve (Standby or Safety)	Motor-Operated	Spurious Operation	MOV-CO-W	3.00E-07	H	5
Water	Valve (Standby or Safety)	Motor-Operated	Spurious Operation	MOV-OC-W	3.00E-07	H	5
Water	Valve (Standby or Safety)	Motor-Operated	Plugs	MOV-PG-W	5.00E-08	H	10
Water	Valve (Standby or Safety)	Motor-Operated	Leakage (internal)	MOV-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Motor-Operated	Rupture (internal)	MOV-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Motor-Operated	Leakage (external)	MOV-LE-W	1.00E-08	H	10
Water	Valve (Standby or Safety)	Motor-Operated	Rupture (external)	MOV-RE-W	5.00E-10	H	30
Water	Valve (Standby or Safety)	Air-Operated	Fails to Open/Close	AOV-CC-W	1.00E-03	D	30
Water	Valve (Standby or Safety)	Air-Operated	Fails to Open/Close	AOV-OO-W	1.00E-03	D	30
Water	Valve (Standby or Safety)	Air-Operated	Spurious Operation	AOV-CO-W	1.00E-06	H	5
Water	Valve (Standby or Safety)	Air-Operated	Spurious Operation	AOV-OC-W	1.00E-06	H	5
Water	Valve (Standby or Safety)	Air-Operated	Plugs	AOV-PG-W	5.00E-08	H	10
Water	Valve (Standby or Safety)	Air-Operated	Leakage (internal)	AOV-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Air-Operated	Rupture (internal)	AOV-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Air-Operated	Leakage (external)	AOV-LE-W	1.00E-08	H	10
Water	Valve (Standby or Safety)	Air-Operated	Rupture (external)	AOV-RE-W	5.00E-10	H	30
Water	Valve (Standby or Safety)	Solenoid-Operated	Fails to Open/Close	SOV-CC-W	1.00E-03	D	10
Water	Valve (Standby or Safety)	Solenoid-Operated	Fails to Open/Close	SOV-OO-W	1.00E-03	D	10
Water	Valve (Standby or Safety)	Solenoid-Operated	Spurious operation	SOV-CO-W	5.00E-07	H	10
Water	Valve (Standby or Safety)	Solenoid-Operated	Plugs	SOV-PG-W	5.00E-08	H	10
Water	Valve (Standby or Safety)	Solenoid-Operated	Leakage (internal)	SOV-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Solenoid-Operated	Rupture (internal)	SOV-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Solenoid-Operated	Leakage (external)	SOV-LE-W	1.00E-08	H	10

Table B-1	Water System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Water	Valve (Standby or Safety)	Solenoid-Operated	Rupture (external)	SOV-RE-W	5.00E-10	H	30
Water	Valve (Standby or Safety)	Safety/Relief	Fails to Open	SRV-CC-W	3.00E-03	D	3
Water	Valve (Standby or Safety)	Safety/Relief	Fails to reclose	SRV-OO-W	3.00E-03	D	3
Water	Valve (Standby or Safety)	Safety/Relief	Leakage (internal)	SRV-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Safety/Relief	Rupture (internal)	SRV-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Safety/Relief	Leakage (external	SRV-LE-W	1.00E-08	H	10
Water	Valve (Standby or Safety)	Safety/Relief	Rupture (external)	SRV-RE-W	5.00E-10	H	30
Water	Valve (Standby or Safety)	Vacuum-Breaker	Fails to Open	VBV-CC-W	1.00E-02	D	10
Water	Valve (Standby or Safety)	Vacuum-Breaker	Fails to reclose	VBV-OO-W	1.00E-02	D	10
Water	Valve (Standby or Safety)	Vacuum-Breaker	Leakage (internal)	VBV-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Vacuum-Breaker	Rupture (internal)	VBV-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Vacuum-Breaker	Leakage (external)	VBV-LE-W	1.00E-08	H	10
Water	Valve (Standby or Safety)	Vacuum-Breaker	Rupture (external)	VBV-RE-W	5.00E-10	H	30
Water	Valve (Standby or Safety)	Explosive	Fails to open	EXV-CC-W	1.00E-04	D	10
Water	Valve (Standby or Safety)	Explosive	Leakage (internal)	EXV-LI-W	1.00E-06	H	10
Water	Valve (Standby or Safety)	Explosive	Rupture (internal)	EXV-RI-W	5.00E-08	H	30
Water	Valve (Standby or Safety)	Explosive	Leakage (external)	EXV-LE-W	1.00E-08	H	10
Water	Valve (Standby or Safety)	Explosive	Rupture (external)	EXV-RE-W	5.00E-10	H	30
Water	Valve (Control)	Motor-Operated	Fails open	CMV-FO-W	3.00E-06	H	10
Water	Valve (Control)	Motor-Operated	Fails closed	CMV-FC-W	3.00E-06	H	10
Water	Valve (Control)	Motor-Operated	Fails to respond	CMV-NR-W	3.00E-06	H	10
Water	Valve (Control)	Motor-Operated	Plugs	CMV-PG-W	5.00E-08	H	10
Water	Valve (Control)	Motor-Operated	Leakage (external)	CMV-LE-W	1.00E-08	H	10
Water	Valve (Control)	Motor-Operated	Rupture (external)	CMV-RE-W	5.00E-10	H	30
Water	Valve (Control)	Air-Operated	Fails open	CAV-FO-W	3.00E-06	H	10
Water	Valve (Control)	Air-Operated	Fails closed	CAV-FC-W	3.00E-06	H	10
Water	Valve (Control)	Air-Operated	Fails to respond	CAV-NR-W	3.00E-06	H	10
Water	Valve (Control)	Air-Operated	Plugs	CAV-PG-W	5.00E-08	H	10
Water	Valve (Control)	Air-Operated	Leakage (external)	CAV-LE-W	1.00E-08	H	10
Water	Valve (Control)	Air-Operated	Rupture (external)	CAV-RE-W	5.00E-10	H	30
Water	Valve (Control)	Solenoid-Operated	Fails open	CSV-FO-W	3.00E-06	H	10
Water	Valve (Control)	Solenoid-Operated	Fails closed	CSV-FC-W	3.00E-06	H	10
Water	Valve (Control)	Solenoid-Operated	Fails to respond	CSV-FO-W	3.00E-06	H	10
Water	Valve (Control)	Solenoid-Operated	Plugs	CSV-PG-W	5.00E-08	H	10
Water	Valve (Control)	Solenoid-Operated	Leakage (external)	CSV-LE-W	1.00E-08	H	10
Water	Valve (Control)	Solenoid-Operated	Rupture (external)	CSV-RE-W	5.00E-10	H	30
Water	Pump	Motor-Driven	Fails to start	MDP-FS-W	3.00E-03	D	5
Water	Pump	Motor-Driven	Fails to run	MDP-FR-W	3.00E-05	H	10
Water	Pump	Motor-Driven	Overspeed	MDP-OS-W	5.00E-06	H	10

Table B-1	Water System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Water	Pump	Motor-Driven	Fails to stop	MDP-NS-W	3.00E-03	D	5
Water	Pump	Motor-Driven	Leakage (external)	MDP-LE-W	3.00E-08	H	10
Water	Pump	Motor-Driven	Rupture (external)	MDP-RE-W	1.00E-09	H	30
Water	Pump	Turbine-Driven	Fails to start	TDP-FS-W	3.00E-02	D	3
Water	Pump	Turbine-Driven	Fails to run	TDP-FR-W	1.00E-04	H	30
Water	Pump	Turbine-Driven	Overspeed	TDP-OS-W	3.00E-05	H	10
Water	Pump	Turbine-Driven	Fails to stop	TDP-NS-W	3.00E-02	D	3
Water	Pump	Turbine-Driven	Leakage (external)	TDP-LE-W	3.00E-08	H	10
Water	Pump	Turbine-Driven	Rupture (external)	TDP-RE-W	1.00E-09	H	30
Water	Pump	Diesel-Driven	Fails to start	DDP-FS-W	1.00E-02	D	5
Water	Pump	Diesel-Driven	Fails to run	DDP-FR-W	5.00E-03	H	5
Water	Pump	Diesel-Driven	Overspeed	DDP-OS-W	1.00E-03	H	5
Water	Pump	Diesel-Driven	Fails to stop	DDP-NS-W	1.00E-02	D	5
Water	Pump	Diesel-Driven	Leakage (external)	DDP-LE-W	3.00E-08	H	10
Water	Pump	Diesel-Driven	Rupture (external)	DDP-RE-W	1.00E-09	H	30
Water	Piping/Hose/Jumper	Piping	Leakage (external)	PIP-LE-W	3.00E-09	H-FT	10
Water	Piping/Hose/Jumper	Piping	Rupture (external)	PIP-RE-W	1.00E-10	H-FT	30
Water	Piping/Hose/Jumper	Piping	Plugs	PIP-PF-W	1.00E-10	H-FT	30
Water	Piping/Hose/Jumper	Hose	Leakage (external)	HOS-LE-W	1.00E-09	H-FT	10
Water	Piping/Hose/Jumper	Hose	Rupture (external)	HOS-RE-W	1.00E-08	H-FT	10
Water	Piping/Hose/Jumper	Hose	Plugs	HOS-PG-W	1.00E-08	H-FT	10
Water	Piping/Hose/Jumper	Jumper	Leakage (external	JPR-LE-W	1.00E-06	H	10
Water	Piping/Hose/Jumper	Jumper	Rupture (external)	JPR-RE-W	1.00E-08	H	30
Water	Piping/Hose/Jumper	Jumper	Plugs	JPR-PG-W	5.00E-08	H	10
Water	Vessel	Tank (Unpressurized)	Leakage (external)	TKU-LE-W	1.00E-08	H	10
Water	Vessel	Tank (Unpressurized)	Rupture (external)	TKU-RE-W	5.00E-10	H	30
Water	Vessel	Tank (Pressurized)	Leakage (external)	TKP-LE-W	1.00E-08	H	10
Water	Vessel	Tank (Pressurized)	Rupture (external)	TKP-RE-W	5.00E-10	H	30
Water	Vessel	Flange/Gasket	Leakage (external)	FLG-LE-W	1.00E-08	H	10
Water	Vessel	Flange/Gasket	Rupture (external)	FLG-RE-W	1.00E-10	H	30
Water	Heat Exchanger	Shell/Tube	Fouling (tubes)	HTX-FL-W	1.00E-07	H	10
Water	Heat Exchanger	Shell/Tube	Plugs (tubes)	HTX-PG-W	3.00E-08	H	10
Water	Heat Exchanger	Shell/Tube	Leakage (tubes)	HTX-LI-W	1.00E-07	H	10
Water	Heat Exchanger	Shell/Tube	Rupture (tubes)	HTX-RI-W	5.00E-09	H	30
Water	Heat Exchanger	Shell/Tube	Leakage (shell)	HTX-LE-W	1.00E-08	H	10
Water	Heat Exchanger	Shell/Tube	Rupture (shell)	HTX-RE-W	5.00E-10	H	30
Water	Heat Exchanger	Heater (Electrical)	Fails to heat	HTE-FH-W	1.00E-06	H	10
Water	Heat Exchanger	Heater (Electrical)	Overheats	HTE-OH-W	3.00E-07	H	10
Water	Heat Exchanger	Heater (Electrical)	Leakage (external)	HTE-LE-W	1.00E-07	H	10

Table B-1	Water System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Water	Heat Exchanger	Heater (Electrical)	Rupture (external)	HTE-RE-W	5.00E-09	H	30
Water	Strainer/Filter		Plugs	FLT-PG-W	3.00E-06	H	10
Water	Strainer/Filter		Leakage (internal)	FLT-LI-W	3.00E-06	H	10
Water	Strainer/Filter		Rupture (internal)	FLT-RI-W	5.00E-07	H	10
Water	Orifice		Plugs	ORF-PG-W	1.00E-06	H	3
Water	Miscellaneous	Travelling Screen	Plugs	TRS-PG-W	5.00E-07	H	10

Table B-2	Chemical Process System Recommend Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate Distribution (lognormal)		
					Mean	Unit	Error Factor
Chemical Process	Valve (Standby or Safety)	Manual	Fails to open	XVM-CC-C	3.00E-04	D	10
Chemical Process	Valve (Standby or Safety)	Manual	Fails to close	XVM-OO-C	3.00E-04	D	10
Chemical Process	Valve (Standby or Safety)	Manual	Plugs	XVM-PG-C	5.00E-08	H	10
Chemical Process	Valve (Standby or Safety)	Manual	Leakage (internal)	XVM-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Manual	Rupture (internal)	XVM-RI-C	5.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Manual	Leakage (external)	XVM-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Manual	Rupture (external)	XVM-RE-C	3.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Check	Fails to open	CKV-CC-C	5.00E-05	D	10
Chemical Process	Valve (Standby or Safety)	Check	Fails to close	CKV-OO-C	1.00E-03	D	10
Chemical Process	Valve (Standby or Safety)	Check	Plugs	CKV-PG-C	5.00E-08	H	10
Chemical Process	Valve (Standby or Safety)	Check	Leakage (internal)	CKV-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Check	Rupture (internal)	CKV-RI-C	5.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Check	Leakage (external)	CKV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Check	Rupture (external)	CKV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Fails to open	MOV-CC-C	3.00E-03	D	10
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Fails to close	MOV-OO-C	3.00E-03	D	10
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Spurious operation	MOV-CO-C or MOV-OC-C	3.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Plugs	MOV-PG-C	5.00E-08	H	10
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Leakage (internal)	MOV-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Rupture (internal)	MOV-RI-C	5.00E-08	H	10
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Leakage (external)	MOV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Motor-Operated	Rupture (external)	MOV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Air-Operated	Fails to open	AOV-CC-C	1.00E-03	D	30
Chemical Process	Valve (Standby or Safety)	Air-Operated	Fails to close	AOV-OO-C	1.00E-03	D	30
Chemical Process	Valve (Standby or Safety)	Air-Operated	Spurious operation	AOV-CO-C or AOV-OC-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Air-Operated	Plugs	AVO-CO-C or AOV-OC-C	5.00E-08	H	10
Chemical Process	Valve (Standby or Safety)	Air-Operated	Leakage (internal)	AOV-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Air-Operated	Rupture (internal)	AOV-RI-C	5.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Air-Operated	Leakage (external)	AOV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Air-Operated	Rupture (external)	AOV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Fails to open	SOV-CC-C	1.00E-03	D	10
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Fails to close	SOV-OO-C	1.00E-03	D	10
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Spurious operation	SOV-CO-C or SOV-OC-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Plugs	SOV-PG-C	5.00E-08	H	10
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Leakage (internal)	SOV-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Rupture (internal)	SOV-RI-C	5.00E-08	H	30

Table B-2	Chemical Process System Recommend Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate Distribution (lognormal)		
					Mean	Unit	Error Factor
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Leakage (external)	SOV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Solenoid-Operated	Rupture (external)	SOV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Safety/Relief	Fails to open	SRV-CC-C	3 .0E-3	D	10
Chemical Process	Valve (Standby or Safety)	Safety/Relief	Fails to reclose	SRV-OO-C	3.00E-03	D	10
Chemical Process	Valve (Standby or Safety)	Safety/Relief	Leakage (internal)	SRV-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Safety/Relief	Rupture (internal)	SRV-RI-C	5.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Safety/Relief	Leakage (external)	SRV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Safety/Relief	Rupture (external)	SRV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Vacuum-Breaker	Fails to open	VBV-CC-C	1.00E-02	D	10
Chemical Process	Valve (Standby or Safety)	Vacuum-Breaker	Fails to reclose	VBV-OO-C	1.00E-02	D	10
Chemical Process	Valve (Standby or Safety)	Vacuum-Breaker	Leakage (internal)	VBV-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Vacuum-Breaker	Rupture (internal)	VBV-RI-C	5.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Vacuum-Breaker	Leakage (external)	VBV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Vacuum-Breaker	Rupture (external)	VBV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Standby or Safety)	Explosive	Fails to open	EXV-CC-C	1.00E-04	D	10
Chemical Process	Valve (Standby or Safety)	Explosive	Leakage (internal)	EXV-LI-C	1.00E-06	H	10
Chemical Process	Valve (Standby or Safety)	Explosive	Rupture (internal)	EXV-RI-C	5.00E-08	H	10
Chemical Process	Valve (Standby or Safety)	Explosive	Leakage (external)	EXV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Standby or Safety)	Explosive	Rupture (external)	EXV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Control)	Motor-Operated	Fails open	CMV-FO-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Motor-Operated	Fails closed	CMV-FC-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Motor-Operated	Fails to respond	CMV-NR-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Motor-Operated	Plugs	CMV-PG-C	5.00E-08	H	10
Chemical Process	Valve (Control)	Motor-Operated	Leakage (external)	CMV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Control)	Motor-Operated	Rupture (external)	CMV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Control)	Air-Operated	Fails open	CAV-FO-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Air-Operated	Fails closed	CAV-FC-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Air-Operated	Fails to respond	CAV-NR-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Air-Operated	Plugs	CAV-PG-C	5.00E-08	H	10
Chemical Process	Valve (Control)	Air-Operated	Leakage (external)	CAV-LE-C	5.00E-07	H	10
Chemical Process	Valve (Control)	Air-Operated	Rupture (external)	CAV-RE-C	3.00E-08	H	30
Chemical Process	Valve (Control)	Solenoid-Operated	Fails open	CSV-FO-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Solenoid-Operated	Fails closed	CSV-FC-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Solenoid-Operated	Fails to respond	CSV-NR-C	3.00E-06	H	10
Chemical Process	Valve (Control)	Solenoid-Operated	Plugs	CSV-PG-C	5.00E-08	H	10
Chemical Process	Valve (Control)	Solenoid-Operated	Leakage (external)	CSV-LE-C	5.00E-07	H	10

Table B-2	Chemical Process System Recommend Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate Distribution (lognormal)		
					Mean	Unit	Error Factor
Chemical Process	Valve (Control)	Solenoid-Operated	Rupture (external)	CSV-RE-C	3.00E-08	H	30
Chemical Process	Pump	Motor-Driven	Fails to start	MDP-FS-C	1.00E-02	D	10
Chemical Process	Pump	Motor-Driven	Fails to run	MDP-FR-C	1.00E-04	H	10
Chemical Process	Pump	Motor-Driven	Overspeed	MDP-OS-C	3.00E-05	H	10
Chemical Process	Pump	Motor-Driven	Fails to stop	MDP-NS-C	1.00E-02	D	10
Chemical Process	Pump	Motor-Driven	Leakage (external)	MDP-LE-C	1.00E-06	H	10
Chemical Process	Pump	Motor-Driven	Rupture (external)	MDP-RE-C	5.00E-08	H	30
Chemical Process	Pump	Turbine-Driven	Fails to start	TDP-FS-C	3.00E-02	D	10
Chemical Process	Pump	Turbine-Driven	Fails to run	TDP-FR-C	1.00E-04	H	30
Chemical Process	Pump	Turbine-Driven	Overspeed	TDP-OS-C	3.00E-05	H	10
Chemical Process	Pump	Turbine-Driven	Fails to stop	TDP-NS-C	3.00E-02	D	10
Chemical Process	Pump	Turbine-Driven	Leakage (external)	TDP-LE-C	1.00E-06	H	10
Chemical Process	Pump	Turbine-Driven	Rupture (external)	TDP-RE-C	5.00E-08	H	30
Chemical Process	Pump	Diesel-Driven	Fails to start	DDP-FS-C	1.00E-02	D	10
Chemical Process	Pump	Diesel-Driven	Fails to run	DDP-FR-C	5.00E-03	H	10
Chemical Process	Pump	Diesel-Driven	Overspeed	DDP-OS-C	1.00E-03	H	10
Chemical Process	Pump	Diesel-Driven	Fails to Stop	DDP-NS-C	1.00E-02	D	10
Chemical Process	Pump	Diesel-Driven	Leakage (external)	DDP-LE-C	1.00E-06	H	10
Chemical Process	Pump	Diesel-Driven	Rupture (external)	DDP-RE-C	5.00E-08	H	30
Chemical Process	Piping/Hose/Jumper	Piping	Leakage (external)	PIP-LE-C	3.00E-09	H-FT	10
Chemical Process	Piping/Hose/Jumper	Piping	Rupture (external)	PIP-RE-C	1.00E-10	H-FT	30
Chemical Process	Piping/Hose/Jumper	Piping	Plugs	PIP-PG-C	1.00E-10	H-FT	30
Chemical Process	Piping/Hose/Jumper	Hose	Leakage (external)	HOS-LE-C	1.00E-09	H-FT	10
Chemical Process	Piping/Hose/Jumper	Hose	Rupture (external)	HOS-RE-C	1.00E-08	H-FT	10
Chemical Process	Piping/Hose/Jumper	Hose	Plugs	HOS-PG-C	1.00E-08	H-FT	10
Chemical Process	Piping/Hose/Jumper	Jumper	Leakage (external)	JPR-LE-C	1.00E-06	H	10
Chemical Process	Piping/Hose/Jumper	Jumper	Rupture (external)	JPR-RE-C	1.00E-08	H	30
Chemical Process	Piping/Hose/Jumper	Jumper	Plugs	JPR-PG-C	5.00E-08	H	10
Chemical Process	Vessel	Tank (unpressurized)	Leakage (external)	TKU-LE-C	1.00E-07	H	10
Chemical Process	Vessel	Tank (unpressurized)	Rupture (external)	TKU-RE-C	5.00E-09	H	30
Chemical Process	Vessel	Tank (pressurized)	Leakage (external)	TKP-LE-C	1.00E-07	H	10
Chemical Process	Vessel	Tank (pressurized)	Rupture (external)	TKP-RE-C	5.00E-09	H	30
Chemical Process	Vessel	Flange/Gasket	Leakage (external)	FLG-LE-C	1.00E-07	H	10
Chemical Process	Vessel	Flange/Gasket	Rupture (external)	FLG-RE-C	1.00E-09	H	10
Chemical Process	Heat Exchanger	Shell/Tube	Fouling (tubes)	HTX-FL-C	1.00E-06	H	10
Chemical Process	Heat Exchanger	Shell/Tube	Plugs (tubes)	HTX-PG-C	3.00E-07	H	10

Table B-2	Chemical Process System Recommend Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate Distribution (lognormal)		
					Mean	Unit	Error Factor
Chemical Process	Heat Exchanger	Shell/Tube	Leakage (tubes)	HTX-LI-C	1.00E-06	H	10
Chemical Process	Heat Exchanger	Shell/Tube	Rupture (tubes)	HTX-RI-C	5.00E-08	H	30
Chemical Process	Heat Exchanger	Shell/Tube	Leakage (shell)	HTX-LE-C	1.00E-07	H	10
Chemical Process	Heat Exchanger	Shell/Tube	Rupture (shell)	HTX-RE-C	5.00E-09	H	30
Chemical Process	Heat Exchanger	Heater (Electrical)	Fails to heat	HTE-FH-C	1.00E-05	H	10
Chemical Process	Heat Exchanger	Heater (Electrical)	Overheats	HTE-OH-C	3.00E-06	H	10
Chemical Process	Heat Exchanger	Heater (Electrical)	Leakage (external)	HTE-LE-C	1.00E-06	H	10
Chemical Process	Heat Exchanger	Heater (Electrical)	Rupture (external)	HTE-RE-C	5.00E-08	H	30
Chemical Process	Heat Exchanger	Strainer/ Filter	Plugs	FLT-PG-C	3.00E-06	H	10
Chemical Process	Heat Exchanger	Strainer/ Filter	Leakage (internal)	FLT-LI-C	3.00E-06	H	10
Chemical Process	Heat Exchanger	Strainer/ Filter	Rupture (internal)	FLT-RI-C	5.00E-07	H	10
Chemical Process	Heat Exchanger	Orifice	Plugs	ORF-PG-C	1.00E-06	H	10
Chemical Process	Miscellaneous	Mixer/Blender	Failure	MIX-FA-C	5.00E-06	H	10
Chemical Process	Miscellaneous	Agitator	Failure	AGI-FA-C	5.00E-06	H	10
Chemical Process	Miscellaneous	Centrifuge	Failure	CTF-FA-C	5.00E-06	H	10

Table B-3	Compressed Gas System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Compressed Gas	Valve (Standby or Safety)	Manual	Fails to open	XVM-CC-G	1.0E-03	D	10
Compressed Gas	Valve (Standby or Safety)	Manual	Fails to close	XVM-OO-G	1.0E-03	D	10
Compressed Gas	Valve (Standby or Safety)	Manual	Plugs	XVM-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Manual	Leakage (internal)	XVM-LI-G	1.0E-05	H	10
Compressed Gas	Valve (Standby or Safety)	Manual	Rupture (internal)	XVM-RI-G	5.0E-07	H	30
Compressed Gas	Valve (Standby or Safety)	Manual	Leakage (external)	XVM-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Manual	Rupture (external)	XVM-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Standby or Safety)	Check	Fails to open	CKV-CC-G	1.0E-04	D	10
Compressed Gas	Valve (Standby or Safety)	Check	Fails to close	CKV-OO-G	3.0E-03	D	10
Compressed Gas	Valve (Standby or Safety)	Check	Plugs	CKV-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Check	Leakage (internal)	CKV-LI-G	1.0E-05	H	10
Compressed Gas	Valve (Standby or Safety)	Check	Rupture (internal)	CKV-RI-G	5.0E-07	H	30
Compressed Gas	Valve (Standby or Safety)	Check	Leakage (external)	CKV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Check	Rupture (external)	CKV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Fails to open	MOV-CC-G	1.0E-02	D	10
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Fails to close	MOV-OO-G	1.0E-02	D	10
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Spurious operation	MOV-CO-G or MOV-OC-G	3.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Plugs	MOV-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Leakage (internal)	MOV-LI-G	1.0E-05	H	10
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Rupture (internal)	MOV-RI-G	5.0E-07	H	30
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Leakage (external)	MOV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Motor-Operated	Rupture (external)	MOV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Fails to open	AOV-CC-G	3.0E-03	D	30
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Fails to close	AOV-OO-G	3.0E-03	D	30
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Spurious operation	AOV-CO-G or AOV-OC-G	1.0E-06	H	10
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Plugs	AOV-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Leakage (internal)	AOV-LI-G	1.0E-05	H	10
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Rupture (internal)	AOV-RI-G	5.0E-07	H	30
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Leakage (external)	AOV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Air-Operated	Rupture (external)	AOV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Fails to open	SOV-CC-G	3.0E-03	D	10
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Fails to close	SOV-OO-G	3.0E-03	D	10
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Spurious operation	SOV-CO-G or SOV-OC-G	5.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Plugs	SOV-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Leakage (internal)	SOV-LI-G	1.0E-05	H	10
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Rupture (internal)	SOV-RI-G	5.0E-07	H	30
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Leakage (external)	SOV-LE-G	1.0E-07	H	10

Table B-3	Compressed Gas System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Compressed Gas	Valve (Standby or Safety)	Solenoid-Operated	Rupture (external)	SOV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Standby or Safety)	Safety/Relief	Fails to open	SRV-CC-G	1.0E-02	D	10
Compressed Gas	Valve (Standby or Safety)	Safety/Relief	Fails to reclose	SRV-OO-G	1.0E-02	D	10
Compressed Gas	Valve (Standby or Safety)	Safety/Relief	Leakage (internal)	SRV-LI-G	1.0E-05	H	10
Compressed Gas	Valve (Standby or Safety)	Safety/Relief	Rupture (internal)	SRV-RI-G	5.0E-07	H	30
Compressed Gas	Valve (Standby or Safety)	Safety/Relief	Leakage (external)	SRV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Safety/Relief	Rupture (external)	SRV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Standby or Safety)	Vacuum-Breaker	Fails to open	VBV-CC-G	3.0E-02	D	10
Compressed Gas	Valve (Standby or Safety)	Vacuum-Breaker	Fails to reclose	VBV-OO-G	3.0E-02	D	10
Compressed Gas	Valve (Standby or Safety)	Vacuum-Breaker	Leakage (internal)	VBV-LI-G	1.0E-05	H	10
Compressed Gas	Valve (Standby or Safety)	Vacuum-Breaker	Rupture (internal)	VBV-RI-G	5.0E-07	H	30
Compressed Gas	Valve (Standby or Safety)	Vacuum-Breaker	Leakage (external)	VBV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Standby or Safety)	Vacuum-Breaker	Rupture (external)	VBV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Control)	Motor-Operated	Fails open	CMV-FO-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Motor-Operated	Fails closed	CMV-FC-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Motor-Operated	Fails to respond	CMV-NR-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Motor-Operated	Plugs	CMV-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Control)	Motor-Operated	Leakage (external)	CMV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Control)	Motor-Operated	Rupture (external)	CMV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Control)	Air-Operated	Fails open	CAV-FO-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Air-Operated	Fails closed	CAV-FC-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Air-Operated	Fails to respond	CAV-NR-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Air-Operated	Plugs	CAV-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Control)	Air-Operated	Leakage (external)	CAV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Control)	Air-Operated	Rupture (external)	CAV-RE-G	5.0E-09	H	30
Compressed Gas	Valve (Control)	Solenoid-Operated	Fails open	CSV-FO-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Solenoid-Operated	Fails closed	CSV-FC-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Solenoid-Operated	Fails to respond	CSV-NR-G	3.0E-06	H	10
Compressed Gas	Valve (Control)	Solenoid-Operated	Plugs	CSV-PG-G	5.0E-07	H	10
Compressed Gas	Valve (Control)	Solenoid-Operated	Leakage (external)	CSV-LE-G	1.0E-07	H	10
Compressed Gas	Valve (Control)	Solenoid-Operated	Rupture (external)	CSV-RE-G	5.0E-09	H	30
Compressed Gas	Compressor	Motor-Driven	Fails to start	MDC-FS-G	5.0E-03	D	5
Compressed Gas	Compressor	Motor-Driven	Fails to run	MDC-FR-G	5.0E-05	H	3
Compressed Gas	Compressor	Motor-Driven	Overspeed	MDC-OS-G	1.0E-05	H	5
Compressed Gas	Compressor	Motor-Driven	Fails to stop	MDC-NS-G	5.0E-03	D	5
Compressed Gas	Compressor	Motor-Driven	Leakage (external)	MDC-LE-G	3.0E-07	H	10
Compressed Gas	Compressor	Motor-Driven	Rupture (external)	MDC-RE-G	1.0E-08	H	30

Table B-3	Compressed Gas System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Compressed Gas	Piping/Hose/Jumper/Tube	Piping	Leakage (external)	PIP-LE-G	3.0E-08	H-FT	10
Compressed Gas	Piping/Hose/Jumper/Tube	Piping	Rupture (external)	PIP-RE-G	1.0E-09	H-FT	30
Compressed Gas	Piping/Hose/Jumper/Tube	Piping	Plugs	PIP-PG-G	1.0E-09	H-FT	30
Compressed Gas	Piping/Hose/Jumper/Tube	Hose	Leakage (external)	HOS-LE-G	1.0E-08	H-FT	10
Compressed Gas	Piping/Hose/Jumper/Tube	Hose	Rupture (external)	HOS-RE-G	1.0E-07	H-FT	10
Compressed Gas	Piping/Hose/Jumper/Tube	Hose	Plugs	HOS-PG-G	1.0E-07	H-FT	10
Compressed Gas	Piping/Hose/Jumper/Tube	Jumper	Leakage (external)	JPR-LE-G	1.0E-05	H	10
Compressed Gas	Piping/Hose/Jumper/Tube	Jumper	Rupture (external)	JPR-RE-G	1.0E-07	H	30
Compressed Gas	Piping/Hose/Jumper/Tube	Jumper	Plugs	JPR-PG-G	1.0E-07	H	30
Compressed Gas	Piping/Hose/Jumper/Tube	Tube	Leakage (external)	TUB-LE-G	3.0E-07	H-FT	10
Compressed Gas	Piping/Hose/Jumper/Tube	Tube	Rupture (external)	TUB-RE-G	1.0E-08	H-FT	30
Compressed Gas	Piping/Hose/Jumper/Tube	Tube	Plugs	TUB-PG-G	1.0E-08	H-FT	30
Compressed Gas	Vessel	Tank (Pressurized)	Leakage (external)	TKP-LE-G	1.0E-07	H	10
Compressed Gas	Vessel	Tank (Pressurized)	Rupture (external)	TKP-RE-G	5.0E-09	H	30
Compressed Gas	Vessel	Cylinder (Pressurized)	Leakage (external)	CYL-LE-G	1.0E-07	H	10
Compressed Gas	Vessel	Cylinder (Pressurized)	Rupture (external)	CYL-RE-G	5.0E-09	H	30
Compressed Gas	Vessel	Flange/Gasket	Leakage (external)	FLG-LE-G	1.0E-07	H	10
Compressed Gas	Vessel	Flange/Gasket	Rupture (external)	FLG-RE-G	1.0E-09	H	10
Compressed Gas	Heat Exchanger	Shell/Tube	Fouling (tubes)	HTX-FL-G	1.0E-05	H	10
Compressed Gas	Heat Exchanger	Shell/Tube	Plugs (tubes)	HTX-PG-G	3.0E-06	H	10
Compressed Gas	Heat Exchanger	Shell/Tube	Leakage (tubes)	HTX-LI-G	1.0E-05	H	10
Compressed Gas	Heat Exchanger	Shell/Tube	Rupture (tubes)	HTX-RI-G	5.0E-07	H	30
Compressed Gas	Heat Exchanger	Shell/Tube	Leakage (shell)	HTX-LE-G	1.0E-06	H	10
Compressed Gas	Heat Exchanger	Shell/Tube	Rupture (shell)	HTX-RE-G	5.0E-08	H	30
Compressed Gas	Heat Exchanger	Heater (Electrical)	Fails to heat	HTE-FH-G	1.0E-06	H	10
Compressed Gas	Heat Exchanger	Heater (Electrical)	Overheats	HTE-OH-G	3.0E-07	H	10
Compressed Gas	Heat Exchanger	Heater (Electrical)	Leakage (external)	HTE-LE-G	1.0E-06	H	10
Compressed Gas	Heat Exchanger	Heater (Electrical)	Rupture (external)	HTE-RE-G	5.0E-08	H	30
Compressed Gas	Heat Exchanger	Vaporizer	Failure	VAP-FA-G	1.0E-04	H	10
Compressed Gas	Heat Exchanger	Air Dryer	Failure	ADR-FA-G	5.0E-06	H	10
Compressed Gas	Heat Exchanger	Filter	Plugs	FLT-PG-G	3 .00E-6	H	10
Compressed Gas	Heat Exchanger	Filter	Leakage (internal)	FLT-LI-G	3.0E-06	H	10
Compressed Gas	Heat Exchanger	Filter	Rupture (internal)	FLT-RI-G	5.0E-07	H	10
Compressed Gas	Heat Exchanger	Orifice	Plugs	ORF-PG-G	1.0E-06	H	10

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Table B-4	HVAC/Exhaust System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
HVAC/Exhaust	Damper (Standby or Safety)	Manual	Fails to open	XDM-CC-H	3.0E-03	D	10
HVAC/Exhaust	Damper (Standby or Safety)	Manual	Fails to close	XDM-OO-H	3.0E-03	D	10
HVAC/Exhaust	Damper (Standby or Safety)	Manual	Plugs	XDM-PG-H	5.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Manual	Leakage (internal)	XDM-LI-H	1.0E-05	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Manual	Rupture (internal)	XDM-RI-H	5.0E-07	H	30
HVAC/Exhaust	Damper (Standby or Safety)	Manual	Leakage (external)	XDM-LE-H	1.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Manual	Rupture (external)	XDM-RE-H	5.0E-09	H	30
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Fails to open	MOD-CC-H	3.0E-02	D	10
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Fails to close	MOD-OO-H	3.0E-02	D	10
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Spurious operation	MOD-CO-H or MOD-OC-H	3.0E-06	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Plugs	MOD-PG-H	5.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Leakage (internal)	MOD-LI-H	1.0E-05	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Rupture (internal)	MOD-RI-H	5.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Leakage (external)	MOD-LE-H	1.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Motor-Operated	Rupture (external)	MOD-RE-H	5.0E-09	H	30
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Fails to open	AOD-CC-H	1.0E-02	D	30
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Fails to close	AOD-OO-H	1.0E-02	D	30
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Spurious operation	AOD-CO-H or AOD-OC-H	1.0E-05	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Plugs	AOD-PG-H	5.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Leakage (internal)	AOD-LI-H	1.0E-05	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Rupture (internal)	AOD-RI-H	5.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Leakage (external)	AOD-LE-H	1.0E-07	H	10
HVAC/Exhaust	Damper (Standby or Safety)	Air-Operated	Rupture (external)	AOD-RE-H	5.0E-09	H	30
HVAC/Exhaust	Damper (Control)	Motor-Operated	Fails open	CMD-FO-H	3.0E-06	H	10
HVAC/Exhaust	Damper (Control)	Motor-Operated	Fails closed	CMD-FC-H	3.0E-06	H	10
HVAC/Exhaust	Damper (Control)	Motor-Operated	Fails to respond	CMD-NR-H	3.0E-06	H	10
HVAC/Exhaust	Damper (Control)	Motor-Operated	Plugs	CMD-PG-H	5.0E-07	H	10
HVAC/Exhaust	Damper (Control)	Motor-Operated	Leakage (external)	CMD-LE-H	1.0E-07	H	10
HVAC/Exhaust	Damper (Control)	Motor-Operated	Rupture (external)	CMD-RE-H	5.0E-09	H	30
HVAC/Exhaust	Damper (Control)	Air-Operated	Fails open	CAD-FO-H	3.0E-06	H	10
HVAC/Exhaust	Damper (Control)	Air-Operated	Fails closed	CAD-FC-H	3.0E-06	H	10
HVAC/Exhaust	Damper (Control)	Air-Operated	Fails to respond	CAD-NR-H	3.0E-06	H	10
HVAC/Exhaust	Damper (Control)	Air-Operated	Plugs	CAD-PG-H	5.0E-07	H	10
HVAC/Exhaust	Damper (Control)	Air-Operated	Leakage (external)	CAD-LE-H	1.0E-07	H	10
HVAC/Exhaust	Damper (Control)	Air-Operated	Rupture (external)	CAD-RE-H	5.0E-09	H	30
HVAC/Exhaust	Fan/Blower	Motor-Driven	Fails to start	MDF-FS-H	5.0E-03	D	5
HVAC/Exhaust	Fan/Blower	Motor-Driven	Fails to run	MDF-FR-H	3.0E-05	H	3
HVAC/Exhaust	Fan/Blower	Motor-Driven	Overspeed	MDF-OS-H	5.0E-06	H	10

Table B-4	HVAC/Exhaust System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
HVAC/Exhaust	Fan/Blower	Motor-Driven	Fails to stop	MDF-NS-H	5.0E-03	D	10
HVAC/Exhaust	Fan/Blower	Motor-Driven	Leakage (external)	MDF-LE-H	3.0E-07	H	10
HVAC/Exhaust	Fan/Blower	Motor-Driven	Rupture (external)	MDF-RE-H	1.0E-08	H	30
HVAC/Exhaust	Fan/Blower	Diesel-Driven	Fails to start	DDF-FS-H	1.0E-02	D	10
HVAC/Exhaust	Fan/Blower	Diesel-Driven	Fails to run	DDF-FR-H	5.0E-03	H	10
HVAC/Exhaust	Fan/Blower	Diesel-Driven	Overspeed	DDF-OS-H	1.0E-03	H	10
HVAC/Exhaust	Fan/Blower	Diesel-Driven	Fails to stop	DDF-NS-H	1.0E-02	D	10
HVAC/Exhaust	Fan/Blower	Diesel-Driven	Leakage (external)	DDF-LE-H	3.0E-07	H	10
HVAC/Exhaust	Fan/Blower	Diesel-Driven	Rupture (external)	DDF-RE-H	1.0E-08	H	10
HVAC/Exhaust	Fan/Blower	Ducting	Leakage (external)	DCT-LE-H	3.0E-07	H-FT	10
HVAC/Exhaust	Fan/Blower	Ducting	Rupture (external)	DCT-RE-H	1.0E-08	H-FT	30
HVAC/Exhaust	Fan/Blower	Ducting	Plugs	DCT-PG-H	1.0E-08	H-FT	30
HVAC/Exhaust	Heat Exchanger	Air Conditioning Unit/Chiller	Fails to start	ACU-FS-H	1.0E-02	D	10
HVAC/Exhaust	Heat Exchanger	Air Conditioning Unit/Chiller	Fails to run	ACU-FR-H	3.0E-05	H	10
HVAC/Exhaust	Heat Exchanger	Fan Cooler Unit	Fails to start	FCU-FS-H	1.0E-02	D	5
HVAC/Exhaust	Heat Exchanger	Fan Cooler Unit	Fails to run	FCU-FR-H	1.0E-05	H	3
HVAC/Exhaust	Heat Exchanger	Heater (Electrical)	Fails to heat	HTE-FH-H	1.0E-06	H	3
HVAC/Exhaust	Heat Exchanger	Heater (Electrical)	Overheats	HTE-OH-H	3.0E-07	H	10
HVAC/Exhaust	Heat Exchanger	Heater (Gas)	Fails to heat	HTG-FH-H	1.0E-03	H	10
HVAC/Exhaust	Heat Exchanger	Heater (Gas)	Overheats	HTG-OH-H	3.0E-04	H	10
HVAC/Exhaust	Filter	Normal	Plugs	FLT-PG-H	3.0E-06	H	10
HVAC/Exhaust	Filter	Normal	Leakage (internal)	FLT-LI-H	3.0E-06	H	10
HVAC/Exhaust	Filter	Normal	Rupture (internal)	FLT-RI-H	5.0E-07	H	10
HVAC/Exhaust	Filter	Low-Efficiency	Plugs	FLL-PG-H	3.0E-06	H	10
HVAC/Exhaust	Filter	Low-Efficiency	Leakage (internal)	FLL-LI-H	3.0E-06	H	10
HVAC/Exhaust	Filter	Low-Efficiency	Rupture (internal)	FLL-RI-H	5.0E-07	H	10
HVAC/Exhaust	Filter	HEPA	Plugs	HPA-PG-H	3.0E-06	H	10
HVAC/Exhaust	Filter	HEPA	Leakage (internal)	HPA-LI-H	3.0E-06	H	10
HVAC/Exhaust	Filter	HEPA	Rupture (internal)	HPA-RI-H	5.0E-07	H	10
HVAC/Exhaust	Filter	Sand	Plugs	FLS-PG-H	3.0E-06	H	10
HVAC/Exhaust	Filter	Sand	Leakage (internal)	FLS-LI-H	3.0E-06	H	10
HVAC/Exhaust	Filter	Sand	Rupture (internal)	FLS-RI-H	5.0E-07	H	10
HVAC/Exhaust	Filter	Baghouse	Plugs	BAG-PG-H	3.0E-05	H	10
HVAC/Exhaust	Filter	Baghouse	Leakage (internal)	BAG-LI-H	3.0E-05	H	10
HVAC/Exhaust	Filter	Baghouse	Rupture (internal)	BAG-RI-H	5.0E-06	H	10
HVAC/Exhaust	Miscellaneous	Mist Eliminator	Failure	MTE-FA-H	1.0E-04	H	10
HVAC/Exhaust	Miscellaneous	Scrubber	Failure	SBR-FA-H	1.0E-06	H	10
HVAC/Exhaust	Miscellaneous	Precipitator	Failure	PCP-FA-H	5.0E-05	H	10

Table B-5	Electrical Distribution System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Electric Power	Generator	Diesel-Driven	Fails to start	DDG-FS-E	1.00E-02	D	3
Electric Power	Generator	Diesel-Driven	Fails to run	DDG-FR-E	5.00E-03	H	3
Electric Power	Generator	Motor-Driven (ac to dc)	Fails to start	MDG-FS-E	1.00E-05	H	10
Electric Power	Generator	Motor-Driven (ac to dc)	Fails to run	MDG-FR-E	3.00E-05	H	10
Electric Power	Generator	Gas-Turbine-Driven	Fails to start	GTG-FS-E	3.00E-02	D	10
Electric Power	Generator	Gas-Turbine-Driven	Fails to run	GTG-FR-E	3.00E-04	H	10
Electric Power	Generator	Hydro-Turbine-Driven	Fails to start	HDG-FS-E	3.00E-03	D	10
Electric Power	Generator	Hydro-Turbine-Driven	Fails to run	HDG-FR-E	3.00E-04	H	10
Electric Power	Generator	Battery	Failure	BAT-FA-E	1.00E-05	H	3
Electric Power	Charger	Rectifier	Failure	RCT-FA-E	1.00E-05	H	3
Electric Power	Bus	Metal-Enclosed	Failure	BUM-FA-E	1.00E-07	H	5
Electric Power	Bus	Bare	Failure	BUB-FA-E	1.00E-06	H	10
Electric Power	Cable/Joint/Termination/Jumper	Cable (Copper, 1000ft)	Failure	CBL-FA-E	3.00E-06	H	3
Electric Power	Cable/Joint/Termination/Jumper	Joint (Copper)	Failure	JNT-FA-E	3.00E-06	H	30
Electric Power	Cable/Joint/Termination/Jumper	Termination (Copper)	Failure	TMN-FA-E	3.00E-07	H	10
Electric Power	Cable/Joint/Termination/Jumper	Jumper (Power)	Failure	JPR-FA-E	5.00E-06	H	10
Electric Power	Circuit Breaker	General	Fails to open	CBR CC-E or	5.00E-04	D	5
Electric Power	Circuit Breaker	General	Fails to close	CBR-OO-E or CBR-NR-E	5.00E-04	D	5
Electric Power	Circuit Breaker	General	Spurious operation	CBR-CO-E or	3.00E-07	H	10
Electric Power	Circuit Breaker	General	Spurious operation	CBR-OC-E or CBR-SO-E	3.00E-07	H	10
Electric Power	Circuit Breaker	Reactor Trip	Fails to open	RTB-CC-E	5.00E-03	D	5
Electric Power	Circuit Breaker	Reactor Trip	Spurious operation	RTB-CO-E	3.00E-06	H	10
Electric Power	Relay	Protective	Fails to open	RLP-CC-E	1.00E-03	D	10
Electric Power	Relay	Protective	Fails to close	RLP-OO-E or RLP-NR-E	1.00E-03	D	10
Electric Power	Relay	Protective	Spurious operation	RLP-CO-E or	1.00E-07	H	10
Electric Power	Relay	Protective	Spurious operation	RLP-OC-E or RLP-SO-E	1.00E-07	H	10
Electric Power	Relay	Control	Fails to open	RLC-CC-E	1.00E-04	D	10
Electric Power	Relay	Control	Fails to close	RLC-OO-E or RLC-NR-E	1.00E-04	D	10
Electric Power	Relay	Control	Spurious operation	RLC-CO-E or	3.00E-07	H	30
Electric Power	Relay	Control	Spurious operation	RLC-OC-E or RLC-SO-E	3.00E-07	H	30
Electric Power	Relay	Bistable	Fails to open	BIS-CC-E	1.00E-05	D	10
Electric Power	Relay	Bistable	Fails to close	BIS-OO-E or BIS-NR-E	1.00E-05	D	10
Electric Power	Relay	Bistable	Spurious operation	BIS-CO-E or	3.00E-07	H	10
Electric Power	Relay	Bistable	Spurious operation	BIS-OC-E or BIS-SO-E	3.00E-07	H	10
Electric Power	Switch	Push-Button (Manual)	Fails to open	XSP-CC-E	1.00E-06	H	10
Electric Power	Switch	Push-Button (Manual)	Fails to close	XSP-OO-E or XSP-NR-E	1.00E-06	H	10
Electric Power	Switch	Push-Button (Manual)	Spurious operation	XSP-CO-E or	1.00E-06	H	10

Table B-5	Electrical Distribution System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate		
					Mean	Unit	Error Factor
Electric Power	Switch	Push-Button (Manual)	Spurious operation	XSP-OC-E or XSP-SO-E	1.00E-06	H	10
Electric Power	Switch	Rotary (Manual)	Fails to open	XSR-CC-E or	5.00E-08	H	10
Electric Power	Switch	Rotary (Manual)	Fails to close	XSR-OO-E or XSR-NR-E	5.00E-08	H	10
Electric Power	Switch	Rotary (Manual)	Spurious operation	XSR-CO-E or	5.00E-07	H	10
Electric Power	Switch	Rotary (Manual)	Spurious operation	XSR-OC-E or XSR-SO-E	5.00E-07	H	10
Electric Power	Switch	Key-Operated (Manual)	Fails to open	XSK-CC-E or	3.00E-07	H	10
Electric Power	Switch	Key-Operated (Manual)	Fails to close	XSK-OO-E or XSK-NR-E	3.00E-07	H	10
Electric Power	Switch	Key-Operated (Manual)	Spurious operation	XSK-CO-E or XSK-OC-E	1.00E-06	H	10
Electric Power	Switch	Key-Operated (Manual)	Spurious operation	XSK-SO-E	1.00E-06	H	10
Electric Power	Switch	Automatic-Transfer	Fails to open	ATS-CC-E or	1.00E-06	H	10
Electric Power	Switch	Automatic-Transfer	Fails to close	ATS-OO-E or ATS-NR-E	1.00E-06	H	10
Electric Power	Switch	Automatic-Transfer	Spurious operation	ATS-CO-E or	1.00E-06	H	10
Electric Power	Switch	Automatic-Transfer+C20	Spurious operation	ATS-OC-E or ATS-SO-E	1.00E-06	H	10
Electric Power	Switch	Limit	Fails to open	LMS-CC-E or	1.00E-06	H	10
Electric Power	Switch	Limit	Fails to close	LMS-OO-E or LMS-NR-E	1.00E-06	H	10
Electric Power	Switch	Limit	Spurious operation	LMS-CO-E or	1.00E-06	H	5
Electric Power	Switch	Limit	Spurious operation	LMS-OC-E or LMS-SO-E	1.00E-06	H	5
Electric Power	Switch	Fuse	Fail to open	FUS-CC-E	1.00E-07	H	10
Electric Power	Switch	Fuse	Premature opening	FUS-SO-E	1.00E-08	H	10
Electric Power	Switch	Inverter	Failure	INV-FA-E	1.00E-05	H	3
Electric Power	Motor	AC	Fails to start	MRA-FS-E	3.00E-04	D	3
Electric Power	Motor	AC	Fails to run	MRA-FR-E	5.00E-06	H	3
Electric Power	Motor	DC	Fails to start	MRD-FS-E	3.00E-04	D	3
Electric Power	Motor	DC	Fails to run	MRD-FR-E	1.00E-05	H	3
Electric Power	Motor	Synchro	Failure	SYN-FA-E	1.00E-05	H	10
Electric Power	Transformer	Power	Failure	TFP-FA-E	1.00E-06	H	10
Electric Power	Transformer	Instrumentation/Control	Failure	TFI-FA-E	1.00E-06	H	10

Table B-6	Instrumentation And Control System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate Distribution (lognormal)		
					Mean	Unit	Error Factor
Instrumentation and Control	Alarm/Annunciator		Fails to alarm	ALR-NR-I	3.00E-05	H	10
Instrumentation and Control	Alarm/Annunciator		Spurious operation	ALR-SO-I	5.00E-06	H	10
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Temperature	Failure	TST-FA-I	1.00E-06	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Pressure	Failure	PST-FA-I	1.00E-06	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Differential Pressure	Failure	DPS-FA-I	3.00E-06	H	10
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Flow	Failure	FST-FA-I	3.00E-06	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Level	Failure	LST-FA-I	5.00E-07	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Humidity	Failure	UST-FA-I	1.00E-05	H	10
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	pH	Failure	HST-FA-I	5.00E-07	H	5
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Oxygen Concentration	Failure	OXC-FA-I	1.00E-05	H	10
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	CO2 Concentration	Failure	COC-FA-I	1.00E-04	H	10
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Hydrogen Concentration	Failure	HYC-FA-I	1.00E-05	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Nitrogen Concentration	Failure	NIC-FA-I	1.00E-05	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Hydrocarbon Concentration	Failure	HCC-FA-I	1.00E-05	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Helium Concentration	Failure	HEC-FA-I	1.00E-05	H	3
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Speed	Failure	SST-FA-I	1.00E-06	H	10
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Seismic	Failure	SET-FA-I	1.00E-06	H	5
Instrumentation and Control	Sensor/Transmitter/Transducer/Process Switch	Radiation	Failure	RST-FA-I	5.00E-06	H	5

Table B-6	Instrumentation And Control System Recommended Generic Failure Rates						
System	Component	Sub-Component	Failure Mode Description	Failure Mode Identifier	Recommended Failure Rate Distribution (lognormal)		
					Mean	Unit	Error Factor
Instrumentation and Control	Indicator	N/A	Failure	IND-FA-I	1.00E-05	H	10
Instrumentation and Control	Amplifier	N/A	Failure	AMP-FA-I	5.00E-06	H	10
Instrumentation and Control	Modifier/Signal Conditioner	N/A	Failure	SCR-FA-I	3.00E-07	H	3
Instrumentation and Control	Logic Module	N/A	Failure	LOG-FA-I	3.00E-06	H	5
Instrumentation and Control	Recorder	N/A	Failure	REC-FA-I	3.00E-05	H	30
Instrumentation and Control	Sampler	N/A	Failure	SAM-FA-I	1.00E-05	H	10
Instrumentation and Control	Analyzer	N/A	Failure	ANA-FA-I	5.00E-06	H	10
Instrumentation and Control	Timer	N/A	Failure	TMR-FA-I	5.00E-06	H	10
Instrumentation and Control	Gas Chromatograph	N/A	Failure	GCR-FA-I	5.00E-05	H	10
Instrumentation and Control	Voltage Regulator	N/A	Failure	VRG-FA-I	3.00E-06	H	10
Instrumentation and Control	Transmitter	N/A	Failure	TRM-FA-I	3.00E-06	H	10
Instrumentation and Control	Transducer	N/A	Failure	TRD-FA-I	1.00E-06	H	10
Instrumentation and Control	Programmable Logic Controller	N/A	Failure	PLC-FA-I	3.00E-05	H	10

APPENDIX C

EVALUATION OF HANFORD SITE SPECIFIC DATA

Tables

C-1 Definition of Failure Effect Codes

C-2 Definition of RAM Applicability Codes

C-3 Sample Evaluations of ORPS Database for Applicability to WFDS Activities

C-4 Example of Information Available in JCS Database

C-5 Sample Evaluations of JCS Database for Applicability to WFDS Activities

C-6a Summary of Input for Bayesian Update of Waste Transfer Pump Hanford Specific Failure Rates

C-6b Results of Bayesian Update of Waste Transfer Pump Hanford Specific Failure Rates

C-6c Transfer History Supporting Waste Transfer Pump Site Specific Evidence for Bayesian Update

C-6d Available Waste Transfer Pump History

Appendix C

C.1. Criteria and Guidelines for ORPS and JCS Evaluations

C.1.1. Sources of RPP Specific Data

RPP specific data evaluated for use in the RAM analysis is primarily located in two databases. These are the Job Control System (JCS) and Occurrence Reporting and Processing System (ORPS) databases. The JCS contains maintenance records for the past eight years for both corrective maintenance and preventative maintenance and/or calibrations. The ORPS data contains events that are reportable under DOE Order 232.1A.

Other sources of RPP specific data include waste transfer history data and Operations Shift Manger Logbooks. Waste transfer data was retrieved from completed waste transfer procedures and manually entered into a Microsoft Excel spreadsheet table to develop the site-specific failure rate parameters for the waste transfer pumps.

C.1.2. Evaluation of Occurrence Reports and Maintenance Records

The JCS database is structured in Advanced Revelation format, but was available to PLG only in text form. To the maximum extent possible, the data was converted to Microsoft Access format for sorting and evaluation. However, evaluation of over 5,000 corrective maintenance work package data records showed that less than 3% were properly encoded with a specific component cross-reference. Therefore, these data records were not useful in calculating component failure rates and recovery times. Since the preliminary RAM analysis was performed as a screening analysis, it was deemed to be unnecessary to perform a more detailed review of the JCS data within the scope of this project.

ORPS data was also provided to the RAM analysis team in text format. Based on the limited number of fields in the database and the stricter guidelines for entering information, the data was easily converted to MS Access format. The ORPS reports were screened for those incidents that could potentially cause delays during a waste transfer operation. The information gained from the review was used to assist the team in validating the chosen failure rates for equipment and human error probabilities for human actions.

The criteria for reviewing the data is outlined below and example ORPS and JCS evaluations are contained in Tables C-2 and C-3, respectively. Results of the data evaluations are discussed in Section 3 of the main report.

Because the ORPS and JCS databases were not designed for automated generation of success and failure data, the following fields are used to evaluate reports from the ORPS and JCS.

Field Name	Definition
Failure Mode	Indicates the observed failure condition that must be corrected or recovered from in order to return the waste transfer activity to an operational condition. Although they are closely related and interdependent, the failure mode should not be confused with the failure cause.
Failure Effect	Categorizes the impact on waste transfer operations. Table C-1 summarizes the failure effect categories used for the preliminary RAM analysis.
Recovery Time	Time required to bring the process or activity back to an operating condition for waste transfer. Types of recovery activities include repair, replacement with like equipment, or realignment to an alternate system. In the case of replacement or realignment, additional action will be required to insure that spares or backup functions become available again.
Effect Rationale	Reasoning for assigning the failure effect based on discussion of impact in the report or evaluation of relation of the failure to the RAM model.
RAM Applicability	Assessment of the usefulness of the event for quantifying the failure mode. The purpose of this field is to enable the analyst to retain events that have occurred to equipment, or under circumstances, that are not directly related to waste transfer operations, but are evidence that could provide insights relative to waste transfers. Table C-2 summarizes the RAM applicability categories used for the preliminary RAM analysis.

Table C-1. Definition of Failure Effect Codes

Failure Effect	Definition	Examples
None	Not a failure associated with the waste transfer process. This event will not divert resources that would be used for process-related operations.	▪ Gasoline spills in parking lots ▪ Violation of an administrative requirement that is not associated with a transfer ▪ Contamination in general areas
Availability Impact	If the failure occurred during a transfer, it would create a delay. However, it was found before it caused a direct delay. The major impact would be a delay in starting an operation while the condition is being corrected.	▪ Failures observed during pre-operational testing ▪ Periodic reviews of equipment status ▪ Failures revealed by surveillance testing
Insignificant Impact	RPP can recover from the failure without delaying transfer activities, but the effort can require resources that would be used for process-related activities.	Failure of items not involved in waste transfer
Potential Delay	The failure occurred under circumstances that would cause a delay if a transfer operation were underway.	Failures revealed during operations

Table C-2. Definition of RAM Applicability Codes

Applicability	Definition	Examples
None	Not a failure associated with the waste transfer process. This event will not divert resources that would be used for process related operations.	▪ Unrelated monitoring equipment ▪ Unrelated surveillances/ housekeeping
Direct	**Equipment** – The failure occurred in equipment that is used in waste transfer operations. The item that failed performs similar functions and is required to operate under similar conditions to that anticipated for the WFDS. **Human Action** – The action is associated with RPP activities and would produce a condition that would stop transfer activities.	▪ Waste transfer valves, MOVs ▪ Leak Detectors ▪ Valve misalignments
Indirect	**Equipment** - A failure occurred on equipment that has similar functions, but operate under different conditions than those in waste transfer operations. **Human Action** – RPP personnel involved in a non-transfer related activity that is similar to those accomplished as part of the WFDS.	▪ Unrelated HVAC components ▪ Unrelated electrical equipment ▪ Equipment verifications

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

Sheet 1 of 28

ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-199 0-0384	**_20_dir_cause code**	1A	**_10a_discovery date**	12/25/90
Component_Type	CAM	**Failure Mode Code**	GCR-FA-I	**_07_sys/building**	242-S

_14_title of occurrence FAILURE OF P-AS-1 VACUUM PUMP AT 242-S FACILITY RESULTS IN LOSS OF AIRBORNE RADIATION MONITORING

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 12/25/90 at 1310 hours, an operator discovered thatthe room air radiation monitoring vacuum pump (P-AS-1)was not operating. The pump was restarted at that time. On12/25/90 at 1400 hours, the pump shut down again. Visualinspection of the vacuum pump indicated that the coolingwater seal had failed, allowing water to enter the airreceiver side of the pump which caused the pump to shutdown.

On 12/25/90, at 1310 hours, it was discovered that the P-AS-1 vacuum pump was not operating. The vacuum pump was immediately restarted and the shift manager was notified.The shift manager initiated a J-1 work request to performrepairs of the vacuum pump.On 12/25/90, at 1400 hours, the vacuum pump was found shutdown again. The condenser room area was placed "On Mask".HPT's were notified and requested to install portable airmonitoring sampler in the control room and AMU areas. On 12/25/90, at 1650 hours, the portable air samplermonitors were installed.On 12/25/90, at 2330 hours, the event was categorized andthe shift manager commenced notification.

Supporting Document WHC-SD-SQA-TA-20012, "TechnicalAssessment of Compliance with Workplace Air Sampling Requirements West Tank Farm Facilities," lists the 242-SEvaporator as being exempt from workplace air samplingbecause there is "no potential to exceed 10 percent DAC(Derived Air Content)." Therefore, Waste Treatment SystemsEngineering has initiated a work package to remove fromservice the sample pump and associated alarms.Distribute this report to Facility Managers for review todetermine if this event is applicable to their facility.Action: R. Flint, Tank Farms Occurrenc Reporting *26b#1 TARGETED ACTION COMPLETION DATE1992/12/04*26c#1 ACTUAL ACTION COMPLETION DATE 1992/09/30*26d#1 REVISED ACTION COMPLETION DATE

The cooling water seal for vacuum pump P-AS-1 failed,allowing water to enter the air receiver side of the pump.This caused it to shut down. The direct cause is adefective or failed part.The root cause of this event is the fact that vacuum pump P-AS-1 was not on a Preventive Maintenance (PM) schedule. Hadit been on a PM schedule, it is likely the appropriatepreventive maintenance could have been performed before theseals failed.

PLG EVALUATION

Failure_Effect	Potential Delay	Air radiation monitoring vacuum pump required replacement seals
RAM_Applicability	Direct	
Safety Related	Yes	Actual recovery time to install portable air montoring samplers
Intrusive	Yes	
Restoration_Time	3	
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

Sheet 2 of 28

ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-199 1-0085	**_20_dir_cause code**	1E	**_10a_discovery date**	1/28/91
Component_Type	PNL	**Failure Mode Code**	ALR-NR-I	**_07_sys/building**	241-AP Control Room

_14_title of occurrence Loss of Power to 241-AP Panel-4 Annunciators

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 1/29/91 at 1348 hours, the Computer AutomatedSurveillance System (CASS) received six alarms associatedwith Panel-4 in the 271-AP Control Room. The operator in271-AP was notified, and he indicated that no alarms hadbeen received in the facility. On 1/28/91 at 1920 hours,during a walk-through of the facility by the shift manager,he discovered that the Panel-4 annunciators had lost power.The following alarms were received by CASS:a. 241-AP Farm Alarm Panel 104 Power Offb. TK-104-AP Pressure Highc. TK-104-AP Pressure Lowd. TK-104-AP Liquid Level Highe. TK-104-AP Annulus Leak Detector-Leak Detectedf. TK-104-AP Annulus Vent Duct Radiation Flow Low

1) On 1/28/91 at 1348 hours, CASS received six alarms fromthe 241-AP-271 control room, panel 4 annunciator.2) On 1/28/91 at 1350 hours, the shift supervisordispatched an operator to verify the alarms which werereceived at CASS. No alarms on the annunciator in questionwere activated.3) On 1/28/91 at 1920 hours, the shift supervisordiscovered that panel 4 had lost power.4) On 1/28/91 at 1935 hours, the 104-AP Annulus CAM waverified as operational by the Health Physics Technician5) On 1/28/91 at 1937 hours, the 104-AP liquid level wasverified at 7.7 inches.6) On 1/28/91 at 1940 hours, the 271-AP Control room wasconstantly manned and the equipment associated with theeffected annunciators were periodically verified as operational.7) On 1/28/91 at 2000 hours, the Shift Manager commencednotifications to the On-Call Plant Manager, DOE-RL and theONC.8) On 1/28/91 at 2045 hours, the On-Call MaintenanceManager was contacted to have an electrician restore powerto Panel-4.9) On 1/28/91 at 2100 hours, a Priority-1 Work Package wasgenerated to troubleshoot and repair the system.10) On 1/28/91 at 2156 hours, power was restored to thePanel-4 Annunciators, and the 6 alarms associated with Tank 102-AP were reset and verified at CASS. Electricians hadfound a loose wire behind the annunciator panel.

Quality Control/Assurance personnel will be made aware ofthis incident and its association with inspection techniquesutilized. Action: J. A. Peltier*26b#1 TARGETED ACTION COMPLETION DATE1991/05/15*26c#1 ACTUAL ACTION COMPLETION DATE1991/04/15*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTION QA/QC personnel will be made aware of this incident and itsassociation with inspection techniques utilized.Action: E. L. Adamson *26b#2 TARGETED ACTION COMPLETION DATE1991/05/30*26c#2 ACTUAL ACTION COMPLETION DATE 1991/05/30*26d#2 REVISED ACTION COMPLETION DATE*26a#3 CORRECTIVE ACTIONThe Shift Manager will discuss the incident with ShiftSupervisors. Emphasis will be directed towardscommunications in an annunciator alarm response. Action: J. J. Badden*26b#3 TARGETED ACTION COMPLETION DATE1991/03/06*26c#3 ACTUAL ACTION COMPLETION DATE1991/03/06*26d#3 REVISED ACTION COMPLETION DATE*26a#4 CORRECTIVE ACTION Discuss event with craft personnel concerning improperinstallation and possible contribution to the event.Action: D. P. Kerwick *26b#4 TARGETED ACTION COMPLETION DATE1991/04/15*26c#4 ACTUAL ACTION COMPLETION DATE 1993/04/15*26d#4 REVISED ACTION COMPLETION DATE

An electrician had found a wire which had backed out of aone way terminal on the annunciator panel. It appears thewire had not been fully inserted into the receptacle and hadvibrated it's way out.

PLG EVALUATION

Failure_Effect	Potential Delay	The panel failure was caused by a disconnected wire. This could happen in panels associated with Phase 1 tanks.
RAM_Applicability	Direct	
Safety Related	Yes	Based on ORPS report to generate work package and make repairs.
Intrusive	No	
Restoration_Time	7	
Comments	None	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

Sheet 3 of 28

ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1991-1008	**_20_dir_cause code**	1A	**_10a_discovery date**	4/18/91
Component_Type		**Failure Mode Code**	Diesel spill	**_07_sys/building**	241-SY Tank Farm

_14_title of occurrence "DIESEL FUEL SPILL FROM THE EMERGENCY GENERATOR AT 241-SY TANK FARM"

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On April 18th, 1991 at 2000 hours, the shift manager and theshift supervisor found diesel fuel on the ground under the emergency generator while conducting a tour.

a. On 04/18/91 at 2000 hours, the shift manager and theshift supervisor observed discolored soil under theemergency generator fuel fill cap. It was assumed that fuelhad leaked out through the fill cap seal.b. On 04/18/91 at 2015 hours, the shift manager andsupervisor exited 241-SY Tank Farm and dispatched operatorsto clean up the area.c. On 04/18/91 at 2120 hours, notified On-Call manager toassist in categorizing the fuel spill.d. On 04/18/91 at 2125 hours, the On-Call manager and themanager of Environmental Safety designated the event as anunusual occurrence, category group 2.B.a, per MRP 5.14.e. On 04/18/91 at 2140 hours, notifications began to ONC,DOE and Waste Tank Safety Assurance.f. On 04/18/91 at 2200 hours, operators completed placingthe fuel soaked dirt in a plastic bag and wiped off theemergency generator.

Where practical, place spill containers underneath fillspouts on equipment.Action: J. S. Lee, Manager, West Facilities, Org 76310Action: R. W. Jacobson, Manager, East Facilities, Org 76240*26b#1 TARGETED ACTION COMPLETION DATE 1991/05/31*26c#1 ACTUAL ACTION COMPLETION DATE1991/05/31*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONSend an internal memo to the appropriate Power OperationsManager stressing the significance of the repetitive natureof this occurrence. Request an action plan to preventfuture incidents.Action: D. G. Hamrick, Manager, Facility Operations,Org. 76000*26b#2 TARGETED ACTION COMPLETION DATE1992/02/15 *26c#2 ACTUAL ACTION COMPLETION DATE1993/06/02*26d#2 REVISED ACTION COMPLETION DATE

A diesel fuel tank was overfilled and subsequently expandedout through the fill cap seal. Personnel topped off a fueltank on the emergency generator in 241-SY Tank Farm. Thelack of adequate ventilation forced the fuel in the tank toexpand, during warm weather, out through the fill cap seal.The re-fueling equipment configuration does not detect fullfuel tank conditions, which would normally shut off the fuelflow when a tank is full.

PLG EVALUATION

Failure_Effect	Potential Delay	Designated as an unusual occurrence, required removal of fuel soaked soil
RAM_Applicability	Direct	
Safety Related	Yes	Required time to complete clean-up
Intrusive	No	
Restoration_Time	2	
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

Sheet 4 of 28

ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1991-1026	**_20_dir_cause code**	1A	**_10a_discovery date**	6/29/91
Component_Type		**Failure Mode Code**	TFI-FA-E	**_07_sys/building**	Tank Farms

_14_title of occurrence LOSS OF ALL ELECTRICAL POWER TO TANK FARM FACILITIES

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On June 29, 1991 at 1510 hours, electrical power was lost toall East Tank Farm facilities for a period of two to threeminutes due to an electrical storm in the area.

On 6/29/91 at 1510 hours, power was lost to the 200 Eastarea, including all Tank Farm facilities, due to anelectrical storm in the area. Tank exhausters, theComputer Automated Surveillance System (CASS) and allmonitoring equipment was temporarily out of service.At approximately 1513 hours, power was restored to the TankFarm facilities. The 244-AR and 244-CR vault exhausterswere restarted. The CASS computer system remained inoperableand the contingency plan (TO-001-030, "CASS ContingencyBackup Procedures") was initiated.At 1540 hours, the 241-AP, AW, AN, AY and AZ exhauster fanswere restarted. A review of the tank pressurization dataindicated that the highest pressure reached in any tankduring the outage was a +0.25" water gauge (atmospheric) intank 241-AN-103.At 1540 hours, the vacuum pump to the 241-AW beta CAM wasfound damaged. At 2230 hours, the beta Cam was cross-connected with the record sampler, and a work authorizationwas written to troubleshoot the beta CAM/vacuum pump.At 1600 hours, the 241-C-105/106 exhauster was restarted.At 1610 hours, the 244-A lift station exhauster wasrestarted.At 1615 hours, the CASS computer system was brought back upand the substations were reset. However, CASScommunications from the substations were still impaired.Maintenance personnel were summoned to troubleshoot theproblem.At 1625 hours, the 244-BX exhauster was restarted.At 1630 hours, the 242-A Master Control System (MCS) programstatus and white alarm went down.At 1635 hours, a smoke detector alarm was discovered at254-BY. The fire department was notified and the alarm wasreset. No further complications occurred.At 1745 hours, all notifications were complete.At 1800 hours, the MCS system engineer returned the systemtonormal.At 1920 hours, the 244-AR vault auxiliary power was switchedback to primary power. The emergency diesel generator wasreturned to standby.At 2015 hours, the CASS system engineer begantroubleshooting the CASS communication problem.

Replace the I/O board in slot-4 of the Central Micro.Action: C. C. Scaief, Instrument Control & Engineering.*26b#1 TARGETED ACTION COMPLETION DATE1991/07/01*26c#1 ACTUAL ACTION COMPLETION DATE1991/07/01 *26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONComplete Work Package to troubleshoot the 241-AW betaCAM/vacuum pump.Action: R. J. Wurz, Manager, 242-A & AW Facilities*26b#2 TARGETED ACTION COMPLETION DATE1991/08/15*26c#2 ACTUAL ACTION COMPLETION DATE1991/08/07*26d#2 REVISED ACTION COMPLETION DATE

The apparent strike of a lightening bolt had apparentlycaused a voltage spike on the 200 East Area power system,and resulted in a brief outage to several facilitiesincluding tank farms.

PLG EVALUATION

Failure_Effect	Potential Delay	Loss of power caused Tank Exhausters, the Computer Automated Surveillance System (CASS), and all monitoring equipment to be out of service
RAM_Applicability	Direct	
Safety Related	Yes	Power returned after 3 min., complete system back to normal took 5 hrs
Intrusive	Yes	
Restoration_Time	1	
Comments	Similar reports: WHC-Grout-1991-1003, WHC-BPLANT-1991-1014, WHC-200EM-1991-1025	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1991-1029	**_20_dir_cause code**	1A	**_10a_discovery date**	7/20/91
Component_Type	Motor and transformer	**Failure Mode Code**	External	**_07_sys/building**	242-A Evaporator
_14_title of occurrence	"LOSS OF ELECTRICAL POWER TO THE 242-A EVAPORATOR"				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On July 20, 1991, at 0400 hours, ventilation for the 242-AEvaporator was lost due to primary and backup powerfailures. The backup ventilation system (steam driven)could not be put in service due to a scheduled steam outage.

On 07-20-91 at 0401 hours, the shift manager was notified bythe 242-A control room operator that 242-A had lost power.On 07-20-91 at 0405 hours, the building emergency director(BED) verified the evacuation of all personnel from 242-A.On 07-20-91 at 0410 hours, the on-call maintenance managerwas called and asked to get an electrician to troubleshootthe problem. On 07-20-91 at 0430 hours, an electrician was sent toinvestigate the loss of power. The electrician found theground fault interrupter (GFI) for the 242-A primary motorcontrol center (MCC-1) in the fault mode. The electricianwas unable to reset the ground fault and continued withtroubleshooting the outage. The on-call maintenance managerwas informed that an additional electrician would berequired to complete troubleshooting and system repair.On 07-20-91 at 0830 hours, an electrician found a blownfuse. The fuse was replaced and primary power was restoredto the 242-A evaporator and the building ventilation placed back in service.On 07-20-91 at 0845 hours, radiological surveys of the coldside areas were completed and no contamination was detected.Normal access to the control room was restored.On 07-20-91 at 0910 hours, electricians found the T2transformer in the automatic transfer switch (ATS) hadfailed causing an electrical ground that tripped allbreakers in the power supply sub-station.On 07-20-91 at 1230 hours, the ATS was repaired by replacingthe ACME Electric control transformer (480-volt to 120-volt...rated @ VA-100) with a SQUARE-D controltransformer (480-volt to 120-volt...rated @ VA-150).

Repair the failed motor and transformer per work package2E-91-00874.Action: R. B. Wurz, Facility Manager, 242-A and 241-AWFacilities, Org. 76240*26b#1 TARGETED ACTION COMPLETION DATE1991/08/10*26c#1 ACTUAL ACTION COMPLETION DATE1991/08/19*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONInvestigate to determine if there is a design problem withthe ATS or a motor capacitor problem.Action: R.J. Nicklas, Manager of Single Shell Tanks -Electrical Engineers*26b#2 TARGETED ACTION COMPLETION DATE 1993/10/27*26c#2 ACTUAL ACTION COMPLETION DATE1993/10/27*26d#2 REVISED ACTION COMPLETION DATE

The unplanned electrical power outage was initially causedby a failed fuse (F4). Upon loss of the fuse, power waslost to the evaporator. This initiated the start of thestand-by diesel generator. The electrical load was notpicked up by the diesel generator because the transferswitch control power transformer failed. The direct androot causes of loss of power to the evaporator is a failedpart.The ATS is designed to transfer the flow, upon loss ofutility power, to stand-by diesel power and supply thispower to MCC-2. The T2 transformer within the ATS hadfailed which prevented the ATS from operating. The cause ofthe T2 transformer failure is unknown but has beendetermined not to be a design problem. The contributingcause is a failed part.

PLG EVALUATION

Failure_Effect	Potential Delay	Unplanned power outage, back-up ventilation system (steam driven) could not be put into service due to scheduled steam outage
RAM_Applicability	Direct	
Safety Related	Yes	Time required to trouble shoot and repair primary system
Intrusive	Yes	
Restoration_Time	4	
Comments	Similar reports: 91-0173, 91-0184, and 91-1023	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1991-1060	**_20_dir_cause code**	1A	**_10a_discovery date**	11/9/91
Component_Type	PS	**Failure Mode Code**	External	**_07_sys/building**	Ventilation/242-T

_14_title of occurrence LOSS OF VENTILATION AT 242-T

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

A Health Physics Technician (HPT), during routine surveys,discovered the 242-T exhauster not running, as well as thestack record sampler. Priority/Severity Level D4.

On 11/09/91 at 1735 hours, an HPT notified the shiftsupervisor that the 242-T K2-5-1 Exhauster was no longeroperating. The HPT had verified that the stack recordsampler had shut down with the fan.On 11/09/91 at 1740 hours, upon notification of the event,the shift manager dispatched operations personnel to 242-T.The operator assigned to perform routine instrument readings at that facility had done so on or around 1645 hours. Thefan had been operating at that time.On 11/09/91 at 1800 hours, the K2-5-1 fan was restarted.There were no apparent reasons for the shutdown of the fan.On 11/09/91 at 1900 hours, the On-Call manager was informedof the ventilation loss at 242-T. The occurrence wasclassified as an Off-Normal, per Group 1.I.e of MRP 5.14On 11/09/91 at 1930 hours, notifications of the event werecompleted.On 11/09/91 at 2300 hours, the 242-T building was surveyedfor migration of radiological contaminants. The resultswere negative (no contamination found) and the area was released from on-mask restrictions.

There has been no recurrence of this event since the 242-Tventilation system control switches were replaced onDecember 28, 1991. Additional corrective actions ensuringventilation system modifications are completed aredocumented on RL--WHC-TANKFARM-1991-1081.*26b#1 TARGETED ACTION COMPLETION DATE1992/02/18*26c#1 ACTUAL ACTION COMPLETION DATE1992/02/18*26d#1 REVISED ACTION COMPLETION DATE

Severe winds caused a differential pressure switch tovibrate enough to "break" contact, thus triggering theexhauster shut-off interlock.The design of the ventilation system at 242-T exposescontrol switches, mounted in an unstable instrument panel,to the environment. Environmental conditions negativelyeffect the switchs in that they are disturbed enough to"break" contact, and thus a high vacuum alarm or exhaustershut-off occurrs.The number of past and recent events concerning the loss of ventilation at 242-T can be attributed to a lack ofresources necessary to perform timely modifications to thefacility.

PLG EVALUATION

Failure_Effect	None	Severe winds caused differential pressure switch to vibrate and break contact. 242-T design of ventilation system exposes control switches, mounted in unstable instrument panel.
RAM_Applicability	Indirect	
Safety Related	Yes	N/A Problem associated only with 242-T
Intrusive	Yes	
Restoration_Time		
Comments	Similar reports: 91-1057, 91-1027, 91-1024, and 91-0190	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1991-1066	**_20_dir_cause code**	3A	**_10a_discovery date**	11/25/91
Component_Type	PCV	**Failure Mode Code**	CMV-LE-C	**_07_sys/building**	242-A/241-AW

_14_title of occurrence ACTIVATION OF A SAFETY RELIEF VALVE IN THE RAW WATER SYSTEM RELEASES APPROXIMATELY 500 GALLONS OF WATER INTO DOUBLE-SHELL TANK 241-AW-102

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On November 25, at 1100 hours, while adjusting a 242-AEvaporator raw water pressure regulating valve (PRV), thesystem over-pressurized and a downstream safety relief valve(SRV) opened, releasing approximately 500 gallons of rawwater into the condenser room which drains into double-shelltank (DST) 241-AW-102.

On 11/25/91 at 1105 hours, the raw water to the 242-AEvaporator was shut off and sanitary water was valved in tomaintain cooling water to the air compressors.On 11/25/91 at 1110 hours, it was discovered that water fromthe condenser SRV was overflowing a drain line funnel andrunning onto the condenser room floor, both of which arepiped to DST 102-AW. A short time later, a screen wasremoved from the drain line funnel. The screen had acted asa large particle filter but in this case had restrictedwater flow to the funnel and caused water to spill onto thecondenser room floor.On 11/25/91 at 1120 hours, sanitary water to the compressorswas valved out.On 11/25/91 at 1130 hours, the raw water to the compressorswas valved back in.On 11/25/91 at 1300 hours, it was observed that the liquidlevel in DST 102-AW had not increased, using manual tape readings.On 11/25/91 at 1700 hours, the manual tape reading indicateda .25 inch (688 gallons) increase in DST 102-AW. It shouldbe noted however that the accuracy of manual tape readingsare within .25 inches.

Assure the occurrence report is distributed to the 242-Aengineering support organization for their review.M. S. Garrett, Plant Engineer, Occurrence ReportingOrg. 76510*26b#1 TARGETED ACTION COMPLETION DATE1992/01/31*26c#1 ACTUAL ACTION COMPLETION DATE1992/01/31*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONEnsure the OTP is revised to indicate the proper flowcontrol valve used in adjusting 242-A raw water PRVs.Action: D. Haring, 242-A Engineering Support, Org 7C241*26b#2 TARGETED ACTION COMPLETION DATE 1991/12/11*26c#2 ACTUAL ACTION COMPLETION DATE1991/12/11*26d#2 REVISED ACTION COMPLETION DATE

In an effort to adjust raw water PRVs, a downstream pressurecontrol valve (PCV) was utilized to adjust and maintainwater pressure necessary to make the adjustments. Thedecision to utilize this particular valve to perform thisfunction was inappropriate. The operational test procedure was inadequate in identifyingthe PCV as the method of pressure control for thisoperation.

PLG EVALUATION

Failure_Effect	Potential Delay	Tank storage space is limited, unnecessary water additions requires close evaluation
RAM_Applicability	Direct	
Safety Related	No	Time required to identify source of leak and to bring system back into compliance
Intrusive	Yes	
Restoration_Time	6	

Comments

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1992-0025	**_20_dir_cause code**	1A	**_10a_discovery date**	3/6/92
Component_Type	FCV	**Failure Mode Code**	CMV-FO-C	**_07_sys/building**	242-A, Tank C-100

_14_title of occurrence TANK C-100 (242-A) LIQUID LEVEL DECREASE AND CORRESPONDING LEVELINCREASE IN 241-AW-102 UNDERGROUND STORAGE TANK

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 03/06/92 at 0900 hours a level decrease of approximately1300 gallons from Tank C-100 was detected. An increase ofabout 0.5" in Tank 102-AW had been reported earlier andtroubleshooting activities determined that Tank C-100 wasthe source.

On 03/05/92 at 1730 hours a gradual rise in Tank 102-AWliquid level was noticed. Several possible sources werechecked but no potential leaks were discovered.On 03/06/92 at 0900 hours a computer printout was generatedthat showed that Tank C-100 level began to decrease on03/04/92 at 1500 hours. The printout also showed thedecrease stopping on 03/05/92 at 1200 hours. On 03/06/92 at 0925 hours the On call manager was notifiedand liquid level decrease was classified as an OFF-NORMALper Group 9 d.On 03/06/92 at 1000 hours the Tank C-100 drain valve wasverified as closed, and no leakage was observed in the area around the tank.On 03/06/92 at 1130 hours all notifications were complete.The Tank C-100 liquid level will be monitored at anincreased frequency for the next several days.

Submit a Work Package (#2E-92-0313) to initiate theinstallation of a second valve in each of the C-100 drainlines to provide double valve isolation capability.Actionee: R.B. Wurz, Manager, 241-AW, 241-AP, and 242-AFacilities*26b#1 TARGETED ACTION COMPLETION DATE1992/04/30*26c#1 ACTUAL ACTION COMPLETION DATE1992/06/01*26d#1 REVISED ACTION COMPLETION DATE

A level decrease of approximately 1300 gallons from TankC-100 was detected. An increase of about 0.5" in Tank102-AW had been reported earlier and troubleshootingactivities determined that Tank C-100 was the source. Thedirect cause was an equipment problem/defective or failedpart.No certain definitive root cause has been identified for theleak. However, based on a thorough study of the design, thefollowing scenario has been developed.There are two drain lines from the C-100 tank which couldresult in liquid additions to the 241-AW-102 tank. Eachdrain line has only a single isolation valve to preventleakage instead of the normal two valve isolation requiredto prevent inadvertent transfers. Both valves (valve #'s 1-3 and 1-3a) were found to be in the closed position. TheC-100 tank is known to contain a minor amount of settledsolids. It is believed that some of the solids had settledin one of the valve seats which prevented the valve gatefrom being fully closed, but also plugged the valve sufficiently to prevent leakage. The head pressure from thetank eventually pushed the debris out of the valve, andallowed the valve to leak until the seat plugged again withadditional solids. A more aggressive valve maintenanceprogram where the valves are periodically inspected mighthave prevented or lessened the severity of this event. Thepossible root cause was a design problem/inadequate ordefective design.

PLG EVALUATION

Failure_Effect	Potential Delay	Liquid level decrease and corresponding level increase, source unknown
RAM_Applicability	Direct	
Safety Related	Yes	Time required to check potential sources for the leak, no evidence was uncovered to indicate the source.
Intrusive	Yes	
Restoration_Time	16	

Comments C-100 Tank drain line only has single isolation valve.

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1992-0051	**_20_dir_cause code**	7B	**_10a_discovery date**	6/28/92
Component_Type	500 KVA Transformer	**Failure Mode Code**	External - Power Loss	**_07_sys/building**	200 West Area
_14_title of occurrence	ELECTRICAL STORM DISRUPTS 200 WEST AREA POWER, RESULTING IN TEMPORARYTANK FARM EXHAUSTER AND ALARM FAILURES				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

A lightning storm over the 200 West Tank Farms resulted ina brief power outage which tripped equipment protectioncircuitry. Most equipment and alarms were restarted andreset within 90 minutes.

On 06/28/92 at 2107 hours, a lightning strike on a 500 KVAtransformer caused a 45 second power loss on the C8-L3 andC8-L4 power lines serving the 200 West area. Power to thearea was restored after the 45 second outage without furtheroutage incidents. On 6/28/92 at 2150 hours, a survey of the area by operationspersonnel found the following equipment was de-energized by equipment protection circuitry: 242-S K1-5-3 Exhauster 242-T K2-5-1 Exhauster 241-SY Primary Exhauster 241-SY Annulus Exhauster 241-SX Primary Exhauster three 241-SY annulus leak detection vacuum pumpsOther equipment was found to be in a state of alarm: 241-SY Area Radiation Monitors 241-SX Area Radiation Monitors 241-U Area Radiation Monitors 242-S steam condensate radiation monitor 271-SY building radiation monitor 241-SY service pit radiation monitorAdditional equipment which was found to be malfunctioninginclude: S-304 catch tank remote level indicator (located at 242-S) S, T, and U substations for the Computer Automated Surveillance System (CASS)On 6/28/92 at 2240 hours, all of the alarms were reset andequipment returned to service except for the remote level indication for S-304 Catch Tank. A work order wasinitiated for it's repair. Local level indication for thecatch tank was functional.A review of the chart recorders monitoring the 241-SY tankpressures showed the tank pressure had not exceeded -0.1"water gauge. A review of the exhauster history for thistank farm showed a total of 4.5 hours accumulated exhausterdown time during the past year prior to this event. Withthe added time of this occurrence, the total is still wellbelow the 40 hour per year limitation established in Section11.6 of OSR-T-152-00001.On 6/28/92 at 2250 hours, the event was categorized as a Unusual Occurrence.On 6/28/92 at 2345 hours, all notifications were complete.

Instruct all CASS operators, via required reading, on theimportance of paying extra attention to alarms duringinclement weather. The instruction should explainmanagements expectations and the methods available to verifythe status of the CASS substations. Action: J. J. Badden, Manager, Shift Operations*26b#1 TARGETED ACTION COMPLETION DATE1992/08/21*26c#1 ACTUAL ACTION COMPLETION DATE1993/05/11*26d#1 REVISED ACTION COMPLETION DATE

The various equipment shutdowns were the result of a briefpower outage. The Direct Cause was a power failure ortransient. Weather or ambient condition was selected as the Root Causeof this event.

PLG EVALUATION

Failure_Effect	Potential Delay	Loss of ventilation possible OSR violation
RAM_Applicability	Direct	
Safety Related	Yes	Due to the brief power outage, CASS substations de-energized and failed to reset when power was restored. Loss of alarm signals from the substations slowed process of identifying and resetting de-energized equipment
Intrusive	No	
Restoration_Time	2	
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-199 2-0072	**_20_dir_cause code**	1A	**_10a_discovery date**	9/30/92
Component_Type	PIPE	**Failure Mode Code**	Unexpected level rise in	**_07_sys/building**	241-AW
_14_title of occurrence	UNEXPECTED LEVEL RISE IN INTERCONNECTED TANK 102-AW DURING A ROUTINEWASTE TRANSFER BETWEEN UNDERGROUND STORAGE TANKS 106-AN AND 102-AP.				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 9/30/92 at 0930, a transfer was started from Double ShellTank (DST) 106-AN to 102-AP.On 9/30/92 at 1145, an unexpected level rise was noted inDST 102-AW. This DST is interconnected to the transferroute via a drain line in the 241-AW-A valve pit. Thetransfer was immediately stopped to determine the source ofthe intrusion.On 9/30/92 at 1230, the 242-A Evaporator was eliminated as apossible source of the intrusion.On 9/30/92 at 1330, a limited visual inspection of the 241-AW-A valve pit was performed through an inspection port inthe cover block. During the inspection, it was observedthat the floor of the valve pit was wet.On 9/30/92 at 1415, the material balance for the transferwas checked which initially indicated a 3575 gallondiscrepancy in tank levels.On 9/30/92 at 1600, another inspection of the 241-AW-A valvepit was performed. During this inspection, liquid wasobserved to be flowing from the vicinity of a pipe jumperconnection to the floor of the pit. The pit floor drainleads to 102-AW. Also, the leak detector probe was observedto be positioned near the valve pit wall instead of over thefloor drain which is the low point in the pit.

On 9/30/92, a work package (2E-92-01299) was initiated toopen the valve pit and inspect/repair the jumper connection.This work has been delayed because the crane crew has beenassigned to work at 241-SY-101 to assist with "Window G"activities.On 9/30/92, the material balance discrepancy was carefullydetermined. The liquid level in DST 106-AN decreasedapproximately 5.7 inches. The liquid level in DST 102-APincreased approximately 4.5 inches. The liquid level in DST102-AW increased 1.2 inches or 3300 gallons which accountedfor the discrepancy between the sending and receiving tanks.(All of the DSTs involved are of the same nominal onemillion gallon capacity and contain 2750 gallons for eachinch of liquid level.)

Assure that work package 2E-92-01299, "241-AW-A Valve Pit-Repair Jumper Connection," is scheduled and completed assoon as resources become available.Action: R. W. Jacobson, Manager, East Tank Farm Facilities Org: 7C150*26b#1 TARGETED ACTION COMPLETION DATE1992/11/30*26c#1 ACTUAL ACTION COMPLETION DATE1994/01/20*26d#1 REVISED ACTION COMPLETION DATE

The direct cause of the leak was a failure of a pipe jumperin the valve pit.The leak detector probe was improperly positioned away fromthe lowest point in the valve pit. The probe was apparentlymoved when some jumpers were stacked on the floor of the pitfor storage. Inattention to detail was a contributingcause.The 102-AW level indicator (FIC) had been giving erratic readings prior to the incident (a log entry noted .6"fluctuation). Another contributing cause was a defective orfailed part because the FIC appeared to be unreliable.The 102-AW FIC had been giving erratic readings for severaldays prior to the incident, yet no work package was in placeto troubleshoot and repair it. Another contributing causewas a work organization or planning deficiency.The root cause appears to be a defective or inadequateprocedure. The current procedure does not require double encased transfer lines to be leak tested after a jumperchange. This policy is based on the fact that pit and lineleak detectors normally would alarm during a leak, andresult in an immediate shutdown of the transfer.

PLG EVALUATION

Failure_Effect	Potential Delay	Transfer operation immediately stopped to determine source of intrusion
RAM_Applicability	Direct	
Safety Related	Yes	6.5 hrs needed before source of leak determined, required repair of jumper
Intrusive	Yes	
Restoration_Time	9	
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1993-0005	**_20_dir_cause code**	7A	**_10a_discovery date**	1/12/93
Component_Type	105/106-C Exhausters	**Failure Mode Code**	External - Ice and snow fall	**_07_sys/building**	241-C TK-105/106
_14_title of occurrence	MISSED SURVEILLANCE READING ON TK-105-C & TK-106-C VACUUMS RESULTS INA NON-CONFORMANCE TO OSR-T-152-00003, SECTION 11.4.1.1.				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

Missed surveillance readings for the 105/106-C Exhausterresulted in an Operational Safety Requirement (OSR)Non-Conformance to OSR-T-152-00003, section 11.4.1.1 "SingleShell Tank Vapor Space Vacuum". The Section 11.4.1.1."Surveillance" requirement is for vacuum readingsto be obtained "Daily, not exceed 30-hours". Twelve hourselapsed beyond the 30-hour requirement, before vacuumreadings were obtained.On 01/11/93 at 1200, it was noted that the 105/106-Cexhauster readings could not be taken due to the inabilityto safely access the tank farm. The access stairway wascovered with ice and the farm had snow drifts up to waistdeep.On 01/11/93 at 1500, 100 pounds of deicer was ordered. Itwas delivered near the end of the shift. On 01/12/93 at 0430, the Shift Manager discovered the missedsurveillance.

On 01/12/93 at 0430 hours, the OSR recovery action wasinitiated.On 01/12/93 at 0445 hours, the entry steps to the 241-C tankfarm were cleared of snow and ice. Deicer was applied tothe steps as well.On 01/12/93 at 0500 hours, tank vacuums were obtained onTanks 105-C & 106-C. The vacuums were as follows:Tank 105-C [-.5" w.g.]Tank 106-C [-1.5" w.g.]On 01/12/92 at 0910 hours, all notifications were complete,including Conference call to DOE-HQ.NOTE: Attempts to reach the Emergency Control Center (ECC)in Washington, D.C. were unsuccessful.

This report will be distributed through the normal channelssostudied for lessons learned. Noadditional corrective actions*26b#1 TARGETED ACTION COMPLETION DATE1993/01/25*26c#1 ACTUAL ACTION COMPLETION DATE1993/01/25 *26d#1 REVISED ACTION COMPLETION DATE

Repeated snowfalls covered the stairway leading to the farmwith ice and snow. High winds resulted in snow driftsapproximately waist deep in the farm. The farm is in adepression relative to the surrounding terrain whichcontributed to the drifting problem. The direct cause wasweather.The 241-C tank farm requires supplied air for entry due toconcerns about potentially hazardous vapors emanating fromthe tanks. Normal farm entry is accomplished using SelfContained Breathing Apparatus (SCBA). The SCBA unitsutilize compressed air bottles on a backpack which containenough air for approximately 30 minutes of normal activity.Strenuous activity shortens this amount of timesubstantially. The wearer's center of gravity is shiftedwhen the SCBA backpacks are worn which increases the hazardwhen negotiating slippery surfaces. The SCBA face maskhampers vision somewhat which adds to this hazard. Theprotective equipment necessitated by the potential vaporhazard made the slipping hazard much more severe. Aninadequate work environment was a contributing cause.The OSR required readings could have been obtained on swingshift before the time limit expired. However, the readingswere not obtained until graveyard shift. The Shift Managerin charge on swing shift was preoccupied trying to clear upproblems which were preventing a much needed waste transfer.As a result, the missed OSR readings did not receiveadequate priority. The root cause was inadequatesupervision.

PLG EVALUATION

Failure_Effect	Maybe	241-C Tank Farm requires supplied air for entry. Access stairway was covered with ice and the Farm had snow drifts waste high
RAM_Applicability	Direct	
Safety Related	No	N/A - Twelve hrs elapsed beyond the 30-hour requirement before vacuum readings were taken. The vacuum readings were within the normal range
Intrusive	No	
Restoration_Time		
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1993-0011	**_20_dir_cause code**	3A	**_10a_discovery date**	1/21/93
Component_Type	Magnetic motor starter	**Failure Mode Code**	HA - Inattention to	**_07_sys/building**	AY/AZ Farm Vent Fan
_14_title of occurrence	TEMPORARY LOSS OF 241-AY&AZ PRIMARY TANK VENTILATION DUE TO PERSONNEL ERROR; NO CONTAMINATION SPREAD OR PERSONNEL INJURY RESULTED.				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

While performing maintenance on the primary tank ventilationsystem for the AY and AZ Tank Farms, an electrician inadvertently bumped the magnetic motor starter for one ofthe isolated fans. As a result, the only operational fanfor the facility shutdown allowing the ventilation system togo stagnant. The two back-up fans were locked out formaintenance work. The A-Complex Tank Farms were immediatelyevacuated as per procedure. Personnel re-entered the farmin respiratory protection and restored the ventilation.Radiological surveys were performed and no contaminationspread was detected.The electricians were replacing the wire which supplies thepower to one of the two isolated exhaust fans. Theinsulation on the old wire had deteriorated to the pointwhere the reliability of the fans were in question.Both of the isolated exhaust fans are powered from the samepower source. As a result, both fans had to be locked outto perform the scheduled repair. It was necessary for the control circuit, which is common to all three exhaust fans,to be left in the energized state.The electricians were pulling the old wire from the conduitleading into the switch gear panel. The wire was beingpulled through the open door of the switch gear. A wirepulling winch was being utilized. The winch was beingdisconnected and reattached to the old wire. As the tensionon the wire slacked, the wire curled back into theelectrical cabinet and depressed the iron core on themagnetic motor starter for the isolated fan. The naturaltension in the heavy gauge wire was sufficient to keep theiron core depressed. The iron core made up a set ofcontacts which put the control circuit into theconfiguration required for running one of the isolated fans.The control circuit is interlocked to prevent more than oneexhaust fan from operating at a time. Thus, the onlyoperational fan shut down because the control circuit"thought" that one of the isolated fans was running.

On 1/21/93 at 1015 hours, the only operating exhaust fan forthe AY and AZ Tank Farm shutdown when an electrician inadvertently bumped a control switch.On 1/21/93 at 1017 hours, the AY and AZ Tank Farms wereevacuated.On 1/21/93 at 1027 hours, operations and maintenancepersonnel donned respiratory protection, reentered the farm,and restarted the exhauster. On 1/21/93 at 1040 hours, the operator assigned to the AYand AZ facility restarted the air lift circulators for 101-AZ and 102-AZ tanks. The procedure (TO-200-030) calls for asystematic 5 hour restart sequence but the restart was notperformed in accordance with this procedural requirement.On 1/21/93 at 1045 hours, the AY and AZ ventilation loss wasclassified as an Unusual Occurrence per Group 1.I.2.e.On 1/21/93 at 1115 hours, the Health Physics Techniciancompleted radiological surveys of the farms and detected nocontamination spread.On 1/21/93 at 1500 hours, all notifications were completed.

Provide Conduct of Operation trainings for operators andmaintenance personnel.*26b#1 TARGETED ACTION COMPLETION DATE1994/05/25*26c#1 ACTUAL ACTION COMPLETION DATE1994/05/25*26d#1 REVISED ACTION COMPLETION DATE
The electrician accidently depressed the magnetic motorstarter on the isolated fan which resulted in the shutdownof the only operational fan. The direct cause wasinattention to detail.In this case, the violation had no impact because of lowtemperature of the aging waste and the short period of timethat the ALCs were down. However, under other circumstancesthe procedural violation could have increased the severityof the event. A contributing cause was a procedureviolation.The work package for the repair had been through the normalJob Control System review and approval cycle. The potentialfor disabling the operable fan was not dealt with as a partof the review.The root cause was a work organization/planning deficiency.

PLG EVALUATION

Failure_Effect	Potential Delay	Tank Farm evacuated, personnel required to use respiratory protection to reenter the Farm
RAM_Applicability	Direct	
Safety Related	Yes	Exhauster restarted and radiological surveys of the Farms conducted
Intrusive	No	
Restoration_Time	1	
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1993-0027	**_20_dir_cause code**	1A	**_10a_discovery date**	3/5/93
Component_Type	LIT	**Failure Mode Code**	TRM-FA-I	**_07_sys/building**	241-AN TANK FARM

_14_title of occurrence TANK 101-AN LIQUID INDICATING TRANSMITTER (LIT) FAILURE. UNSUCCESSFUL REPAIR EFFORTS RESULT IN MISSED READING AND OSR NON-CONFORMANCE.

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 3/4/93, Tank Farms Personnel were unable to record alevel indication for waste storage tank 101-AN. Repairswere initiated during day shift on 3/4/93 and continued onswing shift. However, repair efforts were unsuccessful inreturning the equipment to service before the end of shift.Failure to obtain a daily liquid level on this tankconstitutes a non-conformance to the surveillance requirements of Operational Safety Requirement (OSR) 11.5,"Primary Tank Minimum Liquid Level", per OSR-T-152-00001.

On 3/4/93, a work order was initiated to repair the levelindicating device for tank 101-AN.On 3/4/93, at approximately 2130 hours, it was determinedthat repairs to the level indicating device could not becompleted before the end of the shift.On 3/4/93 at 2145 hours, efforts were initiated to obtain aliquid level reading by alternative methods.On 3/5/93 at 0001 hours, an Off-Normal event was declared,per Group 9.D.On 3/5/93 at 0710 hours, the event was re-categorized to anUnusual Occurrence, per Group 1.E.2.a.On 3/5/93 at 0730 hours, replacement parts were identifiedto support repairs and return the 101-AN liquid levelindicator to service.On 3/5/93 at 0848 hours, all notifications were completed.On 3/8/93 at approximately 1400 hours, repairs werecompleted and the level indicator was returned to service.

Schedule and track to completion the installation of manualtape liquid level measuring devices in 241-AN tank farm inaccordance with work package 2E-89-0334.Action: R. W. Jacobson, Manager, East Tank Farm FacilitiesOrg: 7C150*26b#1 TARGETED ACTION COMPLETION DATE1993/10/31*26c#1 ACTUAL ACTION COMPLETION DATE1995/01/31 *26d#1 REVISED ACTION COMPLETION DATE

The liquid level reading was missed because of a failedlevel indicator. The direct cause was defective or failedpart.The craft personnel who accepted the overtime assignmentwere called off of a general overtime list as per bargainingunit agreement. Those personnel were unfamiliar with thistype of level indicator, and as a result repairs weredelayed. A contributing cause was insufficient practice orhands-on experience.There is no installed back-up system for obtaining liquidlevels in the 241-AN tank farm. The 241-AN tank farm is theonly double shell tank farm without installed back-up levelindication for each tank. The root cause of the missedreading was inadequate or defective design.

PLG EVALUATION

Failure_Effect	Potential Delay	Non-conformance to surveillance requirements of OSR
RAM_Applicability	Direct	
Safety Related	Yes	Days? Replacement parts needed to be located and repair conducted
Intrusive	Yes	
Restoration_Time		
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1993-0064	**_20_dir_cause code**	1A	**_10a_discovery date**	7/28/93
Component_Type		**Failure Mode Code**	HA-MAINT	**_07_sys/building**	242-A Evaporator
_14_title of occurrence	INADEQUATE TEST PROCEDURE RESULTS IN FAILURE OF 242-A EVAPORATORCONDENSATE PUMP P-C100				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 07/27/93, at 2200 hours, the 242-A Evaporator Operatorwas preparing to transfer condensate from the C-100condensate tank to the evaporator vessel through a temporaryjumper installed for training. When the operator attemptedto start the P-C100 condensate pump, the 242-A Monitoringand Control System (MCS) control board indicated that it wasrunning but was not actually operating as indicated by zerocurrent and zero flow on the MCS control board. A visualinspection of the pump confirmed that it was not operating.A subsequent investigation revealed that the P-C100 pumpmotor controller overload contacts had not been reinstalledfollowing performance of Operation Test Procedure (OTP)TFPE-WP-0200 conducted on 07/06/93. A portion of this OTPrequired removal of the thermal overloads to allow softwareinterlock verification of pump shutdown following detectionof leakage into the encasement of the Liquid EffluentRetention Facility (LERF) transfer piping. The OTP failedto include a step to reinstall the thermal overloadsfollowing completion of testing.

On 07/28/93 at 0500 hours troubleshooting confirmed that thethermal overloads for P-C100 were not in place.On 07/28/93 at 0800 hours the overloads were installed.On 07/28/93 at 0835 hours P-C100 pump started successfully.On 07/28/93 at 1640 hours all notifications were completed.

Ensure the lessons learned are distributed to personnelresonsible for writing/revising procedures.Action: M. S. Garrett, Occurrence Reporting, Org. 7CA40*26b#1 TARGETED ACTION COMPLETION DATE1994/01/22*26c#1 ACTUAL ACTION COMPLETION DATE1994/01/22*26d#1 REVISED ACTION COMPLETION DATE

Direct Cause: Equipment/Material Problem.The P-C100 condensate pump was not functioning and appearedto have failed when operations personnel attempted totransfer condensate from the C-100 condensate tank to theevaporator vessel. AC power was not provided to the P-C100condensate pump due to unconnected overload contacts.Root Cause: Inadequate Procedure. Troubleshooting determined that the pump motor overloadcontacts were disconnected. A review of the OTP by theOperations Manager revealed that a step in the OTP requireddisconnecting the contacts to perform a specific test,however there was no step in the procedure to reconnect thecontacts.

PLG EVALUATION

Failure_Effect	Insignificant	242-A Evaporator test procedure restoration
RAM_Applicability	Indirect	
Safety Related		Night failure, reinstalled disconnected overloads
Intrusive		
Restoration_Time	10.5	
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1993-0067	**_20_dir_cause code**	1B	**_10a_discovery date**	7/30/93
Component_Type	ES	**Failure Mode Code**	ATS-NR-E	**_07_sys/building**	242-A BACKUP POWER DIESEL GENERATOR
_14_title of occurrence	LOSS OF POWER AT 242-A EVAPORATOR AS A RESULT OF AN AUTOMATIC TRANSFERSWITCH (ATS) FAILURE DURING DRILL				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 07/30/93 at 1630 hours, a drill was being conducted atthe 242-A Evaporator for training purposes. The drill wasinitiated to evaluate plant operators on their response to aloss of primary power to the facility. When primary powerwas disabled to 242-A, the backup diesel generator cameon-line as expected but would not accept the electricalload.An operator observing the Monitoring and Control System(MCS) indicators inconjunction with the backside operator,who was dispatched to check the diesel generator indicationsverified the non-acceptance of the electrical load. Thisindicated that the Automatic Transfer Switch (ATS) had notswitched from the normal power to the backup power asrequired.

On 07/30/93 at 1630 hours, a loss of primary power drill wasinitiated to 242-A. The Automatic Transfer Switch failed toswitch from normal power to the emergency backup dieselpower, therefore, the drill was terminated.On 07/30/93 at 1700 hours, 242-A was returned to normalpower and all conditions verified in a safe configuration.On 07/31/93 at 2330, The Shift Operations Manager receivedfinal approval for a priority 1 work package to repair theAutomatic Transfer Switch.On 08/01/93 at 0730 hours, two electricians startedtroubleshooting efforts on the Automatic Transfer Switch.Poor drawings and Certified Vendor Information (CVI) madetroubleshooting efforts difficult. After many hours oftroubleshooting and several attempts at transfer of loads,it was determined additional engineering and vendor supportwould be required for the Automatic Transfer Switch.On 10/26/93 and 10/27/93, the vendor arrived to aid in theresolution of the Automatic Transfer Switch problems.

Obtain vendor support to troubleshoot and repair theAutomatic Transfer Switch.Actionee: Geary, J. E. Manager 242-A EvaporatorOrg code: 7C150*26b#1 TARGETED ACTION COMPLETION DATE1993/10/29*26c#1 ACTUAL ACTION COMPLETION DATE1993/11/05*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTION Implement preventive maintenance for cleaning, operation,and inspection of the Automatic Transfer Switch. Preventive maintenance procedure #2E-22006 has been established for theswitch.*26b#2 TARGETED ACTION COMPLETION DATE 1993/11/05*26c#2 ACTUAL ACTION COMPLETION DATE1993/11/05*26d#2 REVISED ACTION COMPLETION DATE

The direct and root causes are failure of the AutomaticTransfer Switch.The following is offered by engineering and vendor supportas actions taken in response to the occurrence report indetermining the failure of the Automatic Transfer Switch.A loss of power by opening substation breaker 4D wasperformed three times. In all three cases the diesel cameon line and the transfer occurred as expected to emergencypower.During the two days the vendor was here (10/26/93 and10/27/93) a loss of power to the facility was performed inexcess of thirty times. In all these cases the generatoraccepted the load as expected. However, there were severalcases where the ATS would not transfer back to utility powerwhen the power became available. It was noted that therewere two separate problems with the transfer back to utilitypower.The first problem encountered only occurred once in thethirty plus transfers made. It appeared that time delayrelay TD-2 may have had a sticky contact and did not closewhen needed. In the several transfers that followed thisdid not happen again. It is assumed that with the numerous transfers this contact became clean. A new time delay relaywill be ordered and put in spares.The second and more serious problem encountered was theSPM-A Synchronizer located in the ATS was not sending theproper signal to the 2301 governor controller located in thegenerator controls unit. Without this signal workingproperly the generator cannot adjust its speed to allow itto match the voltage and frequency of the utility power.The transfer cannot take place until the loads aresyunchronized. The reason for this signal problem was amissing jumper on the SPM-A Synchronizer, caused by amanufacturing defect. Once the jumper was installed a lossof power test was performed seven times in a row and the ATStransferred to emergency power and back to utility power asexpected. The signal was monitored and found to be correct.The vendor also checked other setting and adjustments on theATS and confirmed that everything is now working properly.

PLG EVALUATION

Failure_Effect	Insignificant	This switch is located in the evaporator complex and would not effect Phase 1 operations. Similar devices do not appear to be in use for Phase 1.
RAM_Applicability	None	
Safety Related	No	Based on ORPS report time indicated for vendor to support site operations.
Intrusive	No	
Restoration_Time	2136	
Comments	This report indicates a need to ensure timely vendor support for Phase 1 equipment where needed.	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-199 3-0069	**_20_dir_cause code**	6B	**_10a_discovery date**	8/4/93
Component_Type	P	**Failure Mode Code**	HAFLOXXXL	**_07_sys/building**	DOUBLE SHELL WASTE TANK 241-SY-101
_14_title of occurrence	LOSS OF FACILITY CONTROL RESULTS IN AN INADVERTENT START OF WASTE TANK 241-SY-101 HYDROGEN MITIGATION PUMP				

1) _16_description 2) _19_immediate cor actn 3) _26_Corrective Action 4) _23_cause narrative

On 8/04/93 at 1522 hours, Waste Tank 241-SY-101 mixer pumpwas inadvertently started when it's disconnect switch (DS-101-25) was closed by an operator. The disconnect switchhad an "information only" tag installed to require the ShiftSupervisor's or Test Engineer's permission prior tooperation. The "information only" tag did not alert theoperator that an Acceptance Test Procedure (ATP) was inprogress, or that DS-101-25 closure would start the mixerpump. With DS-101-25 closed and the subsequent pump start,a violation of the safety analysis requirement resulted.The safety analysis requires that all personnel are nocloser than 300 meters to the tank farm when the pump isstarted due to potential ammonia and noxious vapors that maybe released.At the time of the pump start, Data Acquisition and ControlSystem (DACS) personnel were performing an ATP on the pumpsoftware when the independent speed/power/current monitorindicated positive readings. This indicated that DS-101-25in the tank farm was in the closed/on position and the pumpwas actually running. The ATP required DS-101-25 to be inthe open/off position to prevent pump operation during thesoftware testing. Upon realization of pump start, DACSpersonnel immediately pushed both emergency stop buttonsresulting in the shut down of the pump.242-S Shift Management was notified by DACS test personnelthat the 101-SY mixer pump was inadvertently started. DACSpersonnel proceeded to open the breaker in the motorcontroller center, which assured the pump would not restart.Historical data from the DACS computer indicated the pumphad run for 30 seconds with no indications of a gas release.The Hydrogen and Nitrous Oxide and Ammonia levels arenormal.

On 8/4/93 at 1515 hours, an operator had been directedby shift management to prepare for the pump start by takingpre-test pump data and to close the mixer pump motor localdisconnect. Testing was in progress per section 6.4 ofATP-062 for phase "B" test #25.6. At the same time asoperations personnel were performing pre "pump bump" rounds,the independent speed/power/current monitor was observed tobe reading high. This was an indication of actual pumpmotor operation not just ATP operation. The stop pumpbutton on station #8 screen was pressed as well as theemergency stop push button. DACS personnel notified ShiftManagement as well as the DACS Test Manager that the mixerpump had been inadvertently started.On 8/4/93 at 1522 hours, Shift Management was notified byDACS personnel of the inadvertent pump operation due to theclosing of DS-101-25.On 8/4/93 at 1525 hours, operators were notified to evacuate241-SY Tank Farm.On 8/4/93 at 1535 hours, Shift Management notified DACStest personnel to suspend ATP testing until investigation ofthe inadvertent 101-SY pump start. DACS personnel indicatedthat the pump started at 1515 hours and ran for 30 secondsbefore the emergency stop buttons were pushed.On 8/4/93 at 1555 hours, DACS personnel performed a historyon the pump bump and found that the RPM's went to 533 andthat there was no increases in the tank vapor space gases.(normal pump bump speeds are up to 1000 RPMs)On 8/4/93 at 1600 hours, following initial managementnotifications, a critique was conducted by OccurrenceReporting personnel and a review of the Safety Analysislevel I and II controls was conducted by DACS personnel.On 8/4/93 at 1655 hours, 241-SY Tank Farm was released forentry.On 8/4/93 at 1745 hours, following debriefs from critiquepersonnel, Tank Farms Operations Manager authorized thecontinuation of pump bumps.On 8/06/93 at 1115 hours, upon further review of theincident, it was upgraded to an Unusual Occurrence, pergroup 1.C.2.C.On 8/06/93 at 1115 hours, contacted Shift Operations Managerof occurrence upgrade.On 8/06/93 at 1121 hours, contacted Nuclear Safetyrepresentative of occurrence upgrade.On 8/06/93 at 1125 hours, contacted DOE-RL representative ofoccurrence upgrade.On 8/06/93 at 1127 hours, contacted WHC-ONC of occurrenceupgrade.On 8/06/93 at 1141 hours, contacted DOE-HQ EM program officeof occurrence upgrade.Remove "information only" tags on DS-101-25 and DS-101-26,and replace with Caution tags that require both the ShiftSupervisor's and ATP Test Director's concurrence prior tobreaker operation.*26b#1 TARGETED ACTION COMPLETION DATE1993/08/05*26c#1 ACTUAL ACTION COMPLETION DATE1993/08/05*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONRevise the pump start procedure to ensure permission isobtained specifically from both the Test Director and theSOM prior to any disconnect switch operation.*26b#2 TARGETED ACTION COMPLETION DATE1993/09/09*26c#2 ACTUAL ACTION COMPLETION DATE1993/09/09*26d#2 REVISED ACTION COMPLETION DATE

The Operations Shift Supervisor authorized the closure ofthe disconnect switch without knowing the impact of theoperator's action would have on the testing that was beingconducted. This inadequate work organization/planningdeficiency is the direct cause for this incident.A contributor to this incident was the lack of trainingprovided for operations personnel to understand the intentof the ATP, the impact the ATP had on the facility, or theimpact operator actions could have on the ATP.Another contributor was the poorly defined policy to ensurethere was an overall program to coordinate between tests, orbetween test personnel and operations personnel. This wasevident by which organization (Test Engineering orOperations) had control of testing was inconsistent betweendifferent levels of management as observed by theindependent review team.The inadequate procedural guidance to establish control overoperational activities in support of testing and othernon-routine activities also contributed to this incident.The procedure guidance did not exist for the practical (inthe field) control of the activities.The root cause to this incident was Management's failureto establish, communicate, and verify their expectationsconcerning control at the facility as conditions changedwith time.The single decision by the Operations Shift Supervisor toclose the disconnect switch should not have caused thisevent. Many chapters of the "Conduct of Operations" manualare designed to provide barriers to prevent loss of controlof the facility and to compensate for operator error. Thisevent represents a breakdown in this multi-barrier concept.

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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PLG EVALUATION

Failure_Effect	Potential Delay	A failure to lock out a system being tested or maintained would lead to at least an administrative hold on work to investigate.
RAM_Applicability	Indirect	
Safety Related	Yes	Based on ORPS report to investigate and implement corrective actions.
Intrusive	Yes	
Restoration_Time	864	
Comments	None	

ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1993-0072	**_20_dir_cause code**	1E	**_10a_discovery date**	8/11/93
Component_Type		**Failure Mode Code**	External	**_07_sys/building**	AC Power to AP, AW, AN, and C TANKFARMS Exhaust
_14_title of occurrence	LOSS OF PRIMARY AC POWER TO AP, AW, AND AN TANKFARMS RESULTED IN THELOSS OF PRIMARY EXHAUST FANS TO AP, AW, AN, AND C TANKFARMS				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 08/11/93 at 1802 hours, a momentary loss of power in theEast Tank Farms caused electrical equipment in AN, AP, AW,and C Tank Farms to shut off. The 204-AR, 244-AR and 244-CRfacilities were also effected. The power loss was due to ashort in the system. A bird apparently landed on a powerpole on Gable Mountain and made contact with a transformerand Power Supply Line 6, causing the short. The breaker forthat line opened and automatically reset after 10-15 secondsas designed, restoring power to the line.

On 8/11/93, at 1821 hours, the primary exhauster for AW TankFarm was restarted.On 8/11/93, at 1830 hours, the primary exhauster for AN TankFarm was restarted.On 8/11/93, at 1849 hours, the primary exhauster for AP TankFarm was restarted. On 8/11/93, at 1904 hours, the exhauster at 204-AR wasrestarted.On 8/11/93, at 1920 hours, the exhauster at 244-CR was restarted.On 8/11/93, at 1925 hours, the portable exhauster for105/106-C was restarted.On 8/11/93, at 2015 hours, the Shift Manager reviewedrecorded tank pressures and determined no instrumentsexceeded tolerance.On 8/11/93, at 2030 hours, HPTs reported no contaminationwas released in any facilities.

No further corrective actions are required by Tank Farms.Refer to Occurrence Report RL--WHC-WHC200EM-1993-0040. *26b#1 TARGETED ACTION COMPLETION DATE1993/08/18*26c#1 ACTUAL ACTION COMPLETION DATE 1993/08/18*26d#1 REVISED ACTION COMPLETION DATE

Direct Cause: Electrical Problem.The East Tank Farms lost outside Alternating Current (AC)which provided power to all electrical equipment in the AN,AP, AW, and C Tank Farms. The 204-AR, 244-AR and 244-CRfacilities also lost power.Root Cause: Power Failure or Transient.Power was lost to 13.8 KV line C8-L6 on Gable Mountain dueto short caused by a large bird. The corrective actionslisted in item #18 are adequate. No further correctiveactions are required by Tank Farms. Refer to OccurrenceReport RL--WHC-WHC200EM-1993-0040 for a further evaluation.

PLG EVALUATION

Failure_Effect	Potential Delay	This event could occur during Phase 1 operations with similar effects.
RAM_Applicability	Direct	
Safety Related	Yes	Based on ORPS report time to restart HVAC equipment.
Intrusive	No	
Restoration_Time	2	
Comments	Such an event would likely cause a longer delay during Phase 1 transfers in order to restart pumps and and make other necessary checks.	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1994-0023	**_20_dir_cause code**	1E	**_10a_discovery date**	4/27/94
Component_Type	RA	**Failure Mode Code**	ALR-SO-I	**_07_sys/building**	242-A Evaporator; vessel ventilation system
_14_title of occurrence	SPURIOUS TRIP OF VESSEL VENTILATION SYSTEM RESULTS IN EVAPORATOR SHUT-DOWN AND PARTIAL DUMP OF CA1 FEED TO TANK 241-AW-102				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

A routine setpoint test of the vessel ventilation beta/gammacontinuous air monitor (CAM) sent a spurious shutdown signalto the Monitor and Control System (MCS). This resulted inthe securing of vessel ventilation, breaking vacuum, thesecuring of reboiler steam and the shutting off the PB-1recirculation pump. Approximately 2000 gallons of the 25000gallons of CA1 vessel contents had dumped back to feed tank102-AW before the control room operator bypassed the PB-1shutdown interlock action to secure the dump.

On 4/27/94, at 1015, numerous facility alarms were receivedsimultaneously, indicating a complete facility shutdown hadoccurred. This included a rapid loss of CA1 vessel vacuumwhen the vacuum breaker opened on interlock. The controlroom operator took immediate action to bypass the PB-1recirculation pump shutdown interlock. This action stopsthe eight minute countdown timer to CA1 vessel dump back tothe feed tank. However, the command was not properly inputinto the computer and the countdown timer continued to run.This condition went unnoticed by the control room operatorfor 28 minutes, during which time follow up actions were inprogress. This delay resulted in a total of 2000 gallons ofCA1 vessel contents being dumped back to feed tank 102-AW.The facility was placed in a shutdown line-up and a critiquewas held to determine causes and possible corrective actions. The direct cause of the event was determined to bea loss of vessel ventilation caused by a spurious shutdownsignal. This signal was sent to the MCS during a routinetest of the beta/gamma CAM alarm setpoint.Prior to restart of the facility, the software interlockfunction associated with RI-VVB/G (beta/gamma CAM highradiation alarm, analog signal) was removed.The responsible Facility Manager for this report is W. E.Ross, (509) 373-4565. The name appearing on page one asFacility Manager is for data transmittal purposes only.

Provide Lessons Learned for Hanford personnel.*26b#1 TARGETED ACTION COMPLETION DATE1994/05/24*26c#1 ACTUAL ACTION COMPLETION DATE1994/05/24*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONReview PM/CBRS requirements on other instrumentation todetermine if similar problems exist.*26b#2 TARGETED ACTION COMPLETION DATE1994/05/28*26c#2 ACTUAL ACTION COMPLETION DATE1994/05/28 *26d#2 REVISED ACTION COMPLETION DATE*26a#3 CORRECTIVE ACTIONProvide training for Evaporator and Maintenance personnel sothat they may better understand the instruments and theassociated interlocks.*26b#3 TARGETED ACTION COMPLETION DATE1994/05/28*26c#3 ACTUAL ACTION COMPLETION DATE1994/05/28*26d#3 REVISED ACTION COMPLETION DATE

The direct cause of this event was an Equipment/MaterialProblem/Electrical or Instrument Noise. A spike on thebeta/gamma radiation alarm signal was caused by testing.Troubleshooting by an instrument technician indicated theactuation of the alarm setpoint test button resulted in anincrease in the MCS indication. The MCS indication exceededthe interlock setpoint which resulted in shutdown of theexhauster.The root cause of this event is an inadequate or defectivedesign. The MCS applies a smoothing or averaging functionto the incoming signal from the alarm setpoint test button.This prevents spurious shutdowns due to a spike in thesignal. This smoothing function takes the previous readingand the current reading and averages the two to obtain thenew value. Therefore, the longer the setpoint button isheld in, the closer the MCS value will approach the setpointvalue. Eventually, the MCS value will reach the setpointvalue and cause the interlock to activate, shutting down theexhauster.

PLG EVALUATION

Failure_Effect	Potential Delay	A spurious signal to the various tank ventilation system components is possible and would create some delay in the transfer process.
RAM_Applicability	Indirect	
Safety Related	Yes	Final actions including additional training needed one month to complete. It is likely that the evaporator was placed back into operations before then.
Intrusive	No	
Restoration_Time		
Comments	None	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1994-0029	**_20_dir_cause code**	1A	**_10a_discovery date**	5/16/94
Component_Type		**Failure Mode Code**	HA-SAMPLE	**_07_sys/building**	241-AN-107/Riser 1A

_14_title of occurrence GRAB SAMPLING DEVICE DROPPED IN AN-107 RISER DUE TO SUPPORT LINEBREAKING

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 05/04/94 at 1120 hours, during a sampling process, a grabsampling device was dropped in tank AN-107 riser #1A whenthe sampling device supporting line broke. This wasreported to plant management and DOE-RL on 05/04/94, but wasdetermined not to be a reportable condition at that time.The responsible Facility Manager for this report is R. Ni,(509) 373-0132. The name appearing as Facility Manager onpage one of this report is for data transmittal purposesonly.

On 5/4/94, a critique was held to determine causes andcorrective actions.On 5/12/94, the line supporting the sampling device wasredesigned in order to help prevent recurrence or thisevent. Also, the design of the mechanism for opening thesample bottle in deep sludge was redesigned.On 5/13/94, the dropped sampling device and connectingequipment were recovered, and the sampling task completed.On 5/16/94, after further deliberations, it was determinedthat the incident should be reported into the ORPS database.

Corrective actions beyond those listed in section #18 arenot required.*26b#1 TARGETED ACTION COMPLETION DATE 1994/05/16*26c#1 ACTUAL ACTION COMPLETION DATE1994/05/16*26d#1 REVISED ACTION COMPLETION DATE
The direct cause of this event is a failed part. The cableused to lower the sampling device parted, allowing thesampling device and a portion of the cable to fall into thetank.The root cause is an inadequate design. Sampling from deepsludge was not a factor in the design of the currentsampling device, which was designed for sampling of thelighter liquid above the layer of sludge. As a result, thecable used to lower the sampling device was not sufficientlystrong to be used for sampling in deep sludge.During a critique of the event, it was noted that the properwork plan (TFPE-YP-0168) was used and that it contained noapparent deficiencies. It was also noted that the samplingoperation in general was satisfactory. A sample was to betaken from deep within the sludge at the tank bottom. Dueto the depth from which the sample was to be taken, and theweight of the layer of sludge, it was difficult to removethe stopper of the sample bottle. Several attempts todislodge the stopper were made, one of which exerted enoughforce to sever the cord supporting the sample bottle.The sampling device has been redesigned using stronger cableand an opening mechanism that is easier to operate in deepsludge.

PLG EVALUATION

Failure_Effect	Insignificant	Sampler broke off and fell into tank. Sampling assumed to not be on the critical path, as report states no impact on operations.
RAM_Applicability	Indirect	
Safety Related	No	Time to recover the sampling device from the tank.
Intrusive	Yes	
Restoration_Time	216	
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1994-0033	**_20_dir_cause code**	1E	**_10a_discovery date**	6/3/94
Component_Type		**Failure Mode Code**	HAEDMXXXN	**_07_sys/building**	241-AP Tank Farm ventilation
_14_title of occurrence	241-AP PRIMARY EXHAUSTER SHUTDOWN DUE TO CONTROL POWER BREAKER TRIP				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 6/3/94, maintenance work was being performed per WorkPackage EE-94-580 to replace DPIS-18 and DPIS-20. These pressure switches are across the secondary HEPA filters forthe K2-5-1 and K2-5-2, respectively. Power to thesepressure switches is provided from two sources: (1) theindividual annulus fan MCC, and (2) the control powerbreaker #1 in Panel E. Breaker #1 supplies control power tocomponents in both the K2 Annulus Exhaust System and the K1Primary Exhaust System. Therefore, the control power (110V) had to be left on so that the K1 Primary Exhaust Systemwould continue to operate. The individual annulus fan MCCbreakers were turned off and lock & tagged. Theseconditions were specifically covered in the Pre-Job Safety Meeting.The Instrument Tech removed the electrically 'hot' leadsfrom the Differential Pressure Indicating Switches (DPIS) terminal strip and taped them with electrical tape. Theterminal strip is protected by a plexiglass cover that has ametal grommet-lined opening to allow wire insertion/removal.As the taped wires were being removed from inside theterminal strip housing, the 'hot' wire touched the metalgrommet, shorted, and tripped Breaker #1. Consequently, at1305 hours the K1 Primary Exhaust Fan shutdown, the HighPressure Alarm activated, and personnel exited the farm.The responsible Facility Manager for this report is W. E.Ross, (509) 373-4565. The name appearing on page one asFacility Manager is for data transmittal purposes only.

On 6/3/94 at 1320 hours, Operations and Health Physicspersonnel entered the farm in protective clothing and resetBreaker #1 in Panel E. The K1 Primary Exhaust Fan was thenrestarted.On 6/3/94 at 1350 hours, 241-AP Tank Farm wasradiologically surveyed and released. No contaminationwas found.On 6/3/94 at 1430 hours, a Critique meeting to determinecauses and corrective actions was held with all involvedparties.On 6/3/94 at 1530 hours, all notifications werecompleted.On 6/3/94 at 1545 hours, DPIS-18 and DPIS-20 werereplaced with new switches and the K2-5-1 AnnulusExhaust Fan was placed in service.

Complete Work Package #EE-91-00463, "K1-K2 AP ExhausterControl Power Revision". This will electrically separatethe K1 exhaust system from the K2 exhaust system.Action: W. E. Ross, Manager, 242-A/LERF/241-AP/AWOperations Org. 7C800 *26b#1 TARGETED ACTION COMPLETION DATE1995/04/28*26c#1 ACTUAL ACTION COMPLETION DATE 1994/12/07*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONDiscuss this event at TWRS Waste Tank Maintenance SafetyMeeting to ensure that appropriate personnel are aware ofthe proper actions for and implications of handling "hot"electrical leads.Action: K. W. Leliefeld, Manager, Waste Tank MaintenanceOrg: 7CB00 *26b#2 TARGETED ACTION COMPLETION DATE1994/09/01*26c#2 ACTUAL ACTION COMPLETION DATE 1994/10/24*26d#2 REVISED ACTION COMPLETION DATE

The direct cause of this event was a short in the system.When the Instrument Technician removed the taped "hot" leadfrom the terminal strip, it accidentally touched the metalgrommet-lined opening of the plexiglass cover, resulting ina short that tripped the control power breaker.A contributing cause of this event is inattention to detail.Several wraps of tape should have been used on the "hot"lead. It is accepted practice to use a sufficient amount oftape in order to prevent accidental shorting.The root cause of this event is a design problem. Severalcomponents of the K1 primary exhaust system and the K2annulus exhaust system are fed from the same breaker. Thismakes it impossible to electrically isolate these componentsfrom each other. The K1 system and the K2 system should befed from separate breakers, thus allowing for electricalisolation of one system from the other.

PLG EVALUATION

Failure_Effect	Potential Delay	This event could occur during Phase 1 operations with similar effects.
RAM_Applicability	Direct	
Safety Related	Yes	Based on ORPS report to replace switches and restore system to operation.
Intrusive	No	
Restoration_Time	2.5	
Comments	None	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1994-0040	**_20_dir_cause code**	7B	**_10a_discovery date**	8/5/94
Component_Type	EF	**Failure Mode Code**	External - Loss of Power	**_07_sys/building**	Ventilation/East Area Tank Farms
_14_title of occurrence	LOSS OF VENTILATION TO EAST AREA TANK FARMS DUE TO SUB-CONTRACTORSEVERING A POWER LINE				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 8/05/94 at 1020 hours, shift operations received noticeconcerning a loss of electrical power to East Area TankFarms. Electric Utilities reported the severing of anelectrical cable by a sub-contractor performing excavationwork on the CO-18 project, outside the 200 East area. Thiscaused a power loss to the lines feeding the East Area TankFarms.The loss of electricity resulted in the loss of ventilationin 241-AN, AW, AP, C, 244-BX, and 244-CR. It also caused aloss of all remote tank monitoring capabilities.

Upon loss of ventilation all personnel were instructed toevacuate all the tank farms.On 8/05/94 at 1153 hours, Electric Utilities restored powerto East Tank Farms. Ventilation was restored to allfacilities. Health Physics performed surveys of affected farms which revealed no spread of contamination. Farms weresubsequently released.The 241-C Tank Farm exhauster, surface levels andtemperature indications were off-line for about two hours.The exhauster was restarted and the readings at theradiation survey touch points were stable. The temperatureand surface level indications returned to the pre-poweroutage readings.

Corrective actions beyond those listed in section #18 arenot required.*26b#1 TARGETED ACTION COMPLETION DATE 1994/08/05*26c#1 ACTUAL ACTION COMPLETION DATE1994/08/05*26d#1 REVISED ACTION COMPLETION DATE
The Corrective Action Evaluation Group (CAEG) hasestablished a Priority Planning Grid (PPG) value of 6.05 forthis event (see PPG Risk Evaluation Form #ORT-94-0040).Therefore, in accordance with current policy, an informalroot cause analysis using Simple Methodology was performed.The direct and root cause of this event is the loss ofelectrical power to East Tank Farm facilities. This was theresult of an electrical cable being damaged by asubcontractor performing excavation work outside the 200 East Area near the Liquid Effluent Retention Facility(LERF).

PLG EVALUATION

Failure_Effect	Potential Delay	Electic cable severed by sub-contractor performing excavation work. The loss of power resulted in loss of ventilation in 241-AN, AW, AP, C, 244-BX, and 244-CR.
RAM_Applicability	Direct	Also lost all remote tank monitoring capabilities
Safety Related	Yes	Power restored, ventilation restored to all facilities. HPT performed surveys of affected farms, no spread of contamination.
Intrusive	No	
Restoration_Time	1.5	
Comments	241-C Tank Farm exhauster, surface levels, and temperature indicators were off-line for about two hours.	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1994-0049	**_20_dir_cause code**	2A	**_10a_discovery date**	9/13/94
Component_Type	Alarm by-pass switch	**Failure Mode Code**	Ventilation Loss	**_07_sys/building**	Ventilation/241-SY/K1-Exhauster
_14_title of occurrence	LOSS OF PRIMARY VENTILATION AT 241-SY TANK FARM; DID NOT EXCEED OSR PRESSURIZATION LIMITS				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 9/13/94 at 0913 hours, Instrument Technicians wereperforming monthly Component Based Recall System (CBRS) datasheet, Loop YSYS1, Seq 1, "Continuous Air Monitor (CAM)functional checks at 241-SY Tank Farm". A source was placedin the detector chamber in the CAM to test the highradiation level alarm. Prior to installing the source, thehigh alarm bypass switch was not engaged. The reason theswitch was not engaged was due to the CBRS data sheet notspecifying activating the bypass switch prior to performingthe check. The CAM high radiation alarm activated whichcaused the K-1 exhauster in SY-Farm to shut down. A tankpressurization alarm was received and all personnelevacuated the farm. While in the process of exiting the farm, a senior operator, understanding why the exhauster waslost, restarted the exhauster and the pressurization alarmcleared. The accountable Facility Manager for this report is James H.Wicks Jr., (509) 372-3919. The name appearing as FacilityManager on page one of this report is for data transmittalpurposes only.

On 9/13/94 at 0922 hours, shift operations verified hydrogenand ammonia levels in the Data Acquisition and ControlSystem (DACS) trailer (Hydrogen, 77 parts per million (PPM)and Ammonia, 57 PPM). Health Physics Technicians (HPT's)donned Self-contained breathing apparatus (SCBAs) to entertank farm for radiological survey.On 9/13/94 at 0940 hours, a Respiratory Technician (RT) andan operator were sent into SY farm to verify breathing zoneswhich were below limits for hydrogen, ammonia and organics.On 9/13/94 at 1000 hours, HPT's and RT's reported allsurveys were within limits.On 9/13/94 at 1010 hours, operations verified all steps ofthe Emergency Response Guide (ERG) were complete andreleased SY farm. Additionally, operators entered SY farmto verify proper operation of K1 exhauster and to take tanktemperatures.On 9/13/94 at 1130 hours, shift operations reviewed 101-SYtank temperatures and all were normal. The SY farm tankpressures were as follows: 101-SY - -0.1" water gauge (wg) 102-SY - -0.25" wg 103-SY - -0.2" wgOn 9/13/94 at 1150 hours, shift operations notified Technical Support to verify SY farm pressurization time. SYfarm has had 11 minutes of pressurization time over the pastyear. The 40 hour pressurization OSR limit has not beenexceeded.On 9/13/94 at 1330 hours, operations held a critique withall parties involved to review the event for lessons learnedand to discuss corrective actions necessary to preventrecurrence.

Revise CBRS data sheet to include a step, just prior to thehigh alarm test, to have personnel push the bypass switch,and to add a caution sign stressing that the bypass switchneeds to be pressed.Action: James M. Hay, West Tank Farms Instrumentation Maintenance ManagerOrg. Code: 7CB92*26b#1 TARGETED ACTION COMPLETION DATE1994/10/01*26c#1 ACTUAL ACTION COMPLETION DATE1994/10/01*26d#1 REVISED ACTION COMPLETION DATE*26a#2 CORRECTIVE ACTIONPerform a walkdown of all CBRS data sheets in tank farms.Ensure that any necessary revisions required to meet thatparticular Tank Farms unique test are incorporated into thedata sheets.Action: James M. Hay, West Tank Farms InstrumentationMaintenance ManagerOrg. Code:7CB92*26b#2 TARGETED ACTION COMPLETION DATE1994/10/01 *26c#2 ACTUAL ACTION COMPLETION DATE1994/10/01*26d#2 REVISED ACTION COMPLETION DATE*26a#3 CORRECTIVE ACTIONGenerate a J-3 to create a caution sign to be placed on theannunciator panels to stress pressing the bypass switchprior to the high alarm test.Action: James M. Hay, West Tank Farms InstrumentationMaintenance Manager Org. Code: 7CB92*26b#3 TARGETED ACTION COMPLETION DATE1994/09/30*26c#3 ACTUAL ACTION COMPLETION DATE1994/09/30*26d#3 REVISED ACTION COMPLETION DATE*26a#4 CORRECTIVE ACTION The following were stressed in a safety meeting. Theimportance for personnel while performing functionals, is toread each step and then to perform that step and sign it offbefore proceeding onto the next step. The importance ofevaluating and understanding the system response whenperforming any action was also stressed.Action: James J. Klos, West Tank Farm Operations ManagerOrg. Code: 7C900*26b#4 TARGETED ACTION COMPLETION DATE1994/10/21*26c#4 ACTUAL ACTION COMPLETION DATE1994/10/21*26d#4 REVISED ACTION COMPLETION DATE

On 9/22/94, the Corrective Action Evaluation Group (CAEG)convened and established a Priority Planning Grid (PPG)value of 5.0010 for this event. Therefore, in accordancewith current policy, a simple methodology root causeanalysis will be conducted. The direct and root cause is an inadequate procedure. Theprocedure did not specify activating the bypass switch priorto performing the high pressure alarm test.The contributing cause has been attributed to personnelerror/inattention to detail. The personnel performing thefunctional checks did not read, perform, and sign each stepon the CBRS data sheet before moving onto the next step.

PLG EVALUATION

Failure_Effect	Potential Delay	Farm evacuated following tank pressurization alarm. SCBAs required to enter, normal access restored and work allowed to continue after one hour
RAM_Applicability	Direct	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

Safety Related	Yes	Alarm cleared while exiting facility. One hour wait period observed
Intrusive	Yes	
Restoration_Time	1	
Comments		

ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1994-0055	**_20_dir_cause code**	1A	**_10a_discovery date**	10/1/94
Component_Type	EF POWER	**Failure Mode Code**	MDF-FR-H	**_07_sys/building**	241-AW Tank Farm; primary tank ventilation

_14_title of occurrence LOSS OF PRIMARY TANK VENTILATION AT 241-AW TANK FARM

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 10/01/94 at 2222, the primary ventilation system in241-AW Tank Farm shutdown, causing a loss of confinementventilation in the AW Tank Farm. The 242-A Evaporator,which was operating at the time, was shutdown toRecirculation with Vacuum. Several attempts were madeto restart the ventilation fans with no success.The responsible Facility Manager for this report is W. E.Ross, (509) 373-4565. The name appearing on page one ofthis report as Facility Manager is for data transmittalpurposes only.

Ventilation was verified to be secured by checkingpressure strip chart recorders.An Operator and Health Physics Technician (HPT) enteredfarm to attempt to restart the fans.The Evaporator was shutdown to Recirculation withVacuum. No other transfers were underway.On 10/1/94, at 2341, the fans would not restart, andCrafts personnel were called for troubleshooting andrepair.On 10/2/94, at approximately 0200, HPT's completedradiological surveys of the tank farm with no release of contamination being detected. The farm was then releasedfor normal operations.On 10/2/94, at 0227, Crafts personnel found the controlpower breaker for the primary exhaust fans in the trippedposition. The breaker was reset and the K1-5-2 fan restarted.

Develop a work package to electrically separate the K1exhaust system from the K2 exhaust system.Action: W. E. Ross, Mgr., 242-A/LERF/241-AP/AW Tank FarmOrg. 7C800*26b#1 TARGETED ACTION COMPLETION DATE1995/05/30*26c#1 ACTUAL ACTION COMPLETION DATE1996/04/23*26d#1 REVISED ACTION COMPLETION DATE

The loss of primary tank ventilation was the result of atripped control power breaker. The circuit breaker inquestion is a small 20 amp, molded case breaker very similarto ones that are used in a home. This breaker feeds controlpower to the primary (K1) exhaust fans control circuits.During troubleshooting efforts, it was noted that the loadthrough the breaker was 5.2 amps. This indicates that thenormal load through the breaker was not responsible for thebreaker tripping. It is possible that a voltage spike/transient occurred that caused the breaker to trip.Since this event occurred no other problems have occurredwith this breaker.The root cause is an inadequate design. Several componentsof the K1 primary exhaust system and the K2 annulus exhaustsystem are fed from the same power source. This makes itimpossible to electrically isolate these components fromeach other. The K1 system and the K2 system should bepowered from separate breakers, thus allowing for electricalisolation of one system from the other.

PLG EVALUATION

Failure_Effect	Potential Delay	Loss of control sysytem power, causes loss of ventilation, breaker tripped.
RAM_Applicability	Direct	
Safety Related	Yes?	Time for breaker to be identified and reset.
Intrusive	No	
Restoration_Time		
Comments	BRKR1 CA Done? Both primary and annulus components fed by same breaker.	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1994-0073	**_20_dir_cause code**	1A	**_10a_discovery date**	12/27/94
Component_Type		**Failure Mode Code**	EXTERNAL	**_07_sys/building**	SX-104/Liquid Observation Well
_14_title of occurrence	HIGH FLAMMABLE GAS AND AMMONIA LEVELS DISCOVERED IN SX-104 LIQUIDOBSERVATION WELL (LOW) DURING RISER LINER INSTALLATION ACTIVITIES				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 12/27/94 Work Package 2W-94-00737, "241-SX Install LOWProtective Sleeve in 104", was being performed. Thisconsisted of installing a 6 mil. thick tear resistant innerlining sleeve in the existing failed LOW. The linerfacilitated monitoring of the LOW to provide a liquid levelmeasurement of the tank.Per the work package instructions the LOW was allowed tobreathe through a HEPA filter glovebag for 30 minutes uponopening the riser. A WHC Respiratory Protection Technicianbegan monitoring the area as soon as the flange wasloosened. After the 30 minute time limit, the vapor levelswere still reading above the established limit. Personnelwere then instructed to proceed to step 7.15 of the workpackage. This consisted of reinstalling the flange andsealing the LOW. When this was completed, Draeger tubesamples were drawn confirming high ammonia levels. At 1230 hours, shift operations was notified by Surveillancethat 241-SX-104 LOW readings were 102% of the Lower Flammability Limit (LFL) and ammonia levels were at >700PPM. OSD-T-151-00030 requires the ceasing all workactivities if the vapor space flammable gas concentration isequal to or greater than 20% of the LFL. The recoveryaction is to stop all work and return the equipment to asafe configuration.Upon the initial opening of the riser, the LFL registered102%, ammonia at >700 PPM, and organics at 63 PPM.Local area readings outside the glovebag through-out theoperation were well below all limits.

All associated work was halted and the site was thenreturned to pre-job conditions.

A standing order was issued to ensure gas sampling isperformed prior to opening the LOW.*26b#1 TARGETED ACTION COMPLETION DATE1994/12/29*26c#1 ACTUAL ACTION COMPLETION DATE1994/12/29*26d#1 REVISED ACTION COMPLETION DATE
The LOW developed a leak, resulting in the accumulation oftank vapors inside the LOW.The LOW is used for determining interstitial liquid in thetank. Two work plans are being developed to resolve theinability to determine interstitial liquid level. Surfacelevels can be and are maintained using surface levelmonitoring equipment. Surface level indications remainnormal.

PLG EVALUATION

Failure_Effect	Potential Delay	High Flammable Gas generated USQ evaluation requirement prior to restart of workl
RAM_Applicability	Direct	
Safety Related	Yes	Unk but LONG USQ evaluation must be performed prior to any work being attempted.
Intrusive		
Restoration_Time		
Comments		

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--WHC-TANKFARM-1995-0007	**_20_dir_cause code**	1E	**_10a_discovery date**	1/18/95
Component_Type		**Failure Mode Code**	MDF-FR-H	**_07_sys/building**	K1-4-1/SY-Farm/P-28 Exhauster
_14_title of occurrence	LOSS OF PRIMARY TANK VENTILATION AT 241-SY TANKFARM DUE TO INADVERTENT SHUTDOWN OF THE P-28 EXHAUSTER				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 01/18/95 at 2230 hours, the ventilation system at 241-SYTank Farm was switched from the K1-4-1 exhauster to the P-28 exhauster. At approximately 2240 hours, a Health PhysicsTechnician (HPT) making scheduled continuous air monitor(CAM) checks, noted that there was no flow through thebeta/gamma CAM on the P-28 exhauster. The HPT toggled theCAM power control switch to "off", then back to "on"position and then noticed the record sampler flow indicationdropping off and the P-28 exhaust fan begin shutting down.The HPT then checked the three vacuum pumps but could notsee any problem.Operations is unsure of what caused the shut down. A spikemay have possibly been received on the beta/gamma CAM as itwas toggled off and on. The HPT doesn't believe any vacuumpump hoses were pinched off at any time during this problem.The lowest the pressures got on the SY tanks was -0.20".The accountable Facility Manager for this report is Dave P.Reber, (509) 372-3919. The name appearing as FacilityManager on page one of this report is for data transmittalpurposes only.

Operations personnel taking readings in the instrumentbuilding observed that the tank pressure in the SY farm wasdropping and shortly there-after, the tank farm highpressure alarm activated (2241 hours). The operatorsimmediately went to the P-28 exhauster and restarted it.All systems appeared to be normal.As a precaution, the cover blocks on the pits were checkedfor loose (smearable) radioactive contamination (none wasdetected) and the operational monitoring frequency wasincreased for the P-28 exhauster until stable operation wasassured.

Troubleshoot the exhauster to determine the cause of theequipment malfunction.*26b#1 TARGETED ACTION COMPLETION DATE1995/01/19*26c#1 ACTUAL ACTION COMPLETION DATE1995/01/19*26d#1 REVISED ACTION COMPLETION DATE
The cause of this event has not been determined.Operations, HPT's and maintenance craft personnel went intothe field and under controlled conditions, duplicated theactions taken by the HPT to determine if any of the causedthe unit to shut down. None of the actions caused theexhauster to shut down.

PLG EVALUATION

Failure_Effect	Potential Delay	A spurious signal to the various tank ventilation system components is possible and would create some delay in the transfer process.
RAM_Applicability	Direct	
Safety Related	Yes	The ORPS reprot did not indicate the time required to investigate the event restart the HVAC.
Intrusive	No	
Restoration_Time		
Comments	None	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

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ORPS INFORMATION

_01_orps_number	RL--PHMC-TANKFARM-1997-0009	**_20_dir_cause code**	4B	**_10a_discovery date**	1/23/97
Component_Type		**Failure Mode Code**	See comments	**_07_sys/building**	241-SY P-28 EXHAUSTER

_14_title of occurrence 241-SY TANK FARM PRIMARY EXHAUSTER SHUTDOWN

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

At 1000 hrs, on January 23, 1997, it was reported to the on-duty shift operations manager (SOM) that the 241-SY P-28backup exhauster had shutdown, activating the pressurizationalarm. An operator, who was at the ventilation pad whenthis occurred, immediately restarted the exhauster. Stripcharts recording the tank vacuums indicate tank 102-SYmomentarily read +0.1" wg. It has been determined that theaccuracy of this gauge is + or - .4"wg. The exhauster wasrestarted within one minute of shutting down.

An operator at the exhauster pad taking field readings,realized that the exhauster was shutting down andimmediately pushed the restart button, successfully bringingthe exhauster back on line.The SOM, a Health Physics Technician and an Instrument technician entered the farm and acknowledged and cleared thepressurization alarm.Health Physics Technicians and an Industrial HealthTechnician and were sent to the farm to perform surveys ofthe area. Results of these surveys indicated that there wasno release to the atmosphere.The Double Shell Tank Farm Manager and the Team Coordinatorwent to the exhauster pad to determine the cause of theshutdown. (See section 23, Description of Cause)

The immediate actions taken by the personnel were adequate.No further corrective actions are necessary.*26b#1 TARGETED ACTION COMPLETION DATE1997/03/05*26c#1 ACTUAL ACTION COMPLETION DATE1997/03/05*26d#1 REVISED ACTION COMPLETION DATE

The direct and root cause of this event has been determinedto be an inadequate design. Static pressure gauge PS-2, inthe exhauster instrument cabinet, reads tank vacuum bycomparing the pressure in the vent header and atmosphericpressure. The high vacuum set point on this instrument is-4.0" wg. The reading on the gauge prior to shutting downwas at -2.8" wg. When the door to the cabinet was shut, thecabinet became slightly pressurized, raising the indicationon PS-2 past the high vacuum set point.

PLG EVALUATION

Failure_Effect	Exhauster restarted within one minute of shutting down. Contamination surveys results indicated that there were no release to the atmosphere. Event being considered an isolated incident
RAM_Applicability	
Safety Related	
Intrusive	
Restoration_Time	
Comments	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

ORPS INFORMATION

_01_orps_number	RL--PHMC-TANKFARM-19 97-0083	**_20_dir_cause code**	1E	**_10a_discovery date**	10/8/97
Component_Type	PDAH	**Failure Mode Code**	ALR-SO-I	**_07_sys/building**	241-SX, 296-S-15 "Sludge Cooler" exhauster
_14_title of occurrence	LOSS OF 241-SY 296-S-15 "SLUDGE COOLER" EXHASUTER				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On October 8, 1997 at 0546 hours, the West Tank Farm ShiftOperations Manager (SOM) was notified by the Computer Automated Surveillance System (CASS) operator that the 241-SXtank farm, 296-S-15 "Sludge Cooler" exhauster "shut down" alarm had been received. Loss of this exhauster requiredentry into Limiting Condition for Operation (LCO) 3.2.2 action statement.LCO 3.2.2 requires that Single Shell Tank (SST) ventilationsystem be operable. This requirement is specified to providea method to minimize the accumulation of flammable gas byproviding air flow through the tank vapor space. The LCO requirement for loss of SST ventilation is to restore theactive ventilation system to operable status immediately ANDverify concentration of flammable gas is less than 25 percentof the LFL in the affected tank once per 7 days.Upon notification of the sludge cooler shutting down, the SOMimmediately sent an operator and a Health Physics Technician(HPT) to attempt to restart the sludge cooler. At 0615 hours,the north fan of the sludge cooler was started. This fanoperated for approximately 5 minutes and then shut down. Thesouth fan was then started, which ran for approximately 2minutes before shutting down. Because both fans would notcontinue to run, the shift manager directed the operator andHPT not perform any further attempts to restart the exhausteruntil instrument technicians could determine the cause for theshutdown.Trouble shooting efforts by the instrument technicians couldnot determine the initial cause of the sludge cooler shutdown.At 1020 hours, instrument technicians determined that as aresult of the sludge cooler shutting down, the lowdifferential pressure (dp) switch DPS-11 activated and had notcleared. The low dp not clearing prevented the exhauster fromrestarting. Instrument technicians cleared the low dpinterlock and restarted the exhauster.

At 0546 hours, CASS notified the west area SOM that they hadreceived a 241-SX exhasuter shutdown alarm. Entered into LCO 3.2.2 action statement.At 0550 an operator and an HPT were dispatched to verify thealarm and attempt to restart the sludge cooler if necessary.The exhauster had shutdown and attempts to return the systemto operable were unsuccessful. The exhauster outage promptedentry into the LCO 3.2.2 action statement.The exhauster was restarted at 1020 hours. LCO 3.2.2condition "Active ventilation system is inoperable" no longerapplicable. (exit LCO 3.2.2 condition)This event was categorized as an off normal occurrence1.E.3.a.

Trouble shooting efforts by the instrument technicians couldnot determine the cause of the exhauster shutdown. Theexhauster was restarted and has continued to operate normally.No further corrective actions are necessary.*26b#1 TARGETED ACTION COMPLETION DATE1997/11/17*26c#1 ACTUAL ACTION COMPLETION DATE1997/11/17*26d#1 REVISED ACTION COMPLETION DATE

The direct and root causes of this event have been determinedto be electrical/instrument noise. Instrument technicianswere sent to the field to perform troubleshooting on theexhauster and to determine the cause of the shutdown. Thistroubleshooting activity did not identify any apparentproblems with the exhauster. The exhauster was restarted andcontinued to operate normally. Based on the results of thetroubleshooting, the shutdown has been attributed toelectrical/instrument noise.

PLG EVALUATION

Failure_Effect	Potential Delay	Similar pressure switches exist on Phase 1 systems. It is assumed that an equivalent priority on maintenance would be given during Phase 1 transfers.
RAM_Applicability	Direct	
Safety Related	Yes	Based on ORPS report to troubleshoot system, repair, and place back into operation.
Intrusive	No	
Restoration_Time	5	
Comments	None	

Table C-3. Sample Evaluations of ORPS Database for Applicability to WFDS Activities

Sheet 28 of 28

ORPS INFORMATION

_01_orps_number	RL--PHMC-TANKFARM-1998-0009	**_20_dir_cause code**		**_10a_discovery date**	1/24/98
Component_Type	EF	**Failure Mode Code**	MDF-FR-H	**_07_sys/building**	241-SY Double-Shell Tank Primary Exhauster
_14_title of occurrence	UNPLANNED SHUTDOWN OF DOUBLE-SHELL TANK PRIMARY EXHAUSTER RESULTS IN PRESSURIZATION ALARM - NO OTHER ADVERSE IMPACTS ON THE FACILITY				

1) _16_description **2) _19_immediate cor actn** **3) _26_Corrective Action** **4) _23_cause narrative**

On 01/24/98, at approximately 1730 hours, a pressurizationalarm was received at the Computer Automated SurveillanceSystem (CASS) indicating the 241-SY Double-Shell Tank'sprimary exhauster had likely shutdown. The CASS Operatorinformed the shift manager who dispatched operators toinvestigate. Operators found the exhauster had shutdown, andrestarted it at 1806 hours.

At 1806 hours on 1/24/98, the exhauster was restarted.At 1816 hours, the tank's pressurization alarms cleared.Subsequent radiological surveys did not find any abnormalconditions.

*26b#1 TARGETED ACTION COMPLETION DATE*26c#1 ACTUAL ACTION COMPLETION DATE*26d#1 REVISED ACTION COMPLETION DATE

PLG EVALUATION

Failure_Effect	Potential Delay	Primary Exhauster fails, back-up did not startup
RAM_Applicability	Direct	
Safety Related	Yes	Exhauster restarted without problems, alarms cleared, radiological surveys do not find abnormal conditions
Intrusive	No	
Restoration_Time	1	
Comments		

Table C-4. Example of Information Available in JCS Database

Sheet 1 of 12

Work Package: 2W-93-00296 **ORIG DATE:** 3/30/93 **FIELD WORK COMPL DATE:** 6/28/93

WORK ITEM TITLE: 241-SY-101 SHMS-L SAMPLE PUMP REPLACEMENT

Work Description:

OBJECTIVE: REPLACE SAMPLE PUMP 241-SY-101 SHMS-J. QC HOLD *** QC VERIFY SC/IL 1, 2, AND 3 MATERIAL ON BOM SUPPLEMENT ZERO. INITIAL STAMP AND DATE BOM UPON VERIFICATION. *** ********** SEE J4-A FOR RESOLUTION
********** OBJECTIVE: REPLACE SAMPLE PUMP P-01LSY-1-1. PREQUISITES: 1) IS HAZARDOUS WASTE GENERATED
FROM OR BY THIS WORK? YES/NO/NA_____ PIC/SUP_____DATE/TIME_____
2) ARE APPROPRIATE WASTE CONTAINERS AVAILABLE TO PERFORM THIS WORK AND ARE THEY AT THE JOB SITE? YES/NO_____ PIC/SUP_____DATE/TIME_____ ******NOTE****** DAILY THE PIC/SUPERVISOR SHALL RECORD ON THE J-5 THAT ALL WASTES HAVE BEEN PROPERLY DISPOSED OF PER WHC-IP-0842,
SECTION 16.1, CHAPTER 9 AND/OR TO-100-052. SIGN AND DATE THE J-5 DAILY. SCOPE: 1. OPEN CIRCUIT BREAKER CB-3L1/3L2 AND TAG WITH A DO NOT OPERATE TAG (REFER TO H-2-87278, SH. 1). PERFORM ZERO ENERGY CHECK AT PUMP J-BOX, LOCATED ON THE PUMP STAND, TO ENSURE NO POWER. 2. DISCONNECT TUBING AND WIRING AT THE PUMP.
3. REMOVE EXISTING PUMP AND INSTALL NEW PUMP. 4. CONNECT TUBING AND WIRING. 5. REQUEST OPERATOR REMOVE
TAGS. 6. TAG OLD PUMP WITH IDENTIFICATION/LOCATION, PLACE IN DOUBLE PLASTIC BAG AND STORE IN GMS-1 BUILDING. 7. PIC/SUPERVISOR VERIFY THAT JOB SITE HAS BEEN CLEANED UP AND THAT ALL WASTES HAVE BEEN DISPOSED OF PROPERLY. MAINT. PIC_____DATE/TIME_____ OPERATIONS
PIC_____DATE/TIME_____ 8. OPERATIONS VERIFICATION
PIC_____DATE/TIME_____ 9. PIC ENSURE HOUSEKEEPING IS PERFORMED.
_____ _____ SIGNATURE DATE . N/A QC INVOLVMENT - NONE
RETEST SATISFACTORY N/A QC VERIFY RETEST N/A J-8 FUNCTIONAL RETEST COMPLETE N/A

Work Package: 2W-93-00306 **ORIG DATE:** 4/5/93 **FIELD WORK COMPL DATE:** 5/4/93

WORK ITEM TITLE: 241-TX CALIBRATE 101-TX LIT

Work Description:

********** WORK HAZARD IDENTIFICATION AND PRECAUTIONS 1. WORK WILL BE
DONE ON 120 VOLT AC ENERGIZED CIRCUIT. 2. BE AWARE THAT ELECTRIC SHOCK HAZARD EXISTS. 3. BE AWARE THAT
ELECTRIC ARC HAZARD EXISTS FROM SHORTING ENERGIZED WIRES TO GROUND. 4. USE GOOD ELECTRICAL WORK PRACTICES. 5. USE AC VOLTMETER/INDICATOR TO IDENTIFY ENERGIZED WIRES. 6. USE BUDDY SYSTEM.
********** OBJECTIVE: CALIBRATE/REPAIR UNIT AT 101-TX.
**********CAUTION********** HIGH RADIATION FIELD MAY BE PRESENT ANY TIME THE PLUMMET
IS RAISED INTO THE SIGHT GLASS. ********** SCOPE: 1) WORK REQUIRES RAISING THE PLUMMET INTO THE SIGHT GLASS, OR IF THE PLUMMET IS ALREADY IN THE SIGHT GLASS; AN HPT. MUST BE
PRESENT TO DETERMINE DOSE RATES. 2) TROUBLESHOOT LIT PER 6TF-035 TO DETERMINE REQUIRED REPAIRS, IF NEEDED.
3) REPAIR LIT PER 6TF-035. 4) FOLLOWING REPAIRS, PERFORM FUNCTIONAL CHECK PER 6-TF-035. IF UNIT PASSES CHECK,
RECORD LIQUID LEVEL. _____ _____ _____ SIGNATURE LIQUID LEVEL DATE 4.1) REMOVE DEFICIENCY TAG AND PUT IN PACKAGE. 5) IF CALIBRATION IS NEEDED PERFORM 6-TF-058 AND DOCUMENT FINDINGS ON PISCES JOB CARD TX101-1. 6) IF FLUSHING IS NEEDED, PERFORM FLUSH PER TO-020-420.
APPROVAL OF OPERATIONS WILL BE NEEDED PER PROCEDURE. 7) IF FURTHER REPAIR, PARTS NEEDED, OR IF CONTAINMENT IS TO BE BROKEN; RETURN THE PACKAGE TO PIC FOR A J-7 AND/OR A NEW RWP. 8) DOCUMENT ALL WORK
PERFORMED ON THE ENCLOSED CRAFT RESOURCE/USAGE LOG. 9) PIC ASSURE HOUSEKEEPING IS PERFORMED.
_____ _____ SIGNATURE DATE
---------- J-8 FUNCTIONAL RETEST COMPLETE N/A

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-93-00427 **ORIG DATE:** 5/7/93 **FIELD WORK COMPL DATE:** 7/13/93

WORK ITEM TITLE: 241-S T/S AND REPAIR RAMP 1 FAILED TO RESPOND,

Work Description:

OBJECTIVE: REPAIR 241-S RAMP #1. NOTIFY SHIFT MANAGER OF WORK TO BE DONE. SEE COMMENTS SECTION FOR WORK HAZARD. SCOPE: 1. TROUBLE SHOOT AND REPAIR FAILED RAMP #1. 2. DOCUMENT ALL WORK PREFORMED AND MATERIAL USED ON J-5 CRAFT USAGE LOG. (IF PARTS ARE REQUIRED USE ONLY LIKE/ KIND). 3. IF PARTS ARE REQUIRED
FOR REPAIR PIC TO VERIFY PARTS USED. 4. RETEST: PREFORM PISCES S0078 #2. PISCES S0078-2 QC INVOLVMENT - NONE
RETEST SATISFACTORY FRANKLIN,FP 07/13/93 QC VERIFY RETEST N/A J-8 FUNCTIONAL RETEST COMPLETE AHRENS,JL
07/14/93

Work Package: 2W-93-00573 **ORIG DATE:** 6/9/93 **FIELD WORK COMPL DATE:**

WORK ITEM TITLE: 241-SY REPAIR 101-SY VIDEO CAM. PAN & TILT

Work Description:

PREREQUISITE: *NOTE* THE PIC/SUPERVISOR OF THE JOB OR TASK SHALL PERFORM THE FOLLOWING. 1.0 IS HAZARDOUS WASTE GENERATED FROM OR BY THIS WORK. YES/NO/NA_____/_____
PIC/SUP SIGN DATE/TIME 2.0 ARE THE APPROPRIATE WASTE CONTAINERS AVAILABLE TO PERFORM THIS TASK
AND ARE THEY AT THE JOB SITE YES/NO/NA_____/_____ PIC/SUP
DATE/TIME
3.0 DAILY PIC/SUPERVISOR RECORD ON THE J-5 THAT ALL WASTE HAS BEEN PROPERLY DISPOSED OF. *SIGN AND DATE J-5* COMPLETION OF JOB: PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL
WASTE HAS BEEN PROPERLY DISPOSED OF: OPERATIONS VERIFY, SIGN AND DATE THE J-5
********** WORK SCOPE: 1.DECONTAMINATE PAN AND TILT ASSEMBLY PER OPERATIONS PIC INSTRUCTIONS. 2.HEALTH PHYSICS TECHNICIANS WILL SURVEY AND ESTABLISH ACCEPTABLE LEVELS
OF CONTAMINATION BEFORE REPAIRS ARE MADE TO THE PAN AND TILT ASSEMBLY. 3.WHEN DECONTAMINATION HAS BEEN COMPLETED CRAFTS WILL MAKE REPAIRS PER MAINTENANCE PROCEDURE 6-TF-069 PERFORM STEP 7.5.2 ONLY AS
DIRECTED BY THE SY-101 IN-TANK CAMERA COGNIZANT ENGINEER OR HIS DELEGATE. 4.CRAFTS WILL RECORD ALL ACTIONS TAKEN TO COMPLETE REPAIRS THE J-5 FORM. 5.PERFORM HOUSEKEEPING AT COMPLETION OF JOB. THISM,PACKAGE CANCELED WORK WILL BE PERFORMED UNDER PACKAGE 2W-93-00267/W J. E. PERHAM.

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-93-00750 **ORIG DATE:** 8/4/93 **FIELD WORK COMPL DATE:** 5/25/95

WORK ITEM TITLE: 241-SX REPLACE PIPING NORTH CAB. SLUDGE COOLER STEAM

Work Description:

SCOPE: REPAIR NORTH STEAM SUPPLY CABINET ON THE SX SLUDGE COOLER (296-S-15), WHICH SUPPLIES STEAM TO THE NORTH STEAM COIL AND TO THE SOUTH SIDE STEAM CABINET: 1. REMOVE PIPING, FITTINGS ETC. PER ECN'S 2. CLEAN UP CABINET 3. INSTALL INSULATION TO INSIDE OF CABINET WALLS 4. RE-INSTALL PIPING, CONTROL VALVES AND GAGE PER ECNS'. 5. SHEET/METAL WORKERS REPAIR CABINET 6. PERFORM LEAK TEST PER APPROVED MAINT WORK PROC. 7-GN-083. 7. DOCUMENT WORK SEE J4A FOR RESOLUTION:

SCOPE: REPAIR NORTH STEAM SUPPLY CABINET ON THE SX SLUDGE COOLER (296-S-15), WHICH SUPPLIES STEAM TO THE NORTH STEAM COIL AND TO THE SOUTH SIDE STEAM CABINET. 1. REMOVE PIPING ETC PER ECN'S. 2. CLEAN UP CABINET 3. INSTALL INSULATION TO INSIDE OF CABINET WALLS 4. RE-INSTALL PIPING, TEMP CONTROL VALVES AND GAGE PER ECNS'. 5. LABEL ALL VALVES PER ECN 162545 6. SHEET/METAL WORKERS REPAIR CABINET 7. PERFORM LEAK TEST PER APPROVED MAINT WORK PROC. 7-GN-083. 8. DOCUMENT WORK PREREQUISITE: *NOTE* THE PIC/SUPERVISOR OF THE JOB OR TASK SHALL PERFORM THE FOLLOWING: 1. A PRE-JOB SAFETY MEETING HAS BEEN CONDUCTED UTILIZING THE PRE-JOB SAFETY MEETING CHECKLIST AND THE JOB HAZARD ANALYSIS. _DONITHAN,MG_____ __11-4-93__ SIGNATURE DATE 2. PIC/CRAFT MANAGER SHALL BE IN ATTENDANCE DURING THE PERFORMANCE OF THIS WORK. 3. THE WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. DONITHAN,MG_____ _11-8-93____ PIC/CRAFT MANAGER SIGNATURE DATE SUGGESTED LOCK AND TAG: CLOSE STEAM SUPPLY VALVE LOCATED IN NORTH EAST CORNER OF 241-SX FARM (INSIDE FENCE) AND VALVES AT THE PRESSURE REDUCING STATION LOCATED BETWEEN 244-S AND 241-S-151 DIV BOX. INSTALL LOCK AND TAG. (QC) VERIFY 3Q MAT'L ON BOM SUPPL 1. STAMP AND DATE BOM FOR MAT'L ACCEPTANCE. _____WERNER,PA_____/_____11-8-93 QC DATE **SHOP WORK** 1. CALIBRATE PRESSURE GAGE (0-160) ECN162545 PER 06-TF-054. 2. MAKE UP TAGS FOR VALVE IDENTIFICATION, ECN 162545 AND 176882. LABEL VALVES PER HS-BS- 0015. TYPE 10, 1/8" HIGH CHARACTERS. TAGS: STM-V-1, STM-V-2, STM-V-3, STM-V-4, STM-V-5, STM-V-6, STM-V-7, STM-V-8 CND-V-1, CND-V-2, CND-V-3, CND-V-4, CND-V-5. TCV-1-1. **FIELD WORK:** 1. PRIOR TO STARTING WORK, VERIFY DOUBLE VALVE PROTECTION AND LOCK AND TAG ARE IN PLACE. __TUCKER,RP_____/_11-8-93_____ LOCK AND TAG CUSTODIAN DATE 2. AT THE NORTH STEAM CABINET, REMOVE ALL PIPING, VALVES AND GAGE, WHICH REQUIRE REPLACEMENT. CLEAN INSIDE OF CABINET AND PREP THE CABINET FOR INSTALLATION OF INSULATION. **NOTE** TAKE CARE NOT TO LOSE THE THE DEFIENCY TAG. THE TAG IS RE- QUIRED TO BE PLACED IN THE PACKAGE WHEN WORK IS COMPLETE. (INSULATOR) 3. INSULATE INSIDE OF CABINET AND DOORS WITH 1" ARMAFLEX, USING 520 GLUE AND FINISH WITH WHITE RUBATEX COATING. (MSDS NO. FOR 520 GLUE NO. 10034 AND FOR RUBATEX COATING NO. 19736) 3.A. AFTER GLUE ON SEAMS HAS DRIED PER MANUFACTURES RE- COMMENDATIONS, APPLY FINISH IN TWO COATS ALLOWING FIRST COAT TO DRY PRIOR TO APPLICATION OF SECOND COAT. 4. INSTALL NEW PIPING, VALVES, TCV-1-1, GAGE, TRAPS, STRAINERS AND TAGS AS SHOWN ON ECNS' 162545, 162550, 153934, 162547 604401 & 176882. (VALVE TAG NUMBERS SHOWN ON 176882) 5. REPLACE THE TI-1-1 (TEMPERATURE INDICATOR) PER ECN 162550 AND 604401. (SHEET/METAL) 6. SHEET/METAL CRAFTSMAN REPAIR CABINET. (FRONT CENTER SECTION HAS FALLEN OFF) (QC REQUIRED FOR MAINT. PROC. 7-GN-083) 7. WHEN STEAM BECOMES AVAILABLE: (STEAM MAY BE VALVED OUT AT PRESSURE REDUCING STATION DUE TO MAKING STEAM LEAK REPAIRS) REF WORK PACKAGE 91-1447 "PRES REDUCING STA. REPAIRS" REMOVE LOCK AND TAG. PERFORM LEAK TEST PER 7-GN-083 (STEAM IS PRESENTLY OFF UNTIL THE PRESSURE REDUCING STATION REPAIRS ARE COMPLETE) NORMAL OPERATING PRESSURE TO THE STEAM COILS IS 75 TO 90 PSI. **NOTE** DO NOT TURN STEAM ON TO SYSTEM UNTIL THE NORTH COIL HAS BEEN REPLACED. REF: 91-544, "REPLACE NORTH COIL" (QC HOLD) 7.A QC WITNESS INITIAL SERVICE LEAK TEST PER 7-GN-083. _____/_____/_____ QC STAMP DATE NCR# AFTER LEAK TEST IS COMPLETE, RETURN SYSTEM TO NORMAL OPER- ATION. (STEAM PRESSURE BETWEEN 75 TO 90 PSIG) REMOVE THE CALIBRATION STICKER FROM THE GAGE AND REPLACE IT WITH A "INDICATION ONLY" STICKER. _____ _____ PIC/MGR DATE 8. VERIFY THE DEFIENCY TAG IS REMOVED AND PLACED IN THE WORK PACKAGE.
PIC_____DATE_____ 9. DOCUMENT ON THE J5, EACH DAY THIS WORK PACKAGE IS
WORKED, ALL WORK PERFORMED, MATERIALS USED AND PROBLEMS ENCOUNTERED WHILE PERFORMING WORK. COMPLETION OF JOB: PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL WASTE HAS BEEN PROPERLY CONTAIN- ERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) /WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. OPERATIONS VERIFY AND SIGN AND DATE THE J-5. QCI REQUIRED WHILE PERFORMING RETEST PER 7-GN-083 QC INVOLVMENT - VERIFY RETEST SATISFACTORY N/A QC VERIFY RETEST N/A J-8 FUNCTIONAL RETEST COMPLETE N/A

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-93-00882 **ORIG DATE:** 9/23/93 **FIELD WORK COMPL DATE:**

WORK ITEM TITLE: 242-S TRBSHT/REPR RAW WTR & STM HI RAD ALA G13

Work Description:

OBJECTIVE: TROUBLE/SHOOT ANN. G WINDOW #13 AT 242-S. (RAW WATER AND STEAM LINE RADIATION HI (RA-SP-1) SE
J4-A FOR RESOLUTION. PREREQUISITES: IF REQUIRED CONDUCT A PRE-JOB SAFETY MEETING USING THE PRE-JOB SAFETY MEETING FORM, INCLUDE A HANFORD JOB HAZARD ANALYSIS IF NEEDED. _____ _____ SIGNATURE DATE THE WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _____ _____ PIC/CRAFT MANAGER DATE NOTE>> USE GUIDANCE FROM WHC-4-3, E-2 AS THIS WORK WILL REQUIRE WORKING NEAR ENERGIZED CIRCUITS. (120V) SCOPE: POST WORK REQUIREMENTS: 1. PIC/SUPERVISOR
RECORD ON THE J-5 THAT JOB SITE HAS BEEN CLEANED AND ALL WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) /WHC-IP-O842, SECT 16.1 (NON-RADIOACTIVE), AS APPLICABLE. QC INVOLVMENT - NONE

Work Package: 2W-94-00022 **ORIG DATE:** 1/4/94 **FIELD WORK COMPL DATE:**

WORK ITEM TITLE: 241-SY REWIRE LEAK DETECTORS

Work Description:

OBJECTIVE: REWIRE LEAK DETECTORS AT 241-SY VALVE PIT AND FLUSH PIT TO REFLECT DRAWING. SEE J-4A FOR RESOLUTION 1. PREREQUISITE: *NOTE* THE PIC/SUPERVISOR OF THE JOB OR TASK SHALL PERFORM THE FOLLOWING:
1.1 IF REQUIRED, CONDUCT A PRE-JOB SAFETY MEETING USING THE PRE-JOB SAFETY MEETING FORM. INCLUDE A HANFORD JOB HAZARD ANALYSIS IF NEEDED. 1.2 THE WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _____ _____ PIC/CRAFT MANAGER SIGNATURE DATE 1.3 USE GUIDANCE FROM WHC-4-3, E-2 AS THIS WORK WILL REQUIRE WORKING NEAR ENERGIZED CIRCUITS OF 220 VOLTS. SCOPE: 2. TROUBLESHOOT WIRING PROBLEMS WITH LEAK
DETECTOR FLUSH PITS A AND B, AND VALVE PITS A AND B. THE LEAK DETECTORS ARE NOT WIRED IN THE SEQUENCE
REFLECTED ON DRAWING H-2-37735 SHEET 2, REV. 8. 3. LOCK & TAG LEAK DETECTORS WHEN IDENTIFICATION IS COMPLETE OR AS NEEDED. 4. REWIRE LEAK DETECTORS AND LABLE CONDUCTORS AT SPLICES TO CONFORM WITH DRAWING. JUMPER WIRES MAY BE USED TO RELOCATE WIRES ON TERMINAL STRIPS IF NECESSARY WITH IDENTICAL TYPE
AND SIZE OF WIRE. (WIRE AND BUTT SPLICES FROM SHOP STOCK) QC VERIFY! 4.1 VERIFY DESIGN CONFIGURATION. VERIFY LEAK DETECTOR WIRING PER H-2-37735 SH.2, REV.8. _____ _____ QC SIGNATURE DATE 5. REMOVE LOCK & TAGS AND PERFORM FUNCTIONAL TEST USING CBRS CARDS SY054, SY055, SY036, AND SY037. QC WITNESS! 5.1 QC WITNESS FUNCTIONAL TEST. SIGN BLOCK NUMBER 20 OF J-4 UPON SATISFACTORY COMPLETION OF TEST. 6. POST WORK REQUIREMENTS: 6.1 PIC/SUPERVISOR RECORD ON THE J-5 THAT
THE JOB SITE HAS BEEN CLEANED AND ALL WASTE HAS BEEN PROPERLY CONTAIN- ERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) /WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. PERFORM FUNCTIONAL TEST USING CBRS CARDS SY054, SY055, SY036, AND SY037. QC WITNESS FUNTIONAL TEST OF CBRS. QC INVOLVMENT -
WITNESS

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-94-00473 **ORIG DATE:** 4/8/94 **FIELD WORK COMPL DATE:**

WORK ITEM TITLE: 242-S REPLACE 1C AND 2D BRKRS ON C8-S8 SWGR

Work Description:

RESOLUTION: SEE J4-A. 1 SCOPE: 1.1 INSTALL NEW BREAKERS IN COMPARTMENTS 1C AND 2D AT 242-S IN SWITCHEGEAR C8-S8. 2 DESCRIPTION: 2.1 REMOVE BREAKER FROM COMPARTMENT 1C (600A). 2.2 INSTALL NEW BREAKER IN COMPARTMENT 1C (600A). 2.3 INSTALL NEW BREAKER IN COMPARTMENT 2D (300A). 3 REFERENCED DOCUMENTS: 3.1 H-2-46424 SH 1 REV 8 3.2 H-2-46424 SH 2 REV 2 4 PERMITS AND SPECIAL PROCEDURES: 4.1 N/A
5
MATERIALS AND EQUIPMENT REQUIRED: 5.1 300A BREAKER 5.2 600A BREAKER 6 PREREQUISITES: 6.1 IS A PREJOB SAFETY MEETING REQUIRED? PIC INITAL APPROPRIATE BLOCK. YES_____ NO_____ IF PREJOB IS REQUIRED,
CONDUCT A PREJOB SAFETY MEETING UTILIZING PREJOB SAFETY MEETING CHECKLIST. 6.2 IS A JOB HAZARD ANALYSIS
CHECKLIST REQUIRED? PIC INITIAL APPROPRIATE BLOCK. YES_____ NO_____ IF JHA IS REQUIRED, FILL IT OUT COMPLETELY AND INSURE IT IS SIGNED BY INDUSTRIAL HYGIENE. 6.3 THE WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES.
_____ _____ PIC/CRAFT MANAGER DATE 7 SPECIFIC WORK INSTRUCTIONS:
7.1 OPEN CLOSED BREAKERS ON MCC-E-001 IN 242-S TO UNLOAD BREAKER "1C". RECORD CLOSED BREAKERS ON CRAFT USAGE LOG SHEET. _____ _____ PIC SIGNATURE DATE 7.2 IF NECESSARY, POSITION THE AUTO TRANSFER SWITCH, F8-ATSZ TO EMERGENCY POWER. THIS WILL PROVIDE POWER TO PANEL "D" AND KEEP
PANEL "C" (ALARMS) ACTIVE (THE TRANSFER SWITCH IS POWER SEEKING AND CANNOT BACKFEED C8-S8 BREAKER 2D,
AND IT'S DESIGNED TO WORK UNDER LOAD). 7.3 OPEN BREAKER "1C" AT C8-S8 AND REMOVE. 7.4 INSTALL NEW BREAKER (600A) IN COMPARTMENT "1C". 7.5 PIC TO VERIFY CORRECT BREAKER IS INSTALLED. _____ _____ PIC SIGNATURE DATE 7.6 INSTALL NEW BREAKER (300A) IN COMPARTMENT "2D". 7.7 PIC TO VERIFY
CORRECT BREAKER IS INSTALLED _____ _____ PIC SIGNATURE DATE 7.8 ENERGIZE BREAKER "1C", CLOSE ALL BREAKERS AT MCC THAT WERE OPENED IN STEP #1, DOCUMENT ON J5. 7.9 IF NECESSARY,
ENERGIZE BREAKER "2D" (AUTOMATIC TRANSFER SWITCH "F8-ATSZ" SHOULD SWITCH TO NORMAL POWER). 8 RESTORATION ACTIONS: 8.1 PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL
WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 9 POST-MAINTENANCE TESTING: 9.1 DOCUMENT WORK PERFORMED AND ANY
PROBLEMS ENCOUNTERED ON J-5. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 CHECK FOR PROPER VOLTAGE AT 242-S MCC-E-OO1 AND AT THE AUTOMATIC TRANSFER SWITCH "F8-ATSZ". SEE RETEST J4-A QC INVOLVMENT - NONE QC
VERIFY RETEST N/A

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-94-00749 **ORIG DATE:** 7/6/94 **FIELD WORK COMPL DATE:** 7/25/94

WORK ITEM TITLE: 241-SX 701SX #1 COMPRESSOR AIR LEAK

Work Description:
***** SEE J-4A FOR RESOLUTION **** 1 SCOPE: 1.1 Replace head gasket on middle cylinder of #1 Ingersoll-Rand Air Compressor. 1.1.1 The Head Gasket, second from the top, is leaking air. 1.1.2 Replace both head gaskets. New Gaskets are in the maint shop at 272-WA. 2 DESCRIPTION: 2.1 Lock and Tag Air Compressor #1 and #2 Elect. 2.2 Lock and Tag discharge from Receiver Tank. 2.3 Bleed air from Receiver tank. 2.4 Remove and Replace head gaskets. 2.5 Remove Locks and Tags. 2.6 Run unit for leak check. 2.7 Return System to Operations. 3 REFERENCED DOCUMENTS: 3.1 Refer to Parts List for Type 30 Model 10T3NLME15, Ingersoll-Rand for breakdown. 4 PERMITS AND SPECIAL PROCEDURES: 4.1 N/A 5 MATERIALS AND EQUIPMENT REQUIRED: 5.1 2-27 Part Number 30294193 Gasket, Airhead-Low Pressure. 5.2 2-32 Part Number 37007747 Gasket, Airhead- Top/Bottom 5.3 Portable Air Compressor. 5.3.1 CAUTION: Sludge Cooler will shut down if Portable Air Compressor is not utilized. 6 PREREQUISITES: 6.1 IF REQUIRED CONDUCT A PRE-JOB SAFETY MEETING USING THE PRE-JOB SAFETY MEETING FORM, INCLUDE A HANFORD JOB HAZARD ANALYSIS IF NEEDED. 6.2 THE WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _DONITHAN,MG_____ __7/25/94_____ PIC/CRAFT MANAGER DATE 6.3 Station Portable Air Compressor outside of 241-SX-701 and hook into system. 6.4 Suggested Lock and Tag: 6.4.1 On control panel "CP-SX-001" in 241- SX-701 bld. Place disconnect Switch "DS-SX-001 for CMP-SX-001" to the "OFF" Position and Lock and Tag. 6.4.2 On control panel "CP-SX-002" in 241- SX-701 bld. Place disconnect Switch "DS-SX-002 for CMP-SX-002" to the "OFF" Position and Lock and Tag. 6.4.3 Place Discharge Valve "241-SX-701-V-1" temp tag #W-0194 to the "CLOSED" Position and Lock and Tag. 6.4.4 Bleed Air Pressure from Receiver Tank. 6.5 Refer to Pressure Gages. Pressure to be at "0" PSIG before taking lines loose or loosening bolts. 7 SPECIFIC WORK INSTRUCTIONS: 7.1 Disconnect air lines on top of Air-Head. 7.2 Remove bolts from Head. 7.3 Replace gaskets. 7.4 Reassemble Unit. 8 RESTORATION ACTIONS: 8.1 PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 9 POST-MAINTENANCE TESTING: 9.1 DOCUMENT WORK PERFORMED AND ANY PROBLEMS ENCOUNTERED ON J-5. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 Remove Locks and Tags. 10.2 Disconnect Portable Air Compressor. 10.3 Return Electrical Disconnects and Discharge Valve on #1 and #2 241-SX-701 Air Compressors to Operational condition. 10.4 Start Compressor #1 "CMP-SX-001". 10.5 Perform Leak Check of Gasket Areas and Air Lines. AFTER REPAIR, RUN COMPRESSOR AND CHECK FOR AIR AND OIL LEAKS. QC INVOLVMENT - NONE RETEST SATISFACTORY DONITHAN,MG 07/25/94 QC VERIFY RETEST N/A J-8 FUNCTIONAL RETEST COMPLETE TUCKER,RP 07/28/94

Work Package: 2W-94-00808 **ORIG DATE:** 7/15/94 **FIELD WORK COMPL DATE:** 6/22/95

WORK ITEM TITLE: 242-T REPLACE LOW SIDE P/S ON A/C UNIT

Work Description:
SEE J4-A FOR RESOLUTION 1 SCOPE: 1.1 REPLACE LOW SIDE PRESSURE SWITCH FOR A/C CARRIER UNIT AT 242-T. 2 DESCRIPTION: 2.1 REMOVE DEFECTIVE LOW SIDE PRESSURE SWITCH FROM CONDENSING UNIT. 2.2 INSTALL NEW PRESSURE SWITCH IN CONDENSING UNIT. 3 REFERENCED DOCUMENTS: 3.1 H-2-74831 SHEETS 1 AND 2. 4 PERMITS AND SPECIAL PROCEDURES: 4.1 N/A 5 MATERIALS AND EQUIPMENT REQUIRED: 5.1 LOW SIDE PRESSURE SWITCH, 6 PREREQUISITES: 6.1 IS A PREJOB SAFETY MEETING REQUIRED? PIC INITIAL APPROPRIATE BLOCK. YES_____ NO_____ IF PREJOB IS REQUIRED, CONDUCT A PREJOB SAFETY MEETING UTILIZING PREJOB SAFETY MEETING CHECKLIST. 6.2 IS A JOB HAZARD ANALYSIS CHECKLIST REQUIRED? PIC INITIAL APPROPRIATE BLOCK. YES_____ NO_____ IF JHA IS REQUIRED, FILL IT OUT COMPLETELY AND INSURE IT IS SIGNED BY INDUSTRIAL HYGIENE. 6.3 LOCK AND TAG EQUIPMENT 7 SPECIFIC WORK INSTRUCTIONS: 7.1 VERIFY ZERO POWER IS PRESENT PRIOR TO STARTING WORK. 7.2 DISCONNECT WIRING FROM LOW SIDE PRESSURE SWITCH (ONE WIRE HAS ALREADY BEEN DISCONNECTED). 7.3 REMOVE DEFECTIVE LOW SIDE PRESSURE SWITCH. 7.4 INSTALL NEW LOW SIDE PRESSURE SWITCH. 7.5 RECONNECT WIRING TO LOW SIDE PRESSURE SWITCH. 7.6 REMOVE LOCK/TAG AND RETURN A/C UNIT TO NORMAL OPERATION. 8 RESTORATION ACTIONS: 8.1 PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 9 POST-MAINTENANCE TESTING: 9.1 DOCUMENT WORK PERFORMED AND ANY PROBLEMS ENCOUNTERED ON J-5. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 VERIFY A/C UNIT OPERATES PROPERLY. SEE J4-A QC INVOLVMENT - NONE RETEST SATISFACTORY BANCROFT,WD 06/22/95 QC VERIFY RETEST N/A J-8 FUNCTIONAL RETEST COMPLETE N/A

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-94-00829 **ORIG DATE:** 7/27/94 **FIELD WORK COMPL DATE:** 8/18/94

WORK ITEM TITLE: 244-TX REPLACE K-6 RELAY

Work Description:

SEE J4-A FOR RESOLUTION 1 SCOPE: 1.1 REPLACE DEFECTIVE ALARM RELAY K-6 AT 244-TX WITH REBUILT ALARM
RELAY FROM SHOP. 1.2 REPLACE RE-BUILT ALARM RELAY K-6 AT 244-TX WITH NEW RELAY WHEN RECEIVED. 2 DESCRIPTION: 2.1 RELAY WAS FOUND TO BE DEFECTIVE. REPLACE WITH REBUILT RELAY UNTIL NEW RELAY IS RECIEVED. 3 REFERENCED DOCUMENTS: 3.1 H-2-73818 SH 1 REV 10 H-2-73832 REV 3 H-2-85316 SH 2 REV 0 H-2-27280 REV 1 4 PERMITS AND SPECIAL PROCEDURES: 4.1 N/A 5 MATERIALS AND EQUIPMENT REQUIRED: 5.1
REBUILT RELAY/NEW RELAY 6 PREREQUISITES: 6.1 IF REQUIRED CONDUCT A PRE-JOB SAFETY MEETING USING THE
PRE-JOB SAFETY MEETING FORM, INCLUDE A HANFORD JOB HAZARD ANALYSIS IF NEEDED. 6.2 THE WASTE PLANNING
CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _DRAKULICH,KE_____ _8-1-94_____ PIC/CRAFT MANAGER DATE 7 SPECIFIC WORK INSTRUCTIONS: 7.1 REMOVE DEFECTIVE K-6 RELAY. 7.2 INSTALL NEW K-6 RELAY. 7.3 REPEAT STEPS 7.1 AND 7.2 WHEN NEW K-6 RELAY IS RECEIVED 8 RESTORATION ACTIONS: 8.1 PIC/SUPERVISOR RECORD ON THE J-5 THAT
THE JOB SITE HAS BEEN CLEANED AND ALL WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 9 POST-MAINTENANCE TESTING: 9.1 DOCUMENT WORK PERFORMED AND ANY PROBLEMS ENCOUNTERED ON J-5. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 PERFORM CBRS # 4T039 TO VERIFY PROPER OPERATION OF K-6 RELAY AND ASSOCIATED EQUIPMENT. SEE J4-A FOR RETEST QC INVOLVMENT - NONE RETEST SATISFACTORY YOUNGERMAN,SP 08/18/94 QC VERIFY RETEST N/A J-8 FUNCTIONAL RETEST COMPLETE OWEN,PL 08/23/94

Work Package: 2W-94-00888 **ORIG DATE:** 8/16/94 **FIELD WORK COMPL DATE:**

WORK ITEM TITLE: 241-SY REPLACE LEAK DETECTOR LIGHTS

Work Description:

1 SCOPE: 1.1 241-SY FLUSH PIT A AND B REPAIR LEAK DETECTOR 2 DESCRIPTION: 2.1 REPLACE ZONE LIGHTS 3
REFERENCED DOCUMENTS: 3.1 CBRS: SY054-1 AND SY055-1 3.2 DWGS: H2-37735 SH 2 REV 8 4 PERMITS AND SPECIAL PROCEDURES: 4.1 RWP: TF-001 REV 9 4.2 PRE-APPROVED PROCEDURES: 6-6F-055 5 MATERIALS AND EQUIPMENT REQUIRED: 5.1 2-ZONE LIGHTS 6 PREREQUISITES: 6.1 IF REQUIRED CONDUCT A PRE-JOB SAFETY MEETING USING THE PRE-JOB SAFETY MEETING FORM, INCLUDE A HANFORD JOB HAZARD ANALYSIS IF NEEDED. 6.2 THE
WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _____ _____ PIC/CRAFT MANAGER DATE 6.3 USE OF PERSONAL LOCKING DEVICES AUTHORIZED: YES_____ NO_____ _____ _____ PIC/SUPERVISOR DATE ISOLATION POINTS VERIFIED AND PERSONAL LOCKING DEVICES AUTHORIZED BY SHIFT OPERATION MANAGER: _____ _____ SOM DATE 7 SPECIFIC WORK INSTRUCTIONS:
7.1 REPLACE 241-SY FLUSH PITS A AND B ZONE LIGHTS PER PROCEDURE 6-6F-055 8 RESTORATION ACTIONS: 8.1 PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 9 POST-MAINTENANCE TESTING: 9.1 DOCUMENT WORK PERFORMED AND ANY PROBLEMS ENCOUNTERED ON J-5. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 PERFORM CBRS SY054-1 AND SY055-1

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-94-01137 **ORIG DATE:** 10/13/94 **FIELD WORK COMPL DATE:**

WORK ITEM TITLE: 241-SX REPAIR 101-SX THERMOCOUPLES

Work Description:

SCOPE: REPAIR 101-SX THERMOCOUPLES **********SEE J-4A FOR RESOLUTION********** 1 SCOPE: 1.1
REPAIR 101-SX THERMOCOUPLES 2 DESCRIPTION: 2.1 N/A 3 REFERENCED DOCUMENTS: 3.1 6-TF-191, REV 0, CHG 0 4 PERMITS AND SPECIAL PROCEDURES: 4.1 TF-002, REV 8 5 MATERIALS AND EQUIPMENT REQUIRED: 5.1
SHOP SPARE PARTS 6 PREREQUISITES: 6.1 PRE-JOB SAFETY MEETING IS REQUIRED. CONDUCT PRE- JOB SAFETY
MEETING UTILIZING PRE-JOB SAFETY MEETING CHECKLIST AND JOB HAZARD ANALYSIS CHECKLIST (JHA), INSURE INDUSTRIAL HYGIENE SIGNS JHA. PRE-JOB SAFETY MEETING CONDUCTED. _____ PIC SIGNATURE 6.2 THE
WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _____ _____ PIC/CRAFT MANAGER DATE 7
SPECIFIC WORK INSTRUCTIONS: 7.1 NOTIFY SHIFT OPERATIONS OF INTENT TO PERFORM TASK. 7.2 PERFORM 6-TF-191. 7.3 MAKE APPROPRIATE REPAIRS FROM DATA GATHERED PERFORMING 6-TF-191. SHOP SPARE PARTS WILL
BE USED FOR REPAIRS. 7.4 RETEST PER 6-TF-191. 7.5 NOTIFY SHIFT OPERATIONS OF COMPLETION OF TASK. 8 RESTORATION ACTIONS: 8.1 PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL
WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 9 POST-MAINTENANCE TESTING: 9.1 DOCUMENT WORK PERFORMED AND ANY
PROBLEMS ENCOUNTERED ON J-5. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 N/A . AS STATED IN 6-TF-191 QC INVOLVMENT - NONE QC VERIFY RETEST N/A

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-95-00139 **ORIG DATE:** 2/21/95 **FIELD WORK COMPL DATE:** 4/28/95

WORK ITEM TITLE: 244-U REPLACE FAILED BREAKER AND RELAYS

Work Description:

REPLACE FAILED 15A BREAKER FOR SUMP PUMP P-244-2 AND LUM RELAY FOR TRANSFER PUMP P-244. SEE J4-A FOR BALANCE OF RESOLUTION. 1 SCOPE: 1.1 REPLACE DEFECTIVE 15A BREAKER AND LAM RELAY FOR THE SUMP AND
TRANSFER PUMPS AND LAM METERS FOR BOTH PUMPS AT 244-U. 2 DESCRIPTION: 2.1 REPLACE 15A BREAKER FOR
PORTABLE SUMP PUMP P-244-U-2 AT 244-U. 2.2 REPLACE THE LAM RELAY FOR TRANSFER PUMP P-244-U-1 AT 244-U. 2.3 REPLACE LAM METERS FOR SUMP AND TRANFER PUMPS AT 244-U. 3 REFERENCED DOCUMENTS: TYPE: 3.1
H-2-73819 SH 1 REV 9 DWG 3.2 H-2-73820 SH 1 REV 6 DWG 3.3 6-TF-052 PROC 4 PERMITS AND SPECIAL PROCEDURES: 4.1 N/A 5 MATERIALS AND EQUIPMENT REQUIRED:
**********NOTES********** >
PARTS ARE BEING DETICATED FOR USE THROUGH THE FOLLOWING QC INSPECTIONS. > IF DAMAGE IS DETECTED ON ITEMS, QC SHALL IDENTIFY PROBLEMS ON AN NCR. ENGINEERING WILL RESOLVE ALL PROBLEMS PRIOR TO ITEM ACCEPTANCE. ********** *QC* 5.1 VERIFY TWO (2) AMP METERS, VISIPAK V508-5004, HOLD DC DIGITAL DISPLAY, 0-1 VDC INPUT. 5.1.1 METER PART # V508-5004 YES___ NO___ 5.1.2 DAMAGED:
YES___ NO___ NCR#_____ _____ _____ QC SIGNATURE DATE *QC* 5.2 VERIFY ONE (1) WESTINGHOUSE 600VAC, 3 POLE, 15 AMP, HOLD STYLE #2607D80G04, HMCP015EO, 15 AMP BREAKER. 5.2.1 15 AMP
BREAKER STYLE #2607D80G04, HMCP015EO. YES___ NO___ 5.2.2 DAMAGED: YES___ NO___
NCR#_____ _____ _____ QC SIGNATURE DATE *QC* 5.3 VERIFY FOUR (4) ACTION PAK MODEL 1624-6064,DUAL AC HOLD LIMIT-ALARM, 0-1VAC INPUT, 120 VAC POWER. INSTRUMENT. 5.3.1 MODEL #1624-6064 YES___ NO___ 5.3.2 DAMAGED YES___ NO___ NCR#_____ _____
_____ QC SIGNATURE DATE 6 PREREQUISITES: 6.1 IS A PRE-JOB SAFETY MEETING REQUIRED? PIC INITIAL
APPROPRIATE BLOCK. YES _____ NO _____ 6.1.1 IF PRE-JOB IS REQUIRED, CONDUCT A PRE-JOB SAFETY MEETING UTILIZING PRE-JOB SAFETY MEETING CHECKLIST. 6.2. IS A JOB HAZARD ANALYSIS CHECKLIST REQUIRED? PIC INITIAL
APPROPRIATE BLOCK. YES _____ NO _____ 6.2.1 IF JHA IS REQUIRED, FILL IT OUT COMPLETELY AND INSURE IT IS SIGNED BY INDUSTRIAL HYGIENE. 6.3 THE WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _____
_____ PIC/CRAFT MANAGER DATE **********NOTE********** THE STATMENT OF "STATION
PERSONNEL TO MONITOR DISCONNECT " IN STEPS 7.2 AND 8.3 OF PROC 6-TF-052, DOES NOT APPLY BECAUSE A PERSONAL LOCKING DEVICE WILL BE INSTALLED. ********** 6.4 USE OF PERSONAL LOCKING
DEVICES AUTHORIZED: YES_____ NO_____ _____ _____ PIC/SUPERVISOR DATE
6.4.1 ISOLATION POINTS VERIFIED AND PERSONAL LOCKING DEVICES AUTHORIZED BY SHIFT OPERATION MANAGER:
_____ _____ SOM DATE 7 SPECIFIC WORK INSTRUCTIONS:
**********NOTE********** THE FOLLOWING STEPS MAY BE WORKED IN ANY ORDER
********** 7.1 VERIFY ZERO ENERGY IS PRESENT PRIOR TO STARTING WORK. 7.2 DISCONNECT WIRING FROM DEFECTIVE LIMIT ALARM METER FOR TRANSFER PUMP P-244-U-1 AT 244-U. 7.3 REMOVE DEFECTIVE LIMIT ALARM METER FOR TRANSFER PUMP P-244-U-1. 7.4 INSTALL NEW LIMIT ALARM METER FOR TRANSFER PUMP P-244-U-1. 7.5 RE-CONNECT WIRING TO NEW LIMIT ALARM METER FOR TRANSFER PUMP P-244-U-1. 7.6 DISCONNECT WIRING FROM DEFECTIVE LIMIT ALARM METER FOR PORTABLE SUMP PUMP P-244-U-2 AT 244-U. 7.7 REMOVE DEFECTIVE LIMIT ALARM METER FOR PORTABLE SUMP PUMP P-244-U-2. 7.8 INSTALL NEW LIMIT ALARM METER FOR PORTABLE SUMP PUMP P-244-U-2. 7.9 RE-CONNECT WIRING TO NEW LIMIT ALARM METER FOR PORTABLE SUMP PUMP P-244-U-2. 7.10 REMOVE DEFECTIVE LIMIT ALARM MODULE FROM TRANSFER PUMP P-244-U-1 AT 244-U. 7.11 INSTALL NEW LIMIT ALARM MODULE FOR TRANSFER PUMP P-244-U-1. 7.12 DISCONNECT REQUIRED WIRING FROM 15 AMP BREAKER FOR PORTABLE SUMP PUMP P-244-U-2, IN MCC COMPARTMENT A2, AT 244-U. 7.13 REMOVE DEFECTIVE 15 AMP BREAKER, FOR PORTABLE SUMP PUMP P-244-U-2, IN MCC COMPARTMENT A2. 7.14 INSTALL NEW 15 AMP BREAKER FOR PORTABLE SUMP PUMP P-244-U-2 IN MCC COMPARTMENT A2. 7.15 RE-CONNECT WIRING TO NEW 15 AMP BREAKER FOR PORTABLE SUMP PUMP P-244-U-2 IN MCC COMPARTMENT A2. 7.16 PIC/SUPERVISOR RECORD ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 8 RESTORATION ACTIONS: 8.1 REMOVE LOCK AND TAG. 9 POST-MAINTENANCE TESTING: 9.1 PERFORM PROC 6-TF-052. 9.2 SUMP PUMP LAM RELAY SET POINTS: HI 10.6 AMPS & LO 4.0 AMPS. 9.3 TRANSFER PUMP RELAY SET POINTS: HI 38 AMPS & LO 14 AMPS. NOTE: ENGINEERING, RICH LARSON PROVIDED THE INFORMATION ON THE SET POINTS. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 N/A PERFORM PROC 6-TF-052. QC INVOLVMENT - NONE RETEST SATISFACTORY DRAKULICH,KE 04/28/95 J-8 FUNCTIONAL RETEST COMPLETE N/A

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-95-00229 **ORIG DATE:** 3/28/95 **FIELD WORK COMPL DATE:**

WORK ITEM TITLE: 241-SY REPAIR SERVICE PIT RADIATION MONITOR

Work Description:

1 SCOPE: 1.1 TROUBLESHOOT AND REPAIR SY SERVICE PIT RIAS. 2 DESCRIPTION: 2.1 TWO PROBLEMS; MONITOR FAILED AND DETECTOR UNDER WATER 3 REFERENCED DOCUMENTS: 3.1 WT-00660 PM/S DATA SHEET 3.2 SHOP CVI DATA 4 PERMITS AND SPECIAL PROCEDURES: 4.1 TF-002 REV 9 RWP 4.2 CONFINED SPACES ENTRY PERMIT 5 MATERIALS AND EQUIPMENT REQUIRED: 5.1 N/A 6 PREREQUISITES: 6:1 PRE-JOB SAFETY MEETING IS REQUIRED. CONDUCT PRE- JOB SAFETY MEETING UTILIZING PRE-JOB SAFETY MEETING CHECKLIST AND JOB HAZARD ANALYSIS CHECKLIST (JHA), INSURE INDUSTRIAL SAFETY SIGNS JHA. PRE-JOB SAFETY MEETING CONDUCTED.
_____ PIC SIGNATURE 6.2 THE WASTE PLANNING CHECKLIST HAS BEEN PROVIDED AND THE CORRECT WASTE CONTAINERS ARE AVAILABLE TO PERFORM THE WORK ACTIVITIES. _____
_____ PIC/CRAFT MANAGER DATE 6.3 LOCK AND TAG WATER SOURCE TO SERVICE PIT. 6.4 USE OF
PERSONAL LOCKING DEVICES AUTHORIZED: YES_____NO_____ _____
_____ PIC/SUPERVISOR DATE ISOLATION POINTS VERIFIED AND PERSONAL LOCKING DEVICES AUTHORIZED BY SHIFT MANAGER. _____ _____ SHIFT OPERATIONS MANAGER DATE 7 SPECIFIC WORK INSTRUCTIONS: 7.1 OPERATIONS ENSURE SERVICE PIT IS DRAINED OF WATER. PIC SIGNATURE_____ DATE_____ 7.2 NOTIFY SHIFT OPERATIONS AND CASS OF INTENT TO PERFORM TASK. 7.3 REMOVE COMPONENTS TO SHOP FOR TROUBLESHOOT/REPAIR 7.3.1 REMOVAL OF TECHNICAL ASSSOCIATES LOG RATEMETER AND PWR SUPPLY. 7.3.1.1 DEENERGIZE INSTRUMENT RACK (STANDARD POWER CORD ON REAR OF POWER SUPPLY MODULE) 7.3.1.2 REMOVE RATEMETER AND POWER SUPPLY FROM RACK. 7.3.2 REMOVAL OF DETECTOR AND PRE-AMP: 7.3.2.1 REMOVE ACCESS TO 241-SY SERVICE PIT 7.3.2.2 HI VOLTAGE TO THE DETECTOR HAS BEEN REMOVED BY REMOVING THE TECHNICAL ASSOCIATES POWER SUPPLY IN THE 271-SY INST.BLDG. PERFORM ZERO ENERGY CHECK TO ENSURE NO POWER TO THE DETECTOR. 7.3.2.3 AFTER THE SERVICE PIT ACCESS HAS BEEN OPEN FOR 30 MINUTES, HAVE A RESPRITORY PROTECTION TECHNICIAN SNIFF FOR AMMONIA AND OVM MONITORING AND SUFFICIENT OXYGEN IN THE PIT. 7.3.2.4 ONCE THE RESPIRATORY PROTECTION TECHNICIAN VERIFIES A BREATHABLE ATMOSPHERE, ENTER 241-SY SERVICE PIT, REMOVE THE GM TUBE AND ELECTRONICS FROM THE DETECTOR HOUSING BY REMOVING THE FOUR SCREWS AT THE REAR OF THE HOUSING. REMOVE THE PRE-AMP, LOCATED ON THE PIT WALL BEHIND THE DETECTOR. CAUTION: THE INTERNALS OF THE DETECTOR ARE HARD WIRED TO THE PLUG MOUNTED ON THE HOUSING END CAP. THE HOUSING END CAP IS A LEAD FILLED PLUG WHICH MUST REMAIN WITH THE INTERNAL
COMPONENTS 7.3.2.5 EXIT THE PIT AND REPLACE 241-SY SERVICE PIT ACCESS COVER. 7.4 TROUBLESHOOT AND REPAIR THE DETECTOR AND ELECTRONIC MODULES, AS REQUIRED, IN ACCORDANCE WITH THE SHOP CVI FILES AND STANDARD TROUBLESHOOTING PRACTICES 7.5 RETURNING SYSTEM TO SERVICE IN THE FIELD. 7.5.1 REPLACE DETECTOR: 7.5.1.1 REMOVE ACCESS TO 241-SY SERVICE PIT 7.5.1.2 AFTER THE SERVICE PIT ACCESS HAS BEEN OPEN
FOR 30 MINUTES, HAVE A RESPRITORY PROTECTION TECHNICIAN SNIFF FOR SUFFICIENT OXYGEN IN PIT. 7.5.1.3 ONCE
THE RESPIRATORY PROTECTION TECHNICIAN VERIFIES A BREATHABLE ATMOSPHERE, ENTER 241-SY SERVICE PIT, REINSTALL THE GM TUBE, ELECTRONICS AND THE END CAP. REINSTALL THE PRE-AMP ON PIT WALL. 7.5.1.4 EXIT THE PIT
AND REPLACE 241-SY SERVICE PIT ACCESS COVER. 7.5.2 REPLACE RATEMETER AND POWER SUPPLY IN THE INSTRUMENT RACK IN THE 271-SY INSTRUMENT BUILDING AND ENERGIZE EQUIPMENT. ALLOW APPROXIMATELY 30 MINUTE
WARMUP PERIOD. 7.6 NOTIFY SHIFT OPERATIONS AND CASS OF COMPLETION OF TASK 7.7 PIC/SUPERVISOR RECORD
ON THE J-5 THAT THE JOB SITE HAS BEEN CLEANED AND ALL WASTE PROPERLY CONTAINERIZED PER TO-100-052 (RADIOACTIVE/CONTAMINATED) / WHC-IP-0842, SEC. 16.1 (NON-RADIOACTIVE), AS APPLICABLE. 8 RESTORATION ACTIONS: 8.1 REMOVE LOCK AND TAG FROM WATER SOURCE TO SERVICE PIT 9 POST-MAINTENANCE TESTING: 9.1
PERFORM PM/S DATA SHEET, WT-00660. 10 OPERATIONAL FUNCTIONAL TEST: 10.1 N/A .

Work Package: 2W-96-00524 **ORIG DATE:** 5/22/96 **FIELD WORK COMPL DATE:** 7/8/96

WORK ITEM TITLE: 241-SY 101-SY FIC

Work Description:

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-96-00749 **ORIG DATE:** 7/16/96 **FIELD WORK COMPL DATE:** 7/19/96
WORK ITEM TITLE: 241-SY REPLACE EMPTY GMS-2 NITROGEN BOTTLE
Work Description:
REPLACE EMPTY PRE-PURIFIED, ULTRA-HIGH NITROGEN BOTTLE WITH SAME.

Work Package: 2W-96-01453 **ORIG DATE:** 12/17/96 **FIELD WORK COMPL DATE:** 12/20/96
WORK ITEM TITLE: 241-TX/TY TROUBLESHOOT AIR COMPRESSOR
Work Description:

Work Package: 2W-97-00126 **ORIG DATE:** 2/5/97 **FIELD WORK COMPL DATE:** 2/24/97
WORK ITEM TITLE: 241-TX REPAIR ELECTRICAL DIST. PANEL
Work Description:

Work Package: 2W-97-00178 **ORIG DATE:** 1/29/97 **FIELD WORK COMPL DATE:**
WORK ITEM TITLE: 241-UX-302A LEAK DETECTOR REPAIR
Work Description:
TROUBLESHOOT/REPAIR ALARM. IF PARTS ARE NEEDED, CONTACT PLANNING FOR BOM. IF LOCK AND TAG OR PLD IS
NEEDED, CONTACT PIC, PLANNING OR SHIFT MANAGER. 1. NOTIFY SHIFT OPERATIONS AND CASS OF INTENT TO PERFORM TASK. 2. TROUBLESHOOT AND REPAIR ALARM AS NEEDED. 3. NOTIFY SHIFT OPERATIONS AND CASS OF COMPELTION OF TASK.

Work Package: 2W-97-00182 **ORIG DATE:** 2/12/97 **FIELD WORK COMPL DATE:** 5/21/97
WORK ITEM TITLE: 241-SY REPLACE PAS-103-1
Work Description:
1. CALIBRATE NEW SWITCH PER PM/S DATA SHEET AND PROCEDURE. 2. NOTIFY SHIFT OPERATION AND CASS OF INTENT
TO PERFORM TASK. 3. VERIFY LOCK AND TAG INSTALLED AND PERFORM ZERO ENERGY CHECK ON WIRING FOR SWITCH. ********** USE OF LOCK & TAG WITHOUT CONTROLLING ORGANIZATION
LOCK & TAG AUTHORIZED: YES_____ NO_____ SINGLE POINT OF ISOLATION TO BE LOCKED OUT:
_____ _____ _____ PIC/SUPERVISOR
DATE ISOLATION POINT VERIFIED AND LOCK & TAG WITHOUT CONTROLLING ORGANIZATION LOCK & TAG AUTHORIZED BY SHIFT MANAGER. _____ _____ SHIFT OPERATIONS MANAGER
DATE JM HAY_____05-21-97_____ SAFETY CONDITION CHECK SATISFACTORY
********** 4. REMOVE FAILED SWITCH AND INSTALL NEW, CALIBRATED SWITCH.
5. REMOVE LOCK AND TAG AND PERFORM FUNCTION CHECK OF SWITCH. 6. NOTIFY SHIFT OPERATIONS AND CASS OF
COMPLETION OF TASK. .

Table C-4. Example of Information Available in JCS Database

Work Package: 2W-97-00323 **ORIG DATE:** 3/7/97 **FIELD WORK COMPL DATE:** 7/16/97

WORK ITEM TITLE: 272-WA FITTER SUPPORT FOR FEP DEFICIENCIES

Work Description:

FITTER REPAIRS LIST, BUT NOT LIMITED TO; 1. REPAIR LEAKING SHOWER HEADS IN MENS ROOM. 2. LUNCHROOM, FAUCET ON SINK (WHEN FACING SINK WALL IT ON THE RIGHT) DRIPS. REPLACE WASHERS ETC AS NEEDED. 3. REPLACE/REPAIR FAUCET ASSEMBLY ON THE LEFT HAND SINK. THE HANDLES WORK BACKWARDS. 4. REPAIR OLD WELD SHOP SINK. DOCUMENT REPAIRS ON J-5.

Work Package: 2W-97-00694 **ORIG DATE:** 6/3/97 **FIELD WORK COMPL DATE:** 6/4/97

WORK ITEM TITLE: 242-S TROUBLESHOOT/REPAIR PI-TK-1 FOR 244-S

Work Description:

Work Package: 2W-97-00739 **ORIG DATE:** 6/17/97 **FIELD WORK COMPL DATE:** 6/19/97

WORK ITEM TITLE: 244-TX REPLACE RAW WATER FILTER

Work Description:

1. NOTIFY SHIFT OPERATIONS OF INTENT TO PERFORM TASK. 2. VERIFY VALVE RW-7, LOCATED ON BACKSIDE OF F-1,
IS CLOSED. 3. CLOSE VALVE RW-6, LOCATED INLINE WITH F-1. 4. REPLACE F-1 FILTER WITH SHOP STOCK SPARE. 5. OPEN VALVE RW-6. 6. CHECK FOR ANY LEAKS AND TIGHTEN FITTINGS AS NEEDED. 7. LEAVE VALVE RW-7 CLOSED AS
FOUND. 8. NOTIFY SHIFT OPERATIONS OF COMPLETION OF TASK. .

Work Package: 2W-97-00920 **ORIG DATE:** 8/7/97 **FIELD WORK COMPL DATE:** 8/8/97

WORK ITEM TITLE: 241-SY TROUBLESHOOT GMS-2 AIR COMPRESSOR

Work Description:

Table C-5. Sample Evaluations of JCS Database for Applicability to WFDS Activities

Event ID	Origination Date	Complete Date	Work Package Title	Failure/Error Mode Code	Failure Effect	Applicability of Evidence for RAM Quantification	Rationale	Comp Type	Safety Related Equipment?	Intrusive to Containment Barrier?	Restoration Time (hours)	Restoration Time Rationale
2W-93-00296	3/30/93	6/28/93	241-SY-101 SHMS-L SAMPLE PUMP REPLACEMENT	MDP-FS-C	Potential Delay	Indirect	A gas chromatograph system exists for hydrogen monitoring on Phase 1 systems. It is required that this equipment be operational for waste transfers.	P	Yes	Yes	2160	Based on time from identification to work package field work complete.
2W-93-00306	4/5/93	5/4/93	241-TX CALIBRATE 101-TX LIT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2W-93-00427	5/7/93	7/13/93	241-S T/S AND REPAIR RAMP 1 FAILED TO RESPOND.	RST-FA-I	Insignificant	Indirect	Failure of area radiation monitors would not delay an ongoing waste transfer.	RM	Yes	No	1608	Based on time from identification to work package field work complete.
2W-93-00573	6/9/93		241-SY REPAIR 101-SY VIDEO CAM. PAN & TILT	TFI-FA-E	Insignificant	Indirect	Similar equipment is also included in Phase 1 systems but is not germain to transfer operations.	TV	No	No	Unknown	No field work complete time in database.
2W-93-00750	8/4/93	5/25/95	241-SX REPLACE PIPING NORTH CAB. SLUDGE COOLER STEAM	PIP-LE-C	Insignificant	None	This equipment is not included in the Phase 1 design.	PIPE				
2W-93-00882	9/23/93		242-S TRBSHT/REPR RAW WTR & STM HI RAD ALA G13	ALR-NR-I	Insignificant	None	This is evaporator equipment.	RA				
2W-94-00022	1/4/94		241-SY REWIRE LEAK DETECTORS	UST-FA-I	Potential Delay	Indirect	Similar leak detector repairs could be necessary for Phase 1 systems.	LDE	Yes	Yes	Unknown	No field work complete time in database.
2W-94-00473	4/8/94		242-S REPLACE 1C AND 2D BRKRS ON C8-S8 SWGR	ATS-NR-E	Potential Delay	Indirect	Although this is evaporator equipment, similar equipment exists for Phase 1 systems.	ES	No	No	Unknown	No field work complete time in database.
2W-94-00749	7/6/94	7/25/94	241-SX 701SX #1 COMPRESSOR AIR LEAK	CMP-FR-C	Potential Delay	Indirect	Although compressors are not listed as separate components in the Phase 1 design, they are incorporated as parts of larger systems whose failure could impact waste transfer operations.	CMP	No	No	456	Based on time from identification to work package field work complete.
2W-94-00808	7/15/94	6/22/95	242-T REPLACE LOW SIDE P/S ON A/C UNIT	ACU-FR-H	Insignificant	Indirect	Air conditioning units exist for Phase 1 systems but are not crucial to continuing waste transfers.	ACU	No	No	8208	Based on time from identification to work package field work complete.
2W-94-00829	7/27/94	8/18/94	244-TX REPLACE K-6 RELAY	RLC-NR-E	Potential Delay	Indirect	Similar equipment exists for Phase 1 systems.	ES	No	No	528	Based on time from identification to work package field work complete.
2W-94-00888	8/16/94		241-SY REPLACE LEAK DETECTOR LIGHTS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2W-94-01137	10/13/94		241-SX REPAIR 101-SX THERMOCOUPLES	TST-FA-I	Insignificant	Indirect	It is not clear what the thermocouples pertained to for this effort.	TE	Unknown	Unknown	Unknown	No field work complete time in database.
2W-95-00139	2/21/95	4/28/95	244-U REPLACE FAILED BREAKER AND RELAYS	RLC-NR-E	Potential Delay	Indirect	Similar equipment exists for Phase 1 systems.	ES	No	No	1584	Based on time from identification to work package field work complete.
2W-95-00229	3/28/95		241-SY REPAIR SERVICE PIT RADIATION MONITOR	RST-FA-I	Insignificant	Indirect	This equipment, if it exists for Phase 1 systems, is not crucial for waste transfers.	RM	No	No	Unknown	No field work complete time in database.
2W-96-00524	5/22/96	7/8/96	241-SY 101-SY FIC	TRM-FA-I	Potential Delay	Indirect	Similar equipment exists for Phase 1 systems.	LE	Yes	Yes	1128	Based on time from identification to work package field work complete.
2W-96-00749	7/16/96	7/19/96	241-SY REPLACE EMPTY GMS-2 NITROGEN BOTTLE	N2S-FA-F	Insignificant	Indirect	This type of gas monitoring equipment does not appear to be part of the Phase 1 system design. Other nitrogen support equipment is included and is usually duplicated.	N2	No	No	72	Based on time from identification to work package field work complete.
2W-96-01453	12/17/96	12/20/96	241-TX/TY TROUBLESHOOT AIR COMPRESSOR	CMP-FR-C	Potential Delay	Indirect	Although compressors are not listed as separate components in the Phase 1 design, they are incorporated as parts of larger systems whose failure could impact waste transfer operations.	CMP	No	No	72	Based on time from identification to work package field work complete.

Table C-5. Sample Evaluations of JCS Database for Applicability to WFDS Activities

Event ID	Origination Date	Complete Date	Work Package Title	Failure/Error Mode Code	Failure Effect	Applicability of Evidence for RAM Quantification	Rationale	Comp Type	Safety Related Equipment?	Intrusive to Containment Barrier?	Restoration Time (hours)	Restoration Time Rationale
2W-97-00126	2/5/97	2/24/97	241-TX REPAIR ELECTRICAL DIST. PANEL	TPI-FA-E	Potential Delay	Indirect	An electrical distribution failure of this magnitude would shutdown and delay waste transfer operations.	EY	No	No	456	Based on time from identification to work package field work complete.
2W-97-00178	1/29/97		241-UX-302A LEAK DETECTOR REPAIR	UST-FA-I	Potential Delay	Indirect	Similar leak detector repairs could be necessary for Phase 1 systems.	LDE	Yes	Yes	Unknown	No field work complete time in database.
2W-97-00182	2/12/97	5/21/97	241-SY REPLACE PAS-103-1	PST-FA-I	Potential Delay	Indirect	Similar equipment exists for Phase 1 systems. If this item were tied into the master pump shutdown circuit, transfer could not occur.	PS	Yes	No	2376	Based on time from identification to work package field work complete.
2W-97-00323	3/7/97	7/16/97	272-WA FITTER SUPPORT FOR FEP DEFICIENCIES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2W-97-00694	6/3/97	6/4/97	242-S TROUBLESHOOT/REPAIR PI-TK-1 FOR 244-S	IND-FA-I	Potential Delay	Indirect	Failure during transfer of a pressure indicator would be cause for delaying transfer operations if it were related to tank dome pressure or transfer line pressure..	PI	No	No	24	Based on time from identification to work package field work complete.
2W-97-00739	6/17/97	6/19/97	244-TX REPLACE RAW WATER FILTER	FLT-PG-H	Insignificant	Indirect	Failure of the raw water filter, even during use, would probably not incur a delay in transfer activities.	FLT	No	No	48	Based on time from identification to work package field work complete.
2W-97-00920	8/7/97	8/8/97	241-SY TROUBLESHOOT GMS-2 AIR COMPRESSOR	CMP-FR-C	Potential Delay	Indirect	Although compressors are not listed as separate components in the Phase 1 design, they are incorporated as parts of larger systems whose failure could impact waste transfer operations.	CMP		No	24	Based on time from identification to work package field work complete.

Table C-6a. Summary of Input for Bayesian Update of Waste Transfer Pump Hanford Specific Failure Rates

Generic Pump Data

Failure Mode	Mean Failure Rate	Range Factor (95/50)	SRS Variable
Failure to Run	1.0E-04	10	MDP-FR-C
Fails to Start	1.0E-02	10	MDP-FS-C

Definition of Prior Distributions	Non Catastrophic Failures	Catastrophic Failures
Apportionment between Non-Catastrophic and Catastrophic Failures	80%	20%
Prior Median Failure to Run	3.0E-05	7.6E-06
Prior Median Failure to Start	3.0E-03	7.6E-04

Site-Specific Operating History				RPP RAM Variable	
Waste Feed Pump Data	Experience	Non Catastrophic Failures	Catastrophic Failures	Non Catastrophic Failures	Catastrophic Failures
Total Transfers	61				
Starts (demands)	137	4	0	WFP-FR-1	WFP-FR-2
Run Time (hours)	2338	2	0	WFP-FS-1	WFP-FS-2

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Table C-6b. Results of Bayesian Update of Waste Transfer Pump Hanford Specific Failure Rates

Name	Description	Events	Time/ Demands	Prior Mean	Mean	5th%ile...	Median	95th%ile..
PFPFR1	PRIOR - NON CATASTROPHIC FAILURE TO RUN			N/A	8.11E-05	3.10E-06	3.04E-05	2.99E-04
PFPFR2	PRIOR - CATASTROPHIC FAILURE TO RUN			N/A	2.02E-05	7.74E-07	7.59E-06	7.45E-05
PFPFS1	PRIOR - NON CATASTROPHIC FAILURE TO START			N/A	8.11E-03	3.10E-04	3.04E-03	2.99E-02
PFPFS2	PRIOR - CATASTROPHIC FAILURE TO START			N/A	2.02E-03	7.74E-05	7.59E-04	7.45E-03
WFPFR1	NON CATASTROPHIC FAILURE TO RUN	2.00E+00	2.34E+03	8.11E-05	3.79E-04	5.48E-05	2.84E-04	1.02E-03
WFPFR2	CATASTROPHIC FAILURE TO RUN	0.00E+00	2.34E+03	2.02E-05	1.68E-05	7.44E-07	7.14E-06	6.37E-05
WFPFS1	NON CATASTROPHIC FAILURE TO START	4.00E+00	1.37E+02	8.11E-03	2.23E-02	7.33E-03	2.03E-02	4.44E-02
WFPFS2	CATASTROPHIC FAILURE TO START	0.00E+00	1.37E+02	2.02E-03	1.13E-03	6.68E-05	5.85E-04	4.04E-03

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Table C-6c. Transfer History Supporting Waste Transfer Pump Site Specific Evidence for Bayesian Update

FACILITY / PIT #	Date Installed	Number of Transfers Since 1990	Number of Starts	Run Time (hrs)	Non-Cat. Failure to Start	Non-Cat. Failure to Run	Cat. Failure to Start	Cat. Failure to Run	Comments (See also general comments below)
AN-01A	9/10/81	1	2	115		1			1 restart due to loss of level indication
AN-02A	8/3/82	0	0	0					No logged transfers since 1990
AN-03A	12/27/82	0	0	0					No logged transfers since 1990
AN-04A	8/4/82	0	0	0					No logged transfers since 1990
AN-05A	5/21/84	0	0	0					No logged transfers since 1990
AN-06A	3/19/92	3	10	45	2	3			1 failure to start due to faulty valve pit valve position indication, one shutdown due to catch tank level increase, 2 MPSD signals, and one shutdown for unknown reasons. One transfer noted "numerous" aborted starts, we assumed five aborted starts.
AN-07A	Unknown	0	0	0					No logged transfers since 1990
AP-01A	7/6/88	4	18	68					Two completed transfers and two aborted transfers. For two completed transfers there were four MPSD shutdowns, a line pluggage shutdown, and a shutdown due to conflict with other work. For aborted transfers there were 8 failed attempt to start the pump, two MPSD signals, and a magagement directed shutdown due to discovered calculation errors.
AP-02D	6/9/88	0	0	0					No logged transfers since 1990
AP-03A	6/1/86	1	2	22					1 MPSD signal received.
AP-04A	3/11/88	1	1	99					No problems noted
AP-05A	6/1/88	3	6	189					2 MPSD signals received and one mass balnce calculation error. 1 transfer with no problems noted.
AP-06A	1/15/89	2	3	128					One shutdown due to unknown reasons.
AP-07A	1994	5	8	215					Three transfers with no problems noted. One line high pressure signal, one MPSD signal and one mass balnce discrepancy shutdown
AP-08A	1994	5	6	227					4 transfers with no problems noted, one MPSD signal received.
AW-01A	12/19/84	0	0	0					No logged transfers since 1990
AW-02E	1/27/89	0	0	0					No logged transfers since 1990
AW-03A	10/17/84	0	0	0					No logged transfers since 1990
AW-04A	9/15/82	0	0	0					No logged transfers since 1990
AW-05A	10/19/88	4	7	161					Two transfers with valve pit valve/jumper leakage and no restarts. Two transfer with two MBD discrepancy shutdowns each. One transfer with no problems noted.

Table C-6c. Transfer History Supporting Waste Transfer Pump Site Specific Evidence for Bayesian Update

FACILITY / PIT #	Date Installed	Number of Transfers Since 1990	Number of Starts	Run Time (hrs)	Non-Cat. Failure to Start	Non-Cat. Failure to Run	Cat. Failure to Start	Cat. Failure to Run	Comments (See also general comments below)
AW-06A	7/28/88	27	60	922					13 transfers with no problems noted. Other fourteen transfers restart for MPSD signals, mass balance deviations, motor problems, other alarms and unknown reasons.
AY-01D	Unknown	3	10	85					Assume all complete AY-101 transfers were with this pump. O transfer with 2 MPSD and 1 unknown shutdowns, one transfer with level indicator shutdown, and one transfer with leak detector shutdown.
AY-02D	10/14/86	2	4	62					One transfer with MPSD signal and one with other work conflict.
AZ-01C	3/27/86	0	0	0					No logged transfers since 1990
AZ-02B	12/20/85	0	0	0					No logged transfers since 1990
AZ-02C	10/21/83	0	0	0					No logged transfers since 1990
SY-01A RISER 3A	Unknown	0	0	0					No logged transfers since 1990
SY-01A RISER 12A	Unknown	0	0	0					No logged transfers since 1990
SY-02A	12/30/85	0	0	0					No logged transfers since 1990
SY-02E	8/8/79	0	0	0					No logged transfers since 1990
SY-03A	7/16/80	0	0	0					No logged transfers since 1990
TOTALS:		61	137	2338	2	4	0	0	

Notes:

For calculation purposes assume no "bumping" of pumps has occurred since 1990.
When interruptions occurred, assumed total gallons divided by 140 gallons per minute unless fewer hours

Table C-6d. Available Waste Transfer Pump History (See Notes at End of Table for Source)

FACILITY / PIT #	PUMP #	PUMP TYPE	DATE INSTALL	DATE REMOVE	PROP. #	MANUF.	P.O. #	HP	RPM	LENGTH	SHFT DIA.	BEARING MATERIAL	CBS, INCH	STA	RTD FLOW GPM	RTD TDH FT	FAILURE REASON GIVEN
AN-01A	202P-TX1	vt	9/10/81	active	F258557	Floway	26455	20	3500	48' 11"	1	Metallized graph	60	5	90	250	
AN-02A	65P-TX4	vt	8/3/82	active	F258608	Wilkins	26503	30	3450	49' 0 1/2"	1	Ni-filled graphite		6	150	280	
AN-03A	211P-TX1	vt	12/27/82	active	F258603	Wilkins	26503	22.5	3450	49' 0"	1	Ni-filled graphite		7	90	300	
AN-04A	64P-TX4	vt	8/4/82	active	F258607	Wilkins	26503	30	3450	49' 0 1/2"	1	Ni-filled graphite		6	150	280	
AN-05A	84P-TX4/6P-TX6	vt	5/21/84	active		Floway	294079	20	1760	49' 0 3/8"	1.25	Ni-filled graphite	45	27	100	281	
AN-06A	2P-TX1-XCF	vt	3/19/92	active	F263783	Floway	419574	25	3500	49' 0 3/8"	1.25	Ni-filled graphite	29.5	7	100	300	
AN-07A	OPEN																
AP-01A	1P-AP-4	vt, ff	7/6/88	active	F263558	Goulds	325751	30	3500	33' 0"	1	Ni-impreg graphite		7	140	300	
AP-02A	1P-PSM-001	sub, mix	7/22/87	failed		Hazleton		150				N/A	N/A	1			
AP-02D	1P-TX1-XCF	vt, sw	6/9/88	active	F263782	Floway	419574	30	3500	44' 7"	1.25	Ni-filled graphite	29.5	7			
AP-03A	2P-AP-3	vt	6/1/88	active	F263562	Goulds	325751	30	3500	49' 0 3/8"	1	Ni-impreg graphite		7	140	300	
AP-04A	4P-AP-3	vt	3/11/88	active	F263564	Goulds	325751	30	3500	49' 0 3/8"	1	Ni-impreg graphite		7	140	300	
AP-05A	1P-AP-3	vt	6/1/88	active	F263561	Goulds	325751	30	3500	49' 0 3/8"	1	Ni-impreg graphite		7	140	300	
AP-06A	2P-AP-4	vt, ff	1/15/89	active	F263559	Goulds	325751	30	3500	33' 0"	1	Ni-impreg graphite		7	140	300	
AP-07A	2P-TX4-XCR-1	vt	1994	active	F266001	Floway	481394	30	3500	49' 0 3/8"	1.25	Chr-oxide coated	48 max	6	160	295	
AP-08A	1P-TX4-XCR-1	vt	1994	active	F266000	Floway	481394	30	3500	49' 0 3/8"	1.25	Chr-oxide coated	48 max	6	160	295	
AW-01A	205P-TX1	vt	10/14/81	4/30/84	F258597	Wilkins	26503	22.5	3450		1	Metal-impreg graph		7	100	300	shaft seizure, PE-017
AW-01A	70P-TX4	vt	5/1/84	6/18/84	F258613	Wilkins	26503	30	3450	45'	1	Metal-impreg graph		6	150	280	
AW-01A	101AW-S	sub, tan	6/30/84	12/19/84	none	Flygt 2060		3.7	3300	49'		N/A	N/A	2	58	134	rubber disch. hose severed, PE-023
AW-01A	85P-TX4/7P-TX6	vt	12/19/84	active	F261994	Floway	294079	20	1750	49' 0 3/8"	1.25	Ni-filled graphite	45	27	100	281	
AW-02E	48P-TX4	vt	4/4/80	11/21/83	F258540	Floway	26455	25	3600	45'	1	Metallized graph	60	4	160	170	shaft seizure
AW-02E	102-1 (PTX-4)	vt	11/22/83	7/26/85	F262951	Floway	212188	25	1750	45' 3 3/8"	1.25	Ethylene propylene		27	80	342	leak from top seal
AW-02E	71P-TX4	vt	7/26/85	1/7/86		Floway	294079	20	1760	45' 3 3/8"	1.25	Ni-filled graphite	45	26	100	277	shaft seizure
AW-02E	73P-TX4	vt	1/9/86	3/6/86	F262305	Floway	359040	20	1760	45' 3 3/8"	1.25	Ethylene propylene	45	26	95	330	shaft seizure
AW-02E	77P-TX4/4P-TX5	vt	3/12/86	1/27/89	F262301	Floway	359040	20	1760	45' 3 3/8"	1.25	Ni-filled graphite	45	26	100	280	leak from top seal
AW-02E	78P-TX4/5P-TX5	vt	1/27/89	active	F261993	Floway	359040	20	1760	45' 3 3/8"	1.25	Ni-filled graphite	45	26	100	279	
AW-03A	206P-TX1	vt	12/3/81	3/16/83	F258598	Wilkins	26503	22.5	3450	48' 11"	1	Metal-impreg graph		7	100	300	shaft seizure
AW-03A	103AW-S	sub	9/23/83	6/11/84	none	Flygt		3.7	3300	47' 6"		N/A		1	50	70	
AW-03A	86P-TX4/8P-TX6	vt, ff	10/17/84	active		Floway	294079	20	1760	33'	1.25	Ni-filled graphite	45	27	100	281	

Table C-6d. Available Waste Transfer Pump History (See Notes at End of Table for Source)

FACILITY / PIT #	PUMP #	PUMP TYPE	DATE INSTALL	DATE REMOVE	PROP. #	MANUF.	P.O. #	HP	RPM	LENGTH	SHFT DIA.	BEARING MATERIAL	CBS, INCH	STA	RTD FLOW GPM	RTD TDH FT	FAILURE REASON GIVEN
AW-04A	80P-TX4	vt, oil, sw	9/15/82	failed	F261984	Floway	212149	20	1760	49' 0 3/8"		Cast iron		27	100	281	broken shaft
AW-05A	120-P10	vt	4/4/83	5/18/84	F258210	Floway	83251	7.5	3500	49'	1	Ni-chrome alloy	60	2	75	115	shaft seizure
AW-05A	105AW-S	sub	6/4/84	1/3/85	N/A	Flygt		3.7	3300	49'		N/A	N/A	1			
AW-05A	75P-TX4/2P-TX5	vt, ff	4/30/85	10/19/88	F261999	Floway	359040	20	1760	47' 3 3/8"	1.25	Ethylene propylene	45	26	100	279	shaft seizure
AW-05A	1P-TX1	vt, ff	10/19/88	active	F263871	Floway	423823	30	3500	33' 0 1/4"	1.25	Chr-oxide coated	48 max	7	100	300	
AW-06A	189P-TX1	vt	6/2/80	1/15/85	F258062	Doric		20		48'				6	90	245	shaft seizure
AW-06A	53P-TX4	vt	1/16/85	8/1/85	F258552	Floway	26455	25	3600	49'	1	Metallized graph	60	4	160	170	leak from top seal
AW-06A	12P-TX4	vt	8/1/85	11/23/85	F229816	Floway	31521	30		49'		Ethylene propylene			100	150	shaft seizure
AW-06A	81P-TX4/3P-TX6	vt	11/23/85	2/26/86		Floway	359040	20	1760	49' 0 3/8"	1.25	Ethylene propylene	45	27	100	281	shaft seizure
AW-06A	83P-TX4/5P-TX6	vt	2/26/86	5/29/87		Floway	359040	20	1760	49' 0 3/8"	1.25	Ni-filled graphite	45	26	100	360	leak from top seal
AW-06A	82P-TX4/4P-TX6	vt, oil	6/17/87	7/28/88	F261986	Floway	212149	20	1760	49' 0 3/8"		Cast iron					shaft seizure
AW-06A	1P-TX1-XCR-1	vt	7/28/88	active	F263817	Floway	419574	30	3500	49' 0 3/8"	1.25	Chr-oxide coated	48 max	7	100	300	
AY-01B	F64GT																
AY-01D	122P-10	vt	12/21/79	active	F258418	Floway	83251	7.5	3500	45' 8 5/16"	1	Ni-chrome alloy	60	2	75	115	
AY-02B	8P-105-ATP	vt, mix	4/29/86		F258072	Tait		20		47' 6"				6	350	140	
AY-02D	66P-TX4	vt	9/26/80	4/18/86	F258609	Wilkins	26503	30	3450	47' 3 3/8"	1	Metal-impreg graph	60	7	150	280	motor direct ground
AY-02D	79P-TX4/1P-TX6	vt, oil	5/2/86	10/9/86	F261991	Floway	212149	20	1760	47' 3 3/8"		Cast iron		27	100	281	
AY-02D	87P-TX4/9P-TX6 (OIL LUBE)	vt, oil	10/14/86	active	F261996	Floway	294080	20	1760	47' 3 3/8"	1	Ni-filled graphite	45	27	100	281	motor freeze-up
AZ-01A	182P-TX1	vt	4/17/80	11/23/83		Doric		20		48' 11"				6	100	250	
AZ-01C	204P-TX1	vt	10/6/80	11/29/83	F258183	Doric		20		46' 2 1/2"				6	90	245	
AZ-01C	74P-TX4/1P-TX5	vt	3/27/86	active	F261998	Floway	294079	20	1760	47' 3 3/8"	1.25	Ni-filled graphite	45	26	100	279	
AZ-02A	12P-102-A	agit	9/19/83	10/21/83		Tait	12480	75		49' 4 1/2"		Graphite		5	300	525	leaked on startup
AZ-02B	196P-TX1	vt	6/23/81	12/20/85	F258536	Floway	26455	20	3500	45' 6"	1	Metallized graph	60	5	100	250	motor failure
AZ-02B	74P-TX4/1P-TX5	vt	12/20/85	3/27/86	F261998	Floway	294079	20	1760	47' 3 3/8"	1.25	Ni-filled graphite		5	300	525	
AZ-02C	12P-102-A	agit	10/21/83	10/14/85		Tait	12480	75		49' 4 1/2"		Graphite		5	300	525	
SY-01A RISER 3A	OPEN																
SY-01A RISER 12A	1PSM-002	mix															
SY-02A	185P-TX1	vt	4/26/78	8/5/81	F258039	Doric		20		47' 6 1/4"				6	100	250	
SY-02A	68P-TX4	vt, wi	8/14/81	10/29/84		Wilkins	26503	30	3450	47'	1	Metal-impreg graph	60	6	150	280	
SY-02A	212P-TX1	vt, ff	10/29/84			Wilkins	26503	30	3450	33'	1	Metal-impreg graph	60	6	90	360	
SY-02A	67P-TX4	vt, ff	11/22/84?	12/30/85	F258610	Wilkins	26503	30	3450	33'	1	Metal-impreg graph	60	6	150	280	

Table C-6d. Available Waste Transfer Pump History (See Notes at End of Table for Source)

FACILITY / PIT #	PUMP #	PUMP TYPE	DATE INSTALL	DATE REMOVE	PROP. #	MANUF.	P.O. #	HP	RPM	LENGTH	SHFT DIA.	BEARING MATERIAL	CBS, INCH	STA	RTD FLOW GPM	RTD TDH FT	FAILURE REASON GIVEN
SY-02A	SY-02A-3	vt, ff	12/30/85	active	F262402	Floway	359040				1.25	Ethylene propylene	45				
SY-02E	37P-TX4	vt	3/28/77	8/6/77		Doric		25	3600			Graphite		6	160	200	
SY-02E	30P-TX4	vt	8/6/77	1/24/78		Floway		20		44' 11 3/4"				4	160	170	leak from top seal
SY-02E	60P-TX4	vt	1/24/78	7/6/78		Doric		25	3600	45'				6	160	200	pump shaft broken
SY-02E	38P-TX4	vt	7/6/78	8/8/79		Doric		25	3600	44' 0 1/2"		Graphite		6	160	200	pump "broke", 34' of column still in tank
SY-02E	49P-TX4	vt	8/8/79		F258548	Floway	26455	25	3600	44' 0"	1	Metallized graph	60	4	100	170	
SY-03A	195P-TX1	vt	3/17/80	7/16/80		Floway	26455	20	3510		1	Metallized graph	60	5	100	250	
SY-03A	116P-10	vt	7/16/80	active	F258206	Floway	83251	7.5	3500	47' 6 3/16"	1	Ni-chrome alloy	60	2	75	115	
244A	169P-TX1	vt	4/1/76	10/18/82		Tait		25		19' 11"							
244A	39P-TX4	vt	10/27/82	4/26/83	F258037	Doric		25	3600	19' 11 1/2"		Graphite		6	100	210	
244A	16P-TX1-002-2	vt	5/9/83	9/7/84	F258029	Doric				19' 11"					90	70	column failure?
244A	15P-TX1-002-2	vt	9/7/84	7/7/89	F256959	Layne?	89704	3		19' 11"					80	80	
244A	199P-TX1	vt	7/7/89	active	F258554	Floway	26455	20	3500	19' 11 1/2"	1	Metallized graph	60	5	100	250	
244BX	208P-TX1	vt	2/11/81	active	F258600	Wilkins	26503	22.5	3500	18' 4"	1	Metal-impreg graph	60	6	90	360	
244TX	207P-TX1	vt	11/23/81	8/12/82	F258599	Wilkins	26503	22.5	3500	18' 4"	1	Metal-impreg graph	60	6	90	360	
244TX	167P-TX1	vt	8/12/82	1/1/88	F256947	Tait				18' 4"							
244TX	213P-TX1	vt	1/1/88	failed	F258605	Wilkins	26503	30	3450	18' 4"	1	Metal-impreg graph	60	7	100	355	
244TX AGITATOR	9P-102A	vt	4/8/81	10/1/83	F258023	Tait	12480	75	3550	18' 4"		Metallized graph		5	300	550	
244TX AGITATOR	11P-102A	vt	1/6/84	6/6/84	F258074	Tait	12480	75	3550	18' 4"		Metallized graph		5	300	550	
244TX AGITATOR	10P-TX3 (10P-102A)	vt, oil	6/6/84	11/5/84	F258024	Tait	12480	75	3550	18' 4"		Metallized graph		5	315	550	oil lube line partially blocked
244TX AGITATOR	16P-TX3	vt, oil	11/5/84			Floway	280126	75		18' 4"			48 max	5	440	240	motor failure
244TX AGITATOR	17P-TX3	vt, oil		10/31/85		Floway	280126	75		18' 4"			48 max	5	440	240	seal failure
244TX AGITATOR	244TX-01866		11/5/85	8/31/88		Floway	386130	75							400	300	
244TX AGITATOR	1P-TX3-XCR-1	vt	8/31/88	active	F263815	Floway	419574	75	3550	18' 4"	1.25	Chr-oxide coated	48 max	4	400	300	
244S	112-P10	vt, wi	6/12/80	7/26/88	F258202	Floway	83251	7.5	3500	21' 9 1/8"	1	Ni-chrome alloy	60	2	75	115	
244S	99P-10	vt, wi	7/26/88	active	F257698	Doric	95543	10	3600	21' 9 1/8"				2	105	70	
244S SUMP	113-P10	vt	8/27/80	active	F258203	Floway	83251	7.5	3500		1	Ni-chrome alloy	60	2	75	115	
244U	201P-TX1	vt				Floway	26455	20	3510		1	Metallized graph	60	5	100	250	
244-CR-003 AGITATOR	01A-002		3/11/88					10		20' 3"							

Table C-6d. Available Waste Transfer Pump History (See Notes at End of Table for Source)

FACILITY / PIT #	PUMP #	PUMP TYPE	DATE INSTALL	DATE REMOVE	PROP. #	MANUF.	P.O. #	HP	RPM	LENGTH	SHFT DIA.	BEARING MATERIAL	CBS, INCH	STA	RTD FLOW GPM	RTD TDH FT	FAILURE REASON GIVEN
244-CR-003	2-P-CR-003		12/6/77	9/21/87						20' 7/8"							
244-CR-003	P-CR-003		9/21/87	3/11/88				7.5		20'							
244-CR-003	216P-TX1	vt	3/11/88	active	F262307	Floway	359040	10	1760	18' 4 3/8"	1.25	Ni-filled graphite	45				

NOTES:

Scope: DST'S and DCRT'S

Data compiled by GA Leshikar from the following sources:

1 "The Pump Report", WHC-SD-WM-RPT-025, Rev. 1, 1992, by BK Kemp
2 AW "Card-ex" logbook, thru 7/15/91, East Tank Farms, custodian Ron Wright
3 "WA Pump Book" logbook, West Tank Farms, custodians Judy Steen and Mike Sutey
4 Pump Installation History logbook, custodian GA Leshikar
5 Tank Farm Daily Operating Reports, 2750 library
6 Pump Letterbooks, custodian GA Leshikar
7 Property Records
8 Purchase Orders
9 Vendor data
10 Run-in test data sheets

DEFINITIONS:

PUMP TYPE: vt - vertical turbine
sub - submersible
mix - mixer
ff - flex float
oil - oil lubed
sw - saltwell screen installed
agit - agitator
wi - water injection capability to suction
tan - 2 submersible pumps in tandem (series)

DATE INSTALL - reference source is recorded to cell as an Excel NOTE

DATE REMOVED - reference source is recorded to cell as an Excel NOTE
active - if pump currently installed and believed operable
failed - if pump currently installed and believed inoperable (not yet removed)

PROP. #: RL property number of equipment

P.O. #: purchase order number, given by last digits

CBS: column bearing spacing (inches)

STA: number of stages (impellers)

APPENDIX D

HUMAN RELIABILITY ANALYSIS

Tables

D-1 Definitions of Various Human Action Failure Effects

D-2 Procedural Human Actions Quantified for HLW Waste Qualification and Transfers (AZ-101)

D-3 Procedural Human Actions Quantified for LAW Waste Qualification and Transfers (241-AN-105)

D-4 Definitions of Human Error Rate Variables for Use in WFDS RAM Evaluations (Based on WSRC-TR-93-581)

D-5 Events from ORPS That Have Potential to Produce Delays in WFDS Schedule Activities

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Table D-1. Definition of Human Action Failure Effects

FAILURE EFFECT	DEFINITION	EXAMPLES
None	Not a failure associated with the waste transfer process. This event will not divert resources that would be used for process-related operations.	• Gasoline spills in parking lots • Violation of an administrative requirement that is not associated with transfer
Equipment Failure Cause	Actions that contribute to spurious alarms or other equipment failures once transfer activities commence. These failures do not directly result in a delay at the time of occurrence. They are revealed by the actual occurrence of the alarm or shutdown. Since the occurrences are being counted in the ORPS and JCS databases, including a separate error rate for the human contribution to the equipment failure would in effect double count the failure mode.	• Failure to verify that instruments and alarms are properly set. • Failure to accomplish pre-operational testing • Errors during periodic reviews of equipment status
Verification Activity	Actions that reveal previous failures. The presence of these activities tend to reduce the HEP associated with the previous actions. Errors in these activities would be reflected in a failure to check HEP, which is included in the previous activity	• Independent checks • Checks by a crew supervisor • Periodic inspections of conditions other than equipment status
Monitor Alarms	Refers to being prepared to act should an alarm occur. Generally, alarms result from equipment or control failures that are accounted for in other human actions	• Operators fail to respond to alarms before transition to a shutdown state
Consolidated Action	Actions that repeat or verify another operator action	• Steps that require checking a previous action
Insignificant Delay	The RPP can recover from the failure without delaying transfer activities, but the effort can require resources that would be used for process related activities.	• Errors that were detected and corrected before a transition to a failed state
Potential Delay	The failure occurred under circumstances that would cause a delay if a transfers operation were underway.	• Operator actions lead directly to a state that will require additional time for recovery.

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Table D-2	Procedural Human Actions Quantified for HLW Waste Qualification and Transfers (AZ-101)							
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
A - Qualify HLW	Mix AZ-101	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
A - Qualify HLW	Mix AZ-101	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
B - Batch Transfer HLW	Transfer HLW Batch AZ-101 136,000 gallons	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.22 Through 5.3.23. When the liquid level in TK-105-AN reaches the amount designated by the Shift Manager, shutdown transfer as follows: **Reduce** pump speed to one-third full speed and **Increase** flush water flow to 100 gpm. Continue transfer until 2000 gallons of flush water have been transferred, **Stop** the transfer pump. When another 500 gallons of flush water have been transferred, **Close** main flush valve. **Record** time and date when the transfer stopped and **Initial** TK-105-AN To TK-102-AP Transfer Data Sheet, the Interconnected Tank Liquid Level Monitoring Data Sheet, the Excavation Control Checklist, and the TK-102-AP Transfer Data Sheet.	HATRANSF022	HACADEXXN	3.E-03	RTHUMSML03	28	0.1
B - Batch Transfer HLW	Transfer HLW Batch AZ-101 136,000 gallons	**Perform Post Transfer Line Flushing** - Steps 5.5.1.1 Through 5.5.1.7. **Ensure** diluent/flush system is operable and boiler exit temperature is 130F. **Throttle** flush water flow to 100 gpm using CHEMB-FCV-131. **Align** valves per TK-105-AN To TK 102-AP Flush Valve Position Checklist, "Pump Flush." **Open** main valve, **Backflush** pump for five min. with hot water and **Close** main valve. **Align** valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Transfer Line Flush." **Open** main valve, **Flush** transfer line with approximately 5000 gallons of hot water and **Close** main valve. **Record** actual flush volumes on TK-105-AN To TK-102-AP Transfer Data Sheet. Shift Manager will ensure that procedure TO-040-540, "Water Surveillance and Usage" requirements are followed. During line flushing, catch tank and interconnected tank readings, material balances, constant surveillance requirements, etc., still apply. When flush valving is completed, have an **Independent Verification** of valves' positions performed. Have Operator positioning the valves and the individual performing the independent verification initial the TK-10	HAPERFLS001	HAFACXXXL	5.E-04	RTHUMSML03	28	0.0
B - Batch Transfer HLW	Transfer 685 Kgal from AZ-101 to AY-101	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.11 Through 5.3.12. **Ensure** service water and nitrogen are supplied to pump seals. **Measure** sludge level and **Position** transfer pump intake one foot above sludge level.	HATRANSF014	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0

Table D-2	Procedural Human Actions Quantified for HLW Waste Qualification and Transfers (AZ-101)							
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
B - Batch Transfer HLW	Decant 140,200 gallons to AN-105	**Perform Transfer Valving and Pit Cover Check** - Steps 5.2.16 Through 5.2.19. **Ensure** the transfer cover check is or has been performed within 72 hours prior to removing an administrative lock from physically connected waste transfer pump. **Notify** HPT if a non-permanent, temporary cover is to be used. **Isolate** waste transfer paths connected to active waste transfer pumps not under administrative lock by two closed valves. **Complete** appropriate block on the TK-105-AN To TK-102-AP Valve Position Checklist. **Perform** valving per TK-105-AN To TK-102-AP Valve Position Checklist. Have valve positions **Independently Verified** and Checklist **Initialed**.	HAVLVEPC001	HAFACXXXL	5.E-04	RTHUMLRG02	392	0.2

Table D-3		Procedural Human Actions Quantified for LAW Waste Qualification and Transfers (241-AN-105)						
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity (Extracted from Readiness to Proceed Procedures)**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
A - Degas and Decant to AP-102	Degas AN-105 Using Process Test Plan	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
A - Degas and Decant to AP-102	Add Diluent (~25 Kgal) Decant Pump Recirculate AN-105	**Note - Procedure does not have an "add Diluent" step. Using Step 5.4, "Dissolve 105-AN Soluble Salts and Transfer To 102-AP."** Steps 5.4.1.1 Through 5.4.1.5. **Align** valves per TK-105-AN To TK-102-AP Flush Value Position Checklist, "Tank Flush." **Ensure** diluent/flush system is operable. **Open** main flush valve. **Throttle** diluent flow to 100 gpm using CHEMB-FCV-131. When the amount of diluent has been transferred to TK-105-AN, **Close** main flush valve.	HAADDDIL001	HAFACXXXN	5.E-03	RTHUMSML03	28	0.1
A - Degas and Decant to AP-102	Decant 250 Kgal From AN-105 To AP-102	**Perform Transfer Valving and Pit Cover Check** - Steps 5.2.16 Through 5.2.19. **Ensure** the transfer cover check is or has been performed within 72 hours prior to removing an administrative lock from physically connected waste transfer pump. **Notify** HPT if a non-permanent, temporary cover is to be used. **Isolate** waste transfer paths connected to active waste transfer pumps not under administrative lock by two closed valves. **Complete** appropriate block on the TK-105-AN To TK-102-AP Valve Position Checklist. **Perform** valving per TK-105-AN To TK-102-AP Valve Position Checklist. Have valve positions **Independently Verified** and Checklist **Initialed**.	HAVLVEPC001	HAFACXXXL	5.E-04	RTHUMLRG02	392	0.2
A - Degas and Decant to AP-102	Decant 250 Kgal From AN-105 To AP-102	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.11 Through 5.3.12. **Ensure** service water and nitrogen are supplied to pump seals. **Measure** sludge level and **Position** transfer pump intake one foot above sludge level.	HATRANSF014	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
A - Degas and Decant to AP-102	Decant 250 Kgal From AN-105 To AP-102	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.14 Through 5.3.15. **Align** valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "In-Line Dilution" and **Open** main flush valve. Flow rate must be maintained at 100 gpm. CHEMB-FCV-131 can be adjusted to accomplish this. From transfer pump control panel, **Start** pump and **Set** pump speed to one-third full speed. The setting assumes the transfer pump displaces 123 gpm.	HATRANSF016	HAFACXXXN	5.E-03	RTHUMSML03	28	0.1
A - Degas and Decant to AP-102	Decant 250 Kgal From AN-105 To AP-102	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.22 Through 5.3.23. When the liquid level in TK-105-AN reaches the amount designated by the Shift Manager, shutdown transfer as follows: **Reduce** pump speed to one-third full speed and **Increase** flush water flow to 100 gpm. Continue transfer until 2000 gallons of flush water have been transferred, **Stop** the transfer pump. When another 500 gallons of flush water have been transferred, **Close** main flush valve. **Record** time and date when the transfer stopped and **Initial** TK-105-AN To TK-102-AP Transfer Data Sheet, the Interconnected Tank Liquid Level Monitoring Data Sheet, the Excavation Control Checklist, and the TK-102-AP Transfer Data Sheet.	HATRANSF022	HACADEXXN	3.E-03	RTHUMSML03	28	0.1
A - Degas and Decant to AP-102	Decant 250 Kgal From AN-105 To AP-102	Perform Post Transfer Line Flushing - Steps 5.5.1.1 Through 5.5.1.7. Ensure diluent/flush system is operable and boiler exit temperature is 130F. Throttle flush water flow to 100 gpm using CHEMB-FCV 131. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Pump Flush." Open main valve, Backflush pump for five min. with hot water and Close main valve. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Transfer Line Flush." Open main valve, Flush transfer line with approximately 5000 gallons of hot water and Close main valve. Record actual flush volumes on TK-105-AN To TK-102-AP Transfer Data Sheet. Shift Manager will ensure that procedure TO-040-540, "Water Surveillance and Usage" requirements are followed. During line flushing, catch tank and interconnected tank readings, material balances, constant surveillance requirements, etc., still apply. When flush valving is completed, have an Independent Verification of valves' positions performed. Have Operator positioning the valves and the individual performing the independent verification Initial TK-105-AN To TK-102-AP Flush Valve Position Checklist.	HAPERFLS001	HAFACXXXL	5.E-04	RTHUMSML03	28	0.0

Table D-3		Procedural Human Actions Quantified for LAW Waste Qualification and Transfers (241-AN-105)						
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity (Extracted from Readiness to Proceed Procedures)**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
A - Degas and Decant to AP-102	Operate Mixer Pumps in AN-105	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
A - Degas and Decant to AP-102	Decant Waste From AN-105 To AP-102	**Perform Transfer Valving and Pit Cover Check** - Steps 5.2.16 Through 5.2.19. **Ensure** the transfer cover check is or has been performed within 72 hours prior to removing an administrative lock from physically connected waste transfer pump. **Notify** HPT if a non-permanent, temporary cover is to be used. **Isolate** waste transfer paths connected to active waste transfer pumps not under administrative lock by two closed valves. **Complete** appropriate block on the TK-105-AN To TK-102-AP Valve Position Checklist. **Perform** valving per TK-105-AN To TK-102-AP Valve Position Checklist. Have valve positions **Independently Verified** and Checklist **Initialed**.	HAVLVEPC001	HAFACXXXL	5.E-04	RTHUMLRG02	392	0.2
A - Degas and Decant to AP-102	Decant Waste From AN-105 To AP-102	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.11 Through 5.3.12. **Ensure** service water and nitrogen are supplied to pump seals. **Measure** sludge level and **Position** transfer pump intake one foot above sludge level.	HATRANSF014	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
A - Degas and Decant to AP-102	Decant Waste From AN-105 To AP-102	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.22 Through 5.3.23. When the liquid level in TK-105-AN reaches the amount designated by the Shift Manager, shutdown transfer as follows: **Reduce** pump speed to one-third full speed and **Increase** flush water flow to 100 gpm. Continue transfer until 2000 gallons of flush water have been transferred, **Stop** the transfer pump. When another 500 gallons of flush water have been transferred, **Close** main flush valve. **Record** time and date when the transfer stopped and **Initial** TK-105-AN To TK-102-AP Transfer Data Sheet, the Interconnected Tank Liquid Level Monitoring Data Sheet, the Excavation Control Checklist, and the TK-102-AP Transfer Data Sheet.	HATRANSF022	HACADEXXN	3.E-03	RTHUMSML03	28	0.1
A - Degas and Decant to AP-102	Decant Waste From AN-105 To AP-102	Perform Post Transfer Line Flushing - Steps 5.5.1.1 Through 5.5.1.7. Ensure diluent/flush system is operable and boiler exit temperature is 130F. Throttle flush water flow to 100 gpm using CHEMB-FCV 131. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Pump Flush." Open main valve, Backflush pump for five min. with hot water and Close main valve. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Transfer Line Flush." Open main valve, Flush transfer line with approximately 5000 gallons of hot water and Close main valve. Record actual flush volumes on TK-105-AN To TK-102-AP Transfer Data Sheet. Shift Manager will ensure that procedure TO-040-540, "Water Surveillance and Usage" requirements are followed. During line flushing, catch tank and interconnected tank readings, material balances, constant surveillance requirements, etc., still apply. When flush valving is completed, have an Independent Verification of valves' positions performed. Have Operator positioning the valves and the individual performing the independent verification Initial TK-105-AN To TK-102-AP Flush Valve Position Checklist.	HAPERFLS001	HAFACXXXL	5.E-04	RTHUMSML03	28	0.0
B - Qualify Waste in AP-102	Add Diluent Water To AN--104	**Note - Procedure does not have an "add Diluent" step. Using Step 5.4, "Dissolve 105-AN Soluble Salts and Transfer To 102-AP."** Steps 5.4.1.1 Through 5.4.1.5. **Align** valves per TK-105-AN To TK-102-AP Flush Value Position Checklist, "Tank Flush." **Ensure** diluent/flush system is operable. **Open** main flush valve. **Throttle** diluent flow to 100 gpm using CHEMB-FCV-131. When the amount of diluent has been transferred to TK-105-AN, **Close** main flush valve.	HAADDDIL001	HAFACXXXN	5.E-03	RTHUMSML03	28	0.1
B - Qualify Waste in AP-102	Perform Mixing Operation AN-105/AP-102	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
B - Qualify Waste in AP-102	Obtain/Analyze Process Control Samples AN-105/AP-102	Obtain/Analyze Process Control Samples AN-104/AP-102.	HASAMPLE002	HALAEXXXN	3.E-04	RTHUMLRG01	280	0.1

Table D-3		Procedural Human Actions Quantified for LAW Waste Qualification and Transfers (241-AN-105)						
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity (Extracted from Readiness to Proceed Procedures)**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
B - Qualify Waste in AP-102	Perform Batch Mixing Operations AN-105 in AP-102	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
B - Qualify Waste in AP-102	Perform Xfer From AN 105 To AP-104	**Perform Transfer Valving and Pit Cover Check** - Steps 5.2.16 Through 5.2.19. **Ensure** the transfer cover check is or has been performed within 72 hours prior to removing an administrative lock from physically connected waste transfer pump. **Notify** HPT if a non-permanent, temporary cover is to be used. **Isolate** waste transfer paths connected to active waste transfer pumps not under administrative lock by two closed valves. **Complete** appropriate block on the TK-105-AN To TK-102-AP Valve Position Checklist. **Perform** valving per TK-105-AN To TK-102-AP Valve Position Checklist. Have valve positions **Independently Verified** and Checklist **Initialed**.	HAVLVEPC001	HAFACXXXL	5.E-04	RTHUMLRG02	392	0.2
C - Dissolve Salts in AN-105	Perform Xfer From AN 105 To AP-104	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.11 Through 5.3.12. **Ensure** service water and nitrogen are supplied to pump seals. **Measure** sludge level and **Position** transfer pump intake one foot above sludge level.	HATRANSF014	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
C - Dissolve Salts in AN-105	Perform Xfer From AN 105 To AP-104	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.14 Through 5.3.15. **Align** valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "In-Line Dilution" and **Open** main flush valve. Flow rate must be maintained at 100 gpm. CHEMB-FCV-131 can be adjusted to accomplish this. From transfer pump control panel, **Start** pump and **Set** pump speed to one-third full speed. The setting assumes the transfer pump displaces 123 gpm.	HATRANSF016	HAFACXXXN	5.E-03	RTHUMSML03	28	0.1
D - Transfer to AP-104 and Qualify Waste	Perform Xfer From AN 105 To AP-104	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.22 Through 5.3.23. When the liquid level in TK-105-AN reaches the amount designated by the Shift Manager, shutdown transfer as follows: **Reduce** pump speed to one-third full speed and **Increase** flush water flow to 100 gpm. Continue transfer until 2000 gallons of flush water have been transferred, **Stop** the transfer pump. When another 500 gallons of flush water have been transferred, **Close** main flush valve. **Record** time and date when the transfer stopped and **Initial** TK-105-AN To TK-102-AP Transfer Data Sheet, the Interconnected Tank Liquid Level Monitoring Data Sheet, the Excavation Control Checklist, and the TK-102-AP Transfer Data Sheet.	HATRANSF022	HACADEXXN	3.E-03	RTHUMSML03	28	0.1
D - Transfer to AP-104 and Qualify Waste	Decant Waste From AN-105 To AP-104	**Perform Transfer Valving and Pit Cover Check** - Steps 5.2.16 Through 5.2.19. **Ensure** the transfer cover check is or has been performed within 72 hours prior to removing an administrative lock from physically connected waste transfer pump. **Notify** HPT if a non-permanent, temporary cover is to be used. **Isolate** waste transfer paths connected to active waste transfer pumps not under administrative lock by two closed valves. **Complete** appropriate block on the TK-105-AN To TK-102-AP Valve Position Checklist. **Perform** valving per TK-105-AN To TK-102-AP Valve Position Checklist. Have valve positions **Independently Verified** and Checklist **Initialed**.	HAVLVEPC001	HAFACXXXL	5.E-04	RTHUMLRG02	392	0.2
D - Transfer to AP-104 and Qualify Waste	Decant Waste From AN-105 To AP-104	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.11 Through 5.3.12. **Ensure** service water and nitrogen are supplied to pump seals. **Measure** sludge level and **Position** transfer pump intake one foot above sludge level.	HATRANSF014	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
D - Transfer to AP-104 and Qualify Waste	Decant Waste From AN-105 To AP-104	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.22 Through 5.3.23. When the liquid level in TK-105-AN reaches the amount designated by the Shift Manager, Shutdown transfer as follows: **Reduce** pump speed to one-third full speed and **Increase** flush water flow to 100 gpm. Continue transfer until 2000 gallons of flush water have been transferred, **Stop** the transfer pump. When another 500 gallons of flush water have been transferred, **Close** main flush valve. **Record** time and date when the transfer stopped and **Initial** TK-105-AN To TK-102-AP Transfer Data Sheet, the Interconnected Tank Liquid Level Monitoring Data Sheet, the Excavation Control Checklist, and the TK-102-AP Transfer Data Sheet.	HATRANSF022	HACADEXXN	3.E-03	RTHUMSML03	28	0.1

Table D-3		Procedural Human Actions Quantified for LAW Waste Qualification and Transfers (241-AN-105)						
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity (Extracted from Readiness to Proceed Procedures)**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
D - Transfer to AP-104 and Qualify Waste	Decant Waste From AN-105 To AP-104	**Dissolve 105-AN Soluble Salts and Transfer To 102-AP** - Steps 5.4.1.1 Through 5.4.1.5. **Align** valves per TK-105-AN To TK-102-AP Flush Value Position Checklist, "Tank Flush." **Ensure** diluent/flush system is operable. **Open** main flush valve. **Throttle** diluent flow to 100 gpm using CHEMB-FCV-131. When the amount of diluent has been transferred to TK-105-AN, **Close** main flush valve.	HADISSLT001	HAFACXXXN	5.E-03	RTHUMSML03	28	0.1
D - Transfer to AP-104 and Qualify Waste	Decant Waste From AN-105 To AP-104	Perform Post Transfer Line Flushing - Steps 5.5.1.1 Through 5.5.1.7. Ensure diluent/flush system is operable and boiler exit temperature is 130F. Throttle flush water flow to 100 gpm using CHEMB-FCV 131. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Pump Flush." Open main valve, Backflush pump for five min. with hot water and Close main valve. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Transfer Line Flush." Open main valve, Flush transfer line with approximately 5000 gallons of hot water and Close main valve. Record actual flush volumes on TK-105-AN To TK-102-AP Transfer Data Sheet. Shift Manager will ensure that procedure TO-040-540, "Water Surveillance and Usage" requirements are followed. During line flushing, catch tank and interconnected tank readings, material balances, constant surveillance requirements, etc., still apply. When flush valving is completed, have an Independent Verification of valves' positions performed. Have Operator positioning the valves and the individual performing the independent verification Initial TK-105-AN To TK-102-AP Flush Valve Position Checklist.	HAPERFLS001	HAFACXXXL	5.E-04	RTHUMSML03	28	0.0
D - Transfer to AP-104 and Qualify Waste	Perform Mixing Operation AN-105/AP-104	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
D - Transfer to AP-104 and Qualify Waste	Obtain/Analyze Process Control Samples AN-105/AP-104	Obtain/Analyze Process Control Samples AN-104/AP-104.	HASAMPLE002	HALAEXXXN	3.E-04	RTHUMLRG01	280	0.1
D - Transfer to AP-104 and Qualify Waste	Blend & Shim Tank Chemistry AN-105/AP-104	**Note - Procedure does not have a "Blend & Shim" step. Using Step 5.4, "Dissolve 105-AN Soluble Salts and Transfer To 102-AP."** Steps 5.4.1.1 Through 5.4.1.5. **Align** valves per TK-105-AN To TK-102-AP Flush Value Position Checklist, "Tank Flush." **Ensure** diluent/flush system is operable. **Open** main flush valve. **Throttle** diluent flow to 100 gpm using CHEMB-FCV-131. When the amount of diluent has been transferred to TK-105-AN, **Close** main flush valve.	HAADDDIL001	HAFACXXXN	5.E-03	RTHUMSML03	28	0.1
D - Transfer to AP-104 and Qualify Waste	Perform Batch Mixing Operations AN-105 In AP-104	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
E - Transfer AP-102 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-102/AP-106	**Tank Sweep** - Steps 5.1.2.1 Through 5.1.2.2. **Set** mixer pump speed. **Place** Mixer Pump (WST-P-AN105A) in manual mode and **Orient** it to 30 degrees ±2. **Ensure** pump rotation speed is set at minimum. **Position** start/stop toggle switch on console. **Adjust** pump rotation speed to 15 Hz (0.05 rpm). When pump has rotated to within 2 degrees of target, **Toggle** start/stop switch to stop pump rotation.	HATANKSW001	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
E - Transfer AP-102 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-102/AP-106	**Perform Transfer Valving and Pit Cover Check** - Steps 5.2.16 Through 5.2.19. **Ensure** the transfer cover check is or has been performed within 72 hours prior to removing an administrative lock from physically connected waste transfer pump. **Notify** HPT if a non-permanent, temporary cover is to be used. **Isolate** waste transfer paths connected to active waste transfer pumps not under administrative lock by two closed valves. **Complete** appropriate block on the TK-105-AN To TK-102-AP Valve Position Checklist. **Perform** valving per TK-105-AN To TK-102-AP Valve Position Checklis+H20t. Have valve positions **Independently Verified** and Checklist **Initialed**.	HAVLVEPC001	HAFACXXXL	5.E-04	RTHUMLRG02	392	0.2

Table D-3		Procedural Human Actions Quantified for LAW Waste Qualification and Transfers (241-AN-105)						
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity (Extracted from Readiness to Proceed Procedures)**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
E - Transfer AP-102 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-102/AP-106	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.11 Through 5.3.12. **Ensure** service water and nitrogen are supplied to pump seals. **Measure** sludge level and **Position** transfer pump intake one foot above sludge level.	HATRANSF014	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
E - Transfer AP-102 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-102/AP-106	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.22 Through 5.3.23. When the liquid level in TK-105-AN reaches the amount designated by the Shift Manager, shutdown transfer as follows: **Reduce** pump speed to one-third full speed and **Increase** flush water flow to 100 gpm. Continue transfer until 2000 gallons of flush water have been transferred, **Stop** the transfer pump. When another 500 gallons of flush water have been transferred, **Close** main flush valve. **Record** time and date when the transfer stopped and **Initial** TK-105-AN To TK-102-AP Transfer Data Sheet, the Interconnected Tank Liquid Level Monitoring Data Sheet, the Excavation Control Checklist, and the TK-102-AP Transfer Data Sheet.	HATRANSF022	HACADEXXN	3.E-03	RTHUMSML03	28	0.1
E - Transfer AP-102 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-102/AP-106	Perform Post Transfer Line Flushing - Steps 5.5.1.1 Through 5.5.1.7. Ensure diluent/flush system is operable and boiler exit temperature is 130F. Throttle flush water flow to 100 gpm using CHEMB-FCV 131. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Pump Flush." Open main valve, Backflush pump for five min. with hot water and Close main valve. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Transfer Line Flush." Open main valve, Flush transfer line with approximately 5000 gallons of hot water and Close main valve. Record actual flush volumes on TK-105-AN To TK-102-AP Transfer Data Sheet. Shift Manager will ensure that procedure TO-040-540, "Water Surveillance and Usage" requirements are followed. During line flushing, catch tank and interconnected tank readings, material balances, constant surveillance requirements, etc., still apply. When flush valving is completed, have an Independent Verification of valves' positions performed. Have Operator positioning the valves and the individual performing the independent verification Initial TK-105-AN To TK-102-AP Flush Valve Position Checklist.	HAPERFLS001	HAFACXXXL	5.E-04	RTHUMSML03	28	0.0
F - Transfer AP-104 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-104/AP-108	**Perform Transfer Valving and Pit Cover Check** - Steps 5.2.16 Through 5.2.19. **Ensure** the transfer cover check is or has been performed within 72 hours prior to removing an administrative lock from physically connected waste transfer pump. **Notify** HPT if a non-permanent, temporary cover is to be used. **Isolate** waste transfer paths connected to active waste transfer pumps not under administrative lock by two closed valves. **Complete** appropriate block on the TK-105-AN To TK-102-AP Valve Position Checklist. **Perform** valving per TK-105-AN To TK-102-AP Valve Position Checklist. Have valve positions **Independently Verified** and Checklist **Initialed**.	HAVLVEPC001	HAFACXXXL	5.E-04	RTHUMLRG02	392	0.2
F - Transfer AP-104 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-104/AP-108	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.11 Through 5.3.12. **Ensure** service water and nitrogen are supplied to pump seals. **Measure** sludge level and **Position** transfer pump intake one foot above sludge level.	HATRANSF014	HAFACXXXN	5.E-03	RTHUMLRG02	392	2.0
F - Transfer AP-104 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-104/AP-108	**Transfer From TK-105-AN To TK-102-AP** - Steps 5.3.22 Through 5.3.23. When the liquid level in TK-105-AN reaches the amount designated by the Shift Manager, shutdown transfer as follows: **Reduce** pump speed to one-third full speed and **Increase** flush water flow to 100 gpm. Continue transfer until 2000 gallons of flush water have been transferred, **Stop** the transfer pump. When another 500 gallons of flush water have been transferred, **Close** main flush valve. **Record** time and date when the transfer stopped and **Initial** TK-105-AN To TK-102-AP Transfer Data Sheet, the Interconnected Tank Liquid Level Monitoring Data Sheet, the Excavation Control Checklist, and the TK-102-AP Transfer Data Sheet.	HATRANSF022	HACADEXXN	3.E-03	RTHUMSML03	28	0.1
F - Transfer AP-104 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-104/AP-108	**Dissolve 105-AN Soluble Salts and Transfer To 102-AP** - Steps 5.4.1.1 Through 5.4.1.5. **Align** valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Tank Flush." **Ensure** diluent/flush system is operable and boiler exit temperature is 130F. **Open** main flush valve. **Throttle** flush water flow to 100 gpm using CHEMB-FCV-131. When the amount of water specified by the Shift Manager has been transferred to TK-105-AN, **Close** main flush valve.	HADISSLT001	HAFACXXXN	5.E-03	RTHUMSML03	28	0.1

Table D-3	Procedural Human Actions Quantified for LAW Waste Qualification and Transfers (241-AN-105)							
RAM Model Activity	**Sub-Activity Task Title**	**Operational Activity (Extracted from Readiness to Proceed Procedures)**	**Human Action Identifier**	**HEP Identifier**	**HEP per Operation**	**Recovery Identifier**	**MTTR (hours)**	**Expected Delay (hours)**
F - Transfer AP-104 to BNFL	Transfer 700 Kgal AN-105 Feed From AP-104/AP-108	Perform Post Transfer Line Flushing - Steps 5.5.1.1 Through 5.5.1.7. Ensure diluent/flush system is operable and boiler exit temperature is 130F. Throttle flush water flow to 100 gpm using CHEMB-FCV-131. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Pump Flush." Open main valve, Backflush pump for five min. with hot water and Close main valve. Align valves per TK-105-AN To TK-102-AP Flush Valve Position Checklist, "Transfer Line Flush." Open main valve, Flush transfer line with approximately 5000 gallons of hot water and Close main valve. Record actual flush volumes on TK-105-AN To TK-102-AP Transfer Data Sheet. Shift Manager will ensure that procedure TO-040-540, "Water Surveillance and Usage" requirements are followed. During line flushing, catch tank and interconnected tank readings, material balances, constant surveillance requirements, etc., still apply. When flush valving is completed, have an Independent Verification of valves' positions performed. Have Operator positioning the valves and the individual performing the independent verification Initial TK-105-AN To TK-102-AP Flush Valve Position Checklist.	HAPERFLS001	HAFACXXXL	5.E-04	RTHUMSML03	28	0.0

Table D-4	Definition of Human Error Rate Variables for Use in WFDS RAM Evaluations (Based on WSRC-TR-93-581)						
HUMAN ERROR MODE ID	HUMAN ERROR MODE DESCRIPTION	PERFORMANCE DIFFICULTY DESIGNATOR	HEP ID	HEP	RF	HEP UNITS	SELECTION GUIDANCE
HACADEXX	Chemical addition or delution error	LOW	HACADEXXL	3.E-04	10	per demand	Simple process
HACADEXX	Chemical addition or delution error	NOMINAL	HACADEXXN	3.E-03	10	per demand	Typical process
HACADEXX	Chemical addition or delution error	HIGH	HACADEXXH	3.E-02	5	per demand	Complex process
HACEXXXX	Communication error	LOW	HACEXXXXL	1.E-03	10	per demand	Simple information
HACEXXXX	Communication error	NOMINAL	HACEXXXXN	5.E-02	5	per demand	Moderate information
HACEXXXX	Communication error	HIGH	HACEXXXXH	5.E-01	2	per demand	Complex information
HACSSOXX	Crane/hoist strikes stationary object	LOW	HACSSOXXL	3.E-05	10	per operation	Spotter present
HACSSOXX	Crane/hoist strikes stationary object	NOMINAL	HACSSOXXN	3.E-04	10	per operation	Typical visibility
HACSSOXX	Crane/hoist strikes stationary object	HIGH	HACSSOXXH	3.E-03	10	per operation	No spotter, low visibility
HACVEXXX	Checker verification error	LOW	HACVEXXXL	1.E-02	5	per demand	Checking requires active participation
HACVEXXX	Checker verification error	NOMINAL	HACVEXXXN	1.E-01	3	per demand	Alerted, but not active participant
HACVEXXX	Checker verification error	HIGH	HACVEXXXH	3.E-01	3	per demand	Written materials not used
HADEXXXX	Diagnosis error	LOW	HADEXXXXL	1.E-03	10	per demand	Knowledge-based, greater than 120 minutes
HADEXXXX	Diagnosis error	NOMINAL	HADEXXXXN	1.E-02	5	per demand	Knowledge-based, 30 to 120 minutes
HADEXXXX	Diagnosis error	HIGH	HADEXXXXH	1.E-01	3	per demand	Knowledge-based, 10 to 30 minutes
HADLUCXX	Dropping of load when using crane/hoist	LOW	HADLUCXXL	3.E-05	10	per operation	Standardized load, spotter present
HADLUCXX	Dropping of load when using crane/hoist	NOMINAL	HADLUCXXN	1.E-04	10	per operation	Typical load
HADLUCXX	Dropping of load when using crane/hoist	HIGH	HADLUCXXH	1.E-03	10	per operation	Unusual, unevenly balanced load or remotely operated crane/hoists
HADLUFXX	Dropping of load when using forklift	LOW	HADLUFXXL	1.E-05	10	per operation	Standardized load, spotter present
HADLUFXX	Dropping of load when using forklift	NOMINAL	HADLUFXXN	5.E-05	10	per operation	Typical load
HADLUFXX	Dropping of load when using forklift	HIGH	HADLUFXXH	5.E-04	10	per operation	Unusual, unevenly balanced load
HAEDMXXX	Error during maintenance	LOW	HAEDMXXXL	3.E-04	10	per demand	Good external conditions, routine effort

Table D-4	Definition of Human Error Rate Variables for Use in WFDS RAM Evaluations (Based on WSRC-TR-93-581)						
HUMAN ERROR MODE ID	HUMAN ERROR MODE DESCRIPTION	PERFORMANCE DIFFICULTY DESIGNATOR	HEP ID	HEP	RF	HEP UNITS	SELECTION GUIDANCE
HAEDMXXX	Error during maintenance	NOMINAL	HAEDMXXXN	3.E-02	5	per demand	Good external conditions, unique effort
HAEDMXXX	Error during maintenance	HIGH	HAEDMXXXH	1.E-01	5	per demand	Challenging external conditions, unique effort
HAEEXXXX	Excavation error	LOW	HAEEXXXXL	1.E-03	10	per excavation	Excellent review of area (survey for underground objects)
HAEEXXXX	Excavation error	NOMINAL	HAEEXXXXN	1.E-02	5	per excavation	Good review of area
HAEEXXXX	Excavation error	HIGH	HAEEXXXXH	1.E-01	3	per excavation	Poor review of area
HAESCOCR	Error in selecting control outside control room	LOW	HAESCOCRL	3.E-03	10	per demand	Excellent layout, procedure-driven
HAESCOCR	Error in selecting control outside control room	NOMINAL	HAESCOCRN	1.E-02	5	per demand	Good layout, procedure-driven
HAESCOCR	Error in selecting control outside control room	HIGH	HAESCOCRH	5.E-02	5	per demand	Poor layout, scanning effort
HAESCWCR	Error in selecting control within control room	LOW	HAESCWCRL	1.E-03	10	per demand	Excellent layout, procedure-driven
HAESCWCR	Error in selecting control within control room	NOMINAL	HAESCWCRN	1.E-02	5	per demand	Good layout, procedure-driven
HAESCWCR	Error in selecting control within control room	HIGH	HAESCWCRH	3.E-02	5	per demand	Poor layout, scanning effort
HAFACXXX	Failure of administrative control	LOW	HAFACXXXL	5.E-04	10	per demand	Routine repetitive circumstances, includes checking within the team
HAFACXXX	Failure of administrative control	NOMINAL	HAFACXXXN	5.E-03	10	per demand	Typical circumstances
HAFACXXX	Failure of administrative control	HIGH	HAFACXXXH	5.E-02	5	per demand	Unusual circumstances
HAFLOXXX	Failure to lock out	NOMINAL	HAFLOXXXN	5.E-04	10	per demand	Typical lockout plan (5 to 10 lockouts)
HAFLOXXX	Failure to lock out	HIGH	HAFLOXXXH	5.E-03	10	per demand	Complex lockout plan (11 to 100 lockouts)
HAFLOXXX	Failure to lock out	LOW	HAFLOXXXL	5.E-02	10	per demand	Simple lockout plan (1 to 4 lockouts)
HAFLTAXX	Failure of long term accident recovery	LOW	HAFLTAXXL	3.E-05	10	per demand	3-7 days for recovery, simple recovery actions

Table D-4	Definition of Human Error Rate Variables for Use in WFDS RAM Evaluations (Based on WSRC-TR-93-581)						
HUMAN ERROR MODE ID	HUMAN ERROR MODE DESCRIPTION	PERFORMANCE DIFFICULTY DESIGNATOR	HEP ID	HEP	RF	HEP UNITS	SELECTION GUIDANCE
HAFLTAXX	Failure of long term accident recovery	NOMINAL	HAFLTAXXN	3.E-03	10	per demand	24-48 hours for recovery, simple recovery actions
HAFLTAXX	Failure of long term accident recovery	HIGH	HAFLTAXXH	1.E-01	3	per demand	Less than 24 hours for recovery
HAFMFDXX	Failure of manual fire detection	LOW	HAFMFDXXL	1.E-02	5	per demand	Area occupied 100% of time
HAFMFDXX	Failure of manual fire detection	NOMINAL	HAFMFDXXN	1.E-01	3	per demand	Area occupied 80% of time
HAFMFDXX	Failure of manual fire detection	HIGH	HAFMFDXXH	5.E-01	2	per demand	Area unoccupied
HAFMFSNX	Failure of manual fire suppression by non-occupant	LOW	HAFMFSNXL	3.E-02	5	per demand	Response less than 10 minutes, simple fire
HAFMFSNX	Failure of manual fire suppression by non-occupant	NOMINAL	HAFMFSNXN	1.E-01	3	per demand	Response by 10 minutes, typical fire
HAFMFSNX	Failure of manual fire suppression by non-occupant	HIGH	HAFMFSNXH	3.E-01	3	per demand	Response much longer than 10 minutes, simple fire
HAFMFSOX	Failure of manual fire suppression by occupant	LOW	HAFMFSOXL	1.E-01	3	per demand	Excellent fire extinguisher installation/maintenance
HAFMFSOX	Failure of manual fire suppression by occupant	NOMINAL	HAFMFSOXN	3.E-01	3	per demand	Typical fire extinguisher installation/maintenance
HAFMFSOX	Failure of manual fire suppression by occupant	HIGH	HAFMFSOXH	5.E-01	2	per demand	Poor fire extinguisher installation/maintenance
HAFRCSXX	Failure to respond to compelling signal	LOW	HAFRCSXXL	3.E-03	10	per demand	Few competing signals
HAFRCSXX	Failure to respond to compelling signal	NOMINAL	HAFRCSXXN	1.E-02	5	per demand	Several competing signals
HAFRCSXX	Failure to respond to compelling signal	HIGH	HAFRCSXXH	1.E-01	3	per demand	Many competing signals
HAFRFMXX	Failure to restore following maintenance	LOW	HAFRFMXXL	3.E-03	10	per demand	Two-person team, operator check
HAFRFMXX	Failure to restore following maintenance	NOMINAL	HAFRFMXXN	5.E-03	10	per demand	Single-person, operator check
HAFRFMXX	Failure to restore following maintenance	HIGH	HAFRFMXXH	5.E-02	5	per demand	Single-person, no checks
HAFRFTXX	Failure to restore following test	LOW	HAFRFTXXL	5.E-03	10	per demand	Two-person team, operator check
HAFRFTXX	Failure to restore following test	NOMINAL	HAFRFTXXN	1.E-02	5	per demand	Single-person, operator check
HAFRFTXX	Failure to restore following test	HIGH	HAFRFTXXH	3.E-02	5	per demand	Single-person, no checks

Table D-4	Definition of Human Error Rate Variables for Use in WFDS RAM Evaluations (Based on WSRC-TR-93-581)						
HUMAN ERROR MODE ID	HUMAN ERROR MODE DESCRIPTION	PERFORMANCE DIFFICULTY DESIGNATOR	HEP ID	HEP	RF	HEP UNITS	SELECTION GUIDANCE
HAFVIXXX	Failure of visual inspection	LOW	HAFVIXXXL	1.E-02	5	per demand	Procedure followed, event easy to observe (damage very prominent)
HAFVIXXX	Failure of visual inspection	NOMINAL	HAFVIXXXN	1.E-01	3	per demand	Procedure usually followed, event easy to observe
HAFVIXXX	Failure of visual inspection	HIGH	HAFVIXXXH	5.E-01	2	per demand	Event difficult to observe
HAFVOCRX	Failure to verify outside control room	LOW	HAFVOCRXL	1.E-02	5	per demand	Excellent layout, procedure-driven
HAFVOCRX	Failure to verify outside control room	NOMINAL	HAFVOCRXN	3.E-02	5	per demand	Good layout, procedure-driven
HAFVOCRX	Failure to verify outside control room	HIGH	HAFVOCRXH	1.E-01	3	per demand	Poor layout, scanning effort
HAFVPCXX	Failure to verify parameter with calculation	LOW	HAFVPCXXL	5.E-03	10	per demand	Procedure almost always used, verification
HAFVPCXX	Failure to verify parameter with calculation	NOMINAL	HAFVPCXXN	3.E-02	5	per demand	Procedure usually used, verification
HAFVPCXX	Failure to verify parameter with calculation	HIGH	HAFVPCXXH	1.E-01	3	per demand	No verification
HAFVWCRX	Failure to verify within control room	LOW	HAFVWCRXL	3.E-03	10	per demand	Excellent layout, procedure-driven
HAFVWCRX	Failure to verify within control room	NOMINAL	HAFVWCRXN	1.E-02	5	per demand	Good layout, procedure-driven
HAFVWCRX	Failure to verify within control room	HIGH	HAFVWCRXH	5.E-02	5	per demand	Poor layout, scanning effort
HAIASSXX	Inadvertent actuation/shutdown of system	LOW	HAIASSXXL	5.E-07	10	per hour	Almost no activities could affect system
HAIASSXX	Inadvertent actuation/shutdown of system	NOMINAL	HAIASSXXN	5.E-06	10	per hour	Some activities could affect system
HAIASSXX	Inadvertent actuation/shutdown of system	HIGH	HAIASSXXH	5.E-05	10	per hour	Many activities could affect system
HAILTXXX	Incorrect labeling or tagging	LOW	HAILTXXXL	1.E-03	10	per demand	Excellent administrative controls
HAILTXXX	Incorrect labeling or tagging	NOMINAL	HAILTXXXN	5.E-03	10	per demand	Normal administrative controls
HAILTXXX	Incorrect labeling or tagging	HIGH	HAILTXXXH	3.E-02	5	per demand	Poor administrative controls

Table D-4	Definition of Human Error Rate Variables for Use in WFDS RAM Evaluations (Based on WSRC-TR-93-581)						
HUMAN ERROR MODE ID	HUMAN ERROR MODE DESCRIPTION	PERFORMANCE DIFFICULTY DESIGNATOR	HEP ID	HEP	RF	HEP UNITS	SELECTION GUIDANCE
HAIRDXX	Incorrect reading or recording of data	LOW	HAIRDXXL	3.E-03	10	per demand	Excellent display (digital readout, indicator lamp)
HAIRDXX	Incorrect reading or recording of data	NOMINAL	HAIRDXXN	1.E-02	5	per demand	Good display (graph)
HAIRDXX	Incorrect reading or recording of data	HIGH	HAIRDXXH	5.E-01	2	per demand	Poor display
HALAEXXX	Laboratory analysis error	LOW	HALAEXXXL	3.E-05	10	per demand	Zero dependence check
HALAEXXX	Laboratory analysis error	NOMINAL	HALAEXXXN	3.E-04	10	per demand	Low dependence check
HALAEXXX	Laboratory analysis error	HIGH	HALAEXXXH	1.E-03	10	per demand	No check
HAMCALXX	Miscalibration	LOW	HAMCALXXL	3.E-03	10	per demand	Two-person team, operator check
HAMCALXX	Miscalibration	NOMINAL	HAMCALXXN	5.E-03	10	per demand	Single-person, operator check
HAMCALXX	Miscalibration	HIGH	HAMCALXXH	3.E-02	5	per demand	Single-person, no checks
HAMPDXXX	Procedure development error	LOW	HAMPDXXXL	3.E-04	10	per demand	Simple procedure with adequate time
HAMPDXXX	Procedure development error	NOMINAL	HAMPDXXXN	3.E-02	5	per demand	Complex procedure with adequate time
HAMPDXXX	Procedure development error	HIGH	HAMPDXXXH	1.E-01	5	per demand	Complex procedure with limited time
HAOTXXXX	Overfilling of a tank	LOW	HAOTXXXXL	5.E-07	10	per tank-hour	Low activity (1 potential transfer/year)
HAOTXXXX	Overfilling of a tank	NOMINAL	HAOTXXXXN	5.E-06	10	per tank-hour	Moderate activity (10 potential transfers/year)
HAOTXXXX	Overfilling of a tank	HIGH	HAOTXXXXH	5.E-05	10	per tank-hour	High activity (100 potential transfers/year)
HAPLUFXX	Puncturing of load when using forklift	LOW	HAPLUFXXL	5.E-06	10	per operation	Standardized load, spotter present
HAPLUFXX	Puncturing of load when using forklift	NOMINAL	HAPLUFXXN	3.E-05	10	per operation	Typical load
HAPLUFXX	Puncturing of load when using forklift	HIGH	HAPLUFXXH	3.E-04	10	per operation	Unusual, unevenly balanced load
HASVAXXX	Single vehicle accident	LOW	HASVAXXXL	1.E-07	10	per mile	Freeway environment
HASVAXXX	Single vehicle accident	NOMINAL	HASVAXXXN	1.E-06	10	per mile	Typical highway environment
HASVAXXX	Single vehicle accident	HIGH	HASVAXXXH	1.E-05	10	per mile	Congested road, bad weather

Table D-4	Definition of Human Error Rate Variables for Use in WFDS RAM Evaluations (Based on WSRC-TR-93-581)						
HUMAN ERROR MODE ID	HUMAN ERROR MODE DESCRIPTION	PERFORMANCE DIFFICULTY DESIGNATOR	HEP ID	HEP	RF	HEP UNITS	SELECTION GUIDANCE
HASVEXXX	Supervisor verification error	LOW	HASVEXXXL	1.E-01	3	per demand	Check-off sheet, low dependence
HASVEXXX	Supervisor verification error	NOMINAL	HASVEXXXN	3.E-01	3	per demand	Check-off sheet, medium dependence
HASVEXXX	Supervisor verification error	HIGH	HASVEXXXH	5.E-01	2	per demand	Check-off sheet, high dependence, high stress
HATEXXXX	Transfer error	LOW	HATEXXXXL	3.E-07	10	per tank-hour	Low activity (1 potential transfer/year)
HATEXXXX	Transfer error	NOMINAL	HATEXXXXN	3.E-06	10	per tank-hour	Moderate activity (10 potential transfers/year)
HATEXXXX	Transfer error	HIGH	HATEXXXXH	3.E-05	10	per tank-hour	High activity (100 potential transfers/year)
HAVCMVXX	Vehicle collision with another moving vehicle	LOW	HAVCMVXXL	1.E-07	10	per mile	Freeway environment
HAVCMVXX	Vehicle collision with another moving vehicle	NOMINAL	HAVCMVXXN	1.E-06	10	per mile	Typical highway environment
HAVCMVXX	Vehicle collision with another moving vehicle	HIGH	HAVCMVXXH	1.E-05	10	per mile	Congested road, bad weather
HAVCSOXX	Vehicle collision with stationary object	LOW	HAVCSOXXL	1.E-07	10	per mile	Freeway environment
HAVCSOXX	Vehicle collision with stationary object	NOMINAL	HAVCSOXXN	1.E-06	10	per mile	Typical highway environment
HAVCSOXX	Vehicle collision with stationary object	HIGH	HAVCSOXXH	1.E-05	10	per mile	Congested road, bad weather

Table D-5	Events from ORPS that Have a Potential to Produce Delays in WFDS Schedule Activities									
ORPS ID	Discovery Date	System/ Building	Title	Component Type	Failure Mode Code	Rationale	RAM Equip ID	Restoration Time	Time Rationale	Comments
RL--WHC-TANKFARM-1991-0207	03/14/91	272-AW	"EVACUATION OF 272-AW AS A PRECAUTIONARY MEASURE"	N/A	HA - Pouring bleach down drain	Building evacuated, sampling of air quality performed	272-AW	1	Time from initiation of event to building release	
RL--WHC-TANKFARM-1991-1019	06/18/91	241-BY	"FAILURE TO CONTINUOUSLY MAN CONTROL ROOM DURING TRANSFER PER PROCEDUR E"	N/A	HA - Procedure violation	Control room not manned during waste transfer	241-BY-254 Control Room		Control Room not manned for 30 min., radiation monitors were not alarming when the facility was re-manned	Procedure TO-305-004 requires Building 242-BY staffed at all times during pumping activities to monitor the area radiation alarms
RL--WHC-TANKFARM-1991-1036	08/26/91	241-AN-103	NON COMPLIANCE TO LEVEL MONITORING REQUIREMENTS OF DOUBLE-SHELL TANK 103-AN	N/A	HA - Failed to read tank daily surface level	Surface level transmitter to CASS out of surface, field measurement was necessary to fulfill OSR requirement	241-AN-103 Tank		Failure to read level occurred three days before discovery. There was no adverse effect to facility	
RL--WHC-TANKFARM-1991-1045	09/19/91	244-CR Vault/TK-003	DAILY LIQUID LEVEL MEASUREMENT OF TK-003-CR NOT OBTAINED.	N/A	HA - Failed to read tank daily surface level	OSD requires daily liquid level reading	244-CR Vault , TK-003		Violation detected next day, facility not in operation, no change in liquid level noted in follow-up reading	
RL--WHC-TANKFARM-1991-1054	10/22/91	Tank 244-CR-003	Tank 244-CR-003 Compositional Limit Nonconformance		HACADEXXN	A chemical addition or calculation error is a possible event for Phase 1 operations.		1248	Based on ORPS report data to provide retraining, correct procedures and determine effect of event on tank integrity.	None
RL--WHC-TANKFARM-1991-1067	11/26/91	241-T Tank Farm	241-T TANK FARM THERMOCOUPLE RISER BROKEN OFF BY FRONT-END LOADER WHILE SPREADING GRAVEL	Thermocouple riser broken off	HA - Ran over thermocouple riser	Broken off thermocouple riser, still functional. Tank integrity was not compromised	241-T Tank Farm	0	No apparent damage to wiring or instruments observed. Thermocouples were registering and transmitting recordable data.	
RL--WHC-TANKFARM-1991-1070	12/04/91	Tank 241-A-103	SINGLE-SHELL TANK 103-A LATERAL RADIATION DETECTOR DATA EXCEEDS BASELINE	Lateral Radiation Detector	HA - Detector not positioned for proper reading	Information analyzed for tank leak detection, reading indicated that a leak or mitgration occurred. Operation would be stopped to verify reading	SST 241-A-103	4	Time required to verify reading and to determine basis for high reading. Performing task per procedure would have prevented this event	
RL--WHC-TANKFARM-1991-1074	12/07/91	241-AY Tank Farm	RAW WATER LEAK IN THE 241-AY-01A WATER SERVICE PIT	Drain Valve	HA - Drain valve left open	Break down of communication, personnel were not aware of the valving being opened the previous day	241-AY Water Service Pit	1	Response to possible leak was handled in a timely fashion. Actions necessary to bring system into safe condition was followed as directed	
RL--WHC-TANKFARM-1991-1082	12/26/91	241-AN Tank Farm	DISCREPANCIES IN DATA SHEET RECORDING AT 241-AN TANK FARM	N/A	HA - Data copied from previous day, rather during current operation	Review of corrupt data can lead to falsely believe that the facility is operating safely and thus preclude appropriate actions to rectify an adverse condition indicated by otherwise accurately recorded data sheets	241-AN Tank Farm		Significant discrepancies discovered 6 days after event. Serious misconduct by employee was basis, plant system was functioning as required	

Table D-5	Events from ORPS that Have a Potential to Produce Delays in WFDS Schedule Activities									
ORPS ID	Discovery Date	System/ Building	Title	Component Type	Failure Mode Code	Rationale	RAM Equip ID	Restoration Time	Time Rationale	Comments
RL--WHC-TANKFARM-1992-0018	02/23/92	Tank Farm/Master Key	POSSIBLE LOSS OF TANK FARM 200 EAST AND WEST FACILITY ACCESS MASTER KEYS.	N/A	HA - Loss of Access Master Keys	Disruption of activities due to verification of missing keys, re-keying of affected facilities, and training of personnel	200E and 200W Tank Farm Facilities			
RL--WHC-TANKFARM-1992-0015	02/25/92	SX Sludge Cooler	LOSS OF SX TANK FARM EXHAUSTER DUE TO LOSS OF THE PORTABLE AIR COMPRESSOR	Portable Compressor	HA - Portable Compressor out of fuel	Compressor necessary for the operation of the exhauster	SX Tank Farm		Compressor ran out of fuel, would not restart once re-fueled. ORPS Report does not indicated if replace compressor brought in	
RL--WHC-TANKFARM-1992-0016	02/25/92	241-AZ Tank Farm	241-AZ TANK FARM EVACUATION DUE TO HIGH PRESSURE HORN ACTIVATION	Panel 2	HA - Procedure Violation	Engineer not authorized to open the electrical panels and trace individual circuits. Farm immediately evacuated.	271-A Instrument Building, 241 AZ Tank Farm	2	Contamination survey conducted and no contamination found. Panel was inspected b electrician and no wiring problem discovered	
RL--WHC-TANKFARM-1992-0022	02/28/92	241-SY Leak Detector	LOSS OF CONFIGURATION CONTROL IN THE 241-SY PRIMARY LEAK DETECTION SYSTEM DUE TO AN INACCURATE PROCEDURE	LI	HA-EXT	Conductivity probe set at wrong height, tank level error Unusual Occurrence declared. Conductivity probe provide one of two primary tank leak detection methods required by OSR	241-SY Leak Detector		Days - Procedure required modification, approval and issuance.	
RL--WHC-TANKFARM-1992-0054	07/15/92	A-302-A CT	OSD REQUIREMENT EXCEEDED WHEN F18 TRANSFER TO 102-AN WAS ROUTED THROUG H DIVERSION BOX WHICH DRAINS INTO CATCH TANK ABOVE LIQUID LEVEL LIMITS	N/A	HA - Misrouting of waste	OSD requirement exceeded, violation discovered 10 days after event	A-302-A CT		Violation discovered 10 days after transfer date. ORPS does not discuss corrective action to bring catch tank back into compliance	
RL--WHC-TANKFARM-1992-0087	11/11/92	Tank 241-T-107	PROCEDURE NONCOMPLIANCE AT SINGLE SHELL TANK 241-T-107 RESULTS IN LESS THAN ADEQUATE PRE-JOB MEETING AND SUBSEQUENT JOB PERFORMANCE	N/A	HA - Lack of attention to detail	All work which required a formal pre job safety meeting was discontinued until job supervisors completed re-training	N/A		ORPS Report did not specify when the Stop Work was lifted	
RL--WHC-TANKFARM-1993-0011	01/21/93	AY/AZ Farm Vent Fan	TEMPORARY LOSS OF 241-AY&AZ PRIMARY TANK VENTILATION DUE TO PERSONNEL ERROR; NO CONTAMINATION SPREAD OR PERSONNEL INJURY RESULTED.	Magnetic motor starter for Exhaust Fan	HA - Inattention to details	Tank Farm evacuated, personnel required to use respiratory protection to reenter the Farm	AY and AZ Farm Ventilation	1	Exhauster restarted and radiological surveys of the Farms conducted	
RL--WHC-TANKFARM-1993-0040	04/21/93		LOSS OF CHAIN OF CUSTODY FOR 241-T-102 CORE SAMPLE; EMPTY CASK WAS INADVERTENTLY SHIPPED TO THE LAB WHILE THE SAMPLE WAS STORED IN A RMA		HAFACXXXN	A similar incident could happen during Phase 1 sampling activities.		96	Based on information in ORPS report.	A similar incident during Phase 1 operations could potentially cause operations to resample tanks.

Table D-5 Events from ORPS that Have a Potential to Produce Delays in WFDS Schedule Activities

ORPS ID	Discovery Date	System/ Building	Title	Component Type	Failure Mode Code	Rationale	RAM Equip ID	Restoration Time	Time Rationale	Comments
RL--WHC-TANKFARM-1993-0041	04/28/93	204-AR	THE HEPA FILTERS FOR THE EF-1 EXHAUST SYSTEM AT 204-AR WERE FOUND TO BE DELINQUENT FOR THE ANNUAL EFFICIENCY TEST. NO HAZ-MAT RELEASE.	EF-1 Exhaust System, HEPA filters	HA - Procedure violation	OSD violation. Work package not returned and considered lost. Test on HEPA filters was missed and went unnoticed until it came for recall a year later	204_AR	2.5	Efficiency test check completed on filters, all passed	
RL--WHC-TANKFARM-1993-0059	06/29/93	241-A-401 Condenser Cooling Water System	LOSS OF CONTROL POWER TO 241-A-401 CONDENSER COOLING WATER SYSTEM RESULTED IN OSR NON-CONFORMANCE	Condenser Cooling Water System	HA - Procedure violation	Control power removed from lift pumps, deep well pumps, recirculation fans and recirculation pumps. OSD violation, emergency power and backup capacity required to be provided for Emergency Cooling Water System	241-A-401	23	Loss of control power discovered 7 days after event. Once discovered corrected in 23 hrs.	
RL--WHC-TANKFARM-1993-0069	08/04/93	DOUBLE SHELL WASTE TANK 241-SY-101 MITIGATION PUMP	LOSS OF FACILITY CONTROL RESULTS IN AN INADVERTENT START OF WASTE TANK 241-SY-101 HYDROGEN MITIGATION PUMP	P	HAFLOXXXL	A failure to lock out a system being tested or maintained would lead to at least an administrative hold on work to investigate.		864	Based on ORPS report to investigate and implement corrective actions.	None
RL--WHC-TANKFARM-1993-0071	08/10/93	241-C-106	INADEQUATE WORK CONTROL RESULTS IN PERSONNEL SKIN CONTAMINATION AT WASTE TANK 241-C-106, PIT "B"	N/A	HA - Skin Contamination	Declaration of an administrative hold of non-essential work at Tank Farms given. Resulting from combination of previous events within Tank Farms	241-C-106		Est days - ORPS Report did not specify when the Administrative Hold was lifted	
RL--WHC-TANKFARM-1993-0083	09/06/93	241-AZ-801/241-AY-801	FAILURE TO REPLACE CHART PAPER IN 241-AY/AZ TANK FARM RECORDERS RESULTS IN AN OSR NON-CONFORMANCE		HAEDMXXXL	A similar failure during maintenance could occur during Phase 1 operations with similar effects.		6	Based on ORPS report data to investigate and replace chart paper.	None
RL--WHC-TANKFARM-1993-0090	10/08/93	241-SY-101 Double-Shell Tank Mixer Pump Operations	WASTE TANK 241-SY-101 SAFETY ANALYSIS CALCULATION ERROR FOR AMMONIA RELEASE MECHANISM RESULTS IN AN UNREVIEWED SAFETY QUESTION		HAMPDXXXN	A similar error in FSAR/BIO calculations could be uncovered with similar effects.		0	Based on ORPS report to investigate and implement corrective actions.	The recovery time for this type of event could be large if it involved the generation of a Justification for Continued Operations report during the USQ investigation.
RL--WHC-TANKFARM-1993-0117	12/15/93	241-SX Sludge Cooler	ERROR IN DRAWING INTERPRETATION CAUSING WORK TO BE PERFORMED WITHOUT APPROPRIATE PRECAUTIONS	Differential pressure switch	HA - Inattention to details	Violation of OSD "vapor space" requirements: did not use an electrical grounding strap not an explosive gas monitor	241-SX Tank Farm ventilation system	0	Violation discovered after work had been completed	
RL--WHC-TANKFARM-1994-0001	01/08/94	244-BX to 241-AN-101 Transfer Leak Detection	INADEQUATE COMMUNICATIONS OF OPERATIONAL INFORMATION RESULTS IN VIOLATION OF ALARM RESPONSE PROCEDURE	N/A	HA - Procedure violation	Transfer continued after receiving and alarm, procedure required transfer to have been terminated	244-BX DCRT to Tank 241-AN 101	0	Transfer essentially completed when it was finally shut down	

Table D-5	Events from ORPS that Have a Potential to Produce Delays in WFDS Schedule Activities									
ORPS ID	Discovery Date	System/ Building	Title	Component Type	Failure Mode Code	Rationale	RAM Equip ID	Restoration Time	Time Rationale	Comments
RL--WHC-TANKFARM-1994-0004	01/26/94	105-AN Annulus Continuous Air Monitor	FAILURE TO INITIATE 4 HOURS OPERATOR SURVEILLANCE OF LOCAL ANNULUS LEAK DETECTION SYSTEM RESULTS IN OSR NON-CONFORMANCE	CAM	HA - Procedure Violation	OSR requires that the annuli be equipped with at least one operable leak detection device. When continuous monitoring is interrupted, a 4 hr surveillance of the local leak detection alarm is required	241-AN -105 Tank	0	Surveillance started once violation discovered. No active transfer was ongoing	
RL--WHC-TANKFARM-1994-0033	06/03/94		241-AP PRIMARY EXHAUSTER SHUTDOWN DUE TO CONTROL POWER BREAKER TRIP		HAEDMXXXN	This event could occur during Phase 1 operations with similar effects.		2.5	Based on ORPS report to replace switches and restore system to operation.	None
RL--WHC-TANKFARM-1994-0046	08/19/94	200 East Area waste tank hydroxide levels	ANALYSIS OF WASTE SAMPLES RESULTS IN DISCOVERY OF OUT-OF-SPECIFICATION LEVELS OF HYDROXIDE IN 200 EAST AREA WASTE TANKS	DST	HACADEXXN	Improper chemical additions or dilution errors could occur during Phase 1 operations leading to similar effects.		888	Based on ORPS report to investigate and make proper chemical additions to bring the tank chemistry with OSD requirements.	A similar event during Phase 1 operations would have a lesser impact because of the planned sampling and mixing operation built into the schedule.
RL--WHC-TANKFARM-1994-0063	11/14/94	241-AW Tank Farm/242-A Evaporator	FAILURE TO PROPERLY IMPLEMENT DOUBLE SHELL TANK INTERIM OPERATIONAL SAFETY REQUIREMENTS RESULTS IN MISSED SURVEILLANCE REQUIREMENTS	Pit Covers	HA - Procedure Violation	Violation of verification of covers once every 72 hrs once transfer begins for permanent covers and once per 12 hrs for temporary covers		0	Surveillance violation appears to have occurred over ~6 weeks, correction action (i.e., inspection of covers) was completed within 35 min. of discovery	
RL--WHC-TANKFARM-1994-0064	11/16/94	241-BX-101	INADEQUATE COMMUNICATIONS LEAD TO MISSED LEVEL SURVEILLANCE IN TANK 101-BX	N/A	HA - Inattention to detail	Violation of OSD, the level reading was taken within the 72 hrs grace period, however, written was not obtained	241-BX-101	0	ORPS Report did not specify what corrective actions were taken. There was not an active transfer ongoing at the time	
RL--WHC-TANKFARM-1995-0050	05/30/95	102-AZ Tank	Live Electrical Wire Struck By Worker During Excavation		HAEDMXXXN	A similar near miss event during Phase 1 operations could cause delays to implement corrective actions.		312	Based on ORPS report to investigate and implement corrective actions.	None
RL--WHC-TANKFARM-1995-0082	10/03/95	241-SY/271-S-A/P-28 Back-Up Portable Exhauster	OPENING POWER SUPPLY BREAKER RESULTS IN INADVERTENT SHUTDOWN OF BACK-UP EXHAUSTER FOR 241-SY TANK FARM	EXT	HA	Violation occurred when establishing plant conditions for planned maintenance				
RL--WHC-TANKFARM-1995-0091	10/19/95	241-S Transfer System	LINE FILL RESOLVES DISCREPANCY IN TRANSFER LINE CONFIGURATION	PIPE	HATEXXXXN	A misrouting of water and or waste of similar proportions could occur during Phase 1 operations with similar effects.			Unknown based on ORPS report to investigate and recover.	Flush and recovery of proper routing appears to have taken less than one day. Water did leak through an open nozzle into a valve pit. If this had been waste, the delay would certainly have been longer.

Table D-6	Events from ORPS that Have a Potential to Produce Delays in WFDS Schedule Activities									
ORPS ID	**Discovery Date**	**System/ Building**	**Title**	**Component Type**	**Failure Mode Code**	**Rationale**	**RAM Equip ID**	**Restoration Time**	**Time Rationale**	**Comments**
RL--WHC-TANKFARM-1996-0003	01/05/96	Operator at AW Tankfarm	PERSONNEL SKIN CONTAMINATION AT AW TANKFARM	N/A	HA - Inattention to details	Pumping leak detection pits, crew member became contaminated while removing tubing.	241-AW Leak Detection Pit		Pumping had been completed, contamination occur while exiting equipment from pit	
RL--WHC-TANKFARM-1996-0007	01/15/96	Double Contained Receiver Tank 244-TX	Operating Specifications Document Violation - Liquid Waste Stored in Tank 244-TX Found to Contain Less Hydroxide Than Required		HACADEXXN	Dilution errors and chemical addition errors are a possibility within the Phase 1 process. It may be possible to add too much or too little caustic to have to require recovery flushes which will then change the chemical specification of the delivery product.		0	Based on ORPS report that required no action to be taken.	None
RL--WHC-TANKFARM-1996-0017	02/14/96	AZ-101 Thermocouple	PERSONNEL POTENTIALLY EXCEEDED THE ADMINISTRATIVE CONTROL LEVEL FOR EXTREMITY EXPOSURE	Thermocouple	HA - Inattention to details	Work on project halted until completion of Type-C investigation.	AZ-101		Occurrence occurred while removing thermocouple tree. Work stopped to attend to personnel contamination, ORPS Report does not specify when work was resumed	
RL--WHC-TANKFARM-1996-0050	07/15/96	Riser #14 on tank C-104	TANK C-104, RISER #14 WAS DISCOVERED TO HAVE NO FLANGE COVERING.		HAFRFMXXN	A similar event during Phase 1 operations would cause delay to prevent operator exposure.		672	Based on ORPS report to investigate and perform corrective maintenance.	None
RL--WHC-TANKFARM-1996-0067	09/17/96	Tank C-106, Pump Pit, 06A, Containment Tent	NINETY SEVEN GALLONS OF WATER SPILLED INTO CONTAINMENT TENT AT TANK C-106 PUMP PIT	N/A	HA - Procedure Violation	Water addition started without Shift Manager permission, without the Water Addition Authorization Sheet being signed by the Shift Manager, and without verifying the water addition line-up	C-106 Tank		Work stopped, area surveyed for contamination spread, and water removed from containment tent. Time necessary to complete water addition not specified in ORPS	
RL--WHC-TANKFARM-1996-0072	09/24/96	AN-105 Void Viscometer	NON SPARKING TOOLS USED FOR INTRUSIVE WORK		HAEDMXXXH	Non-sparking tools are required for intrusive maintenance on Phase 1 systems. A similar stop work order would cause delay.			Many corrective actions were required to better train workers on flammable gas issues but it was not indicated when the maintenance work was completed.	None
RL--PHMC-TANKFARM-1996-0001	10/04/96	Single Shell Tank 241-U-110/Level Indicating Transmitter	Failure to Obtain an Intrusion Detection Reading Per the Operating Specification Document Results in a Procedure Violation	LI	HA	OSD-T-151-00031 violated	241-U-110		Temporary round sheet immediately implemented once violation discovered.	After two weeks of baseline data, the frequent of readings was returned to quarterly per the round sheets
RL--PHMC-TANKFARM-1996-0002	10/08/96	AN Tankfarm	LOSS OF VENTILATION IN AN-TANKFARM	EDS-DP-103 Distribution Panel	HA - Inattention to detail	Loss of power, resulting in loss of primary and annulus stack CAM alarms, heat trace alarms, fan failure and HEPA low D/P alarms. The primary fan failure and HEPA low D/P alarms stayed locked in. AN Farm evacuated	AN Tank Farm	1	Ventilation was off for ~ 22 min.	

Table D-5	Events from ORPS that Have a Potential to Produce Delays in WFDS Schedule Activities									
ORPS ID	Discovery Date	System/ Building	Title	Component Type	Failure Mode Code	Rationale	RAM Equip ID	Restoration Time	Time Rationale	Comments
RL--PHMC-TANKFARM-1996-0006	10/18/96	241-A-A Valve Pit Leak Detector	241-A-A INTRINSICALLY SAFE LEAK DETECTOR DOES NOT MEET DESIGN REQUIREMENTS OF THE AUTHORIZATION BASIS	Leak Detector	HA - Inattention to detail	Transfers that depend on the leak detector being operable were not allowed	241-A Valve Pit		ORPS did not specify how long it took to recover from this event	
RL--PHMC-TANKFARM-1997-0029	03/17/97	241-SY	ELECTRICAL LINE SEVERED DURING EXCAVATION		HAEEXXXXN	A similar event during Phase 1 operations would cause delay if power were cut off to critical systems.		312	Based on ORPS report to investigate and complete required repairs to the severed cable.	None
RL--PHMC-TANKFARM-1997-0040	04/28/97	241-S-108 SST, 241-S-110 SST, 244-S DCRT	FAILURE TO PERFORM PREVENTATIVE MAINTENANCE RESULTS IN OSD VIOLATION		HAFACXXXL	A failure to schedule and perform OSD related work on Phase 1 systems would create delay in transfer operations.		72	Based on ORPS report to investigate event and perform the missed maintenance evolution.	None
RL--PHMC-TANKFARM-1997-0042	04/30/97	204-AR Record Sample	OPERATIONS SAFETY REQUIREMENT WAS FOUND TO BE INCONSISTENT WITH FACILITY ENVIRONMENTAL REQUIREMENTS		HAFACXXXL	A failure to schedule and perform OSD related work on Phase 1 systems would create delay in transfer operations.		840	Based on ORPS report to investigate event and perform the missed maintenance evolution.	None
RL--PHMC-TANKFARM-1997-0056	06/27/97	241-SY valve pits	SKIN CONTAMINATION DISCOVERED ON PERSON WHEN EXITING 241-SY TANK FARM	N/A	HA - Procedure Violation	Decision to reinstall jumper with personnel in the pit instead of remotely was made without the RWP prepares, ALARA committee, or West Tank Farm management knowledge	241-SY Valve Pit	0	Construction activity, transfer no in progress	
RL--PHMC-TANKFARM-1997-0092	11/17/97	Tank 101-AN, pits 01D and 01E Drain Seals	NON-INTRINSICALLY SAFE LEAK DETECTORS WERE DISCOVERED TO BE NOT ISOLATED FROM TANK 101-AN	N/A	HA - Inattention to details	SSCs required to be operational per BIO were not operating within approved requirements	AN-101 Tank, Pits 01D and 01E Drain Seals		ORPS Report was unclear when violation was discovered or any corrective taken	
RL--PHMC-TANKFARM-1998-0005	01/13/98	Tank 102-AZ Annulus Leak Detection System	FAILURE TO PERFORM REQUIRED ACTIONS WITHIN THE SPECIFIED TIME FRAME FOR LOSS OF PRIMARY TANK LEAK DETECTION PER AZ-102, L.C.O. 3.2.6	Leak Detection	HA - Procedure Violation	BIO/TSR related problem, flammable gas must be verified to be less than 25% of the LFL once per 12 hrs.	102-AZ	0	Flammable gas verified to be less than 25% LFL, manually checked every 6 hrs until system repaired	
RL--PHMC-TANKFARM-1998-0011	02/03/98	244-A Continuous Air Monitor (CAM)	244-A CONTINUOUS AIR MONITOR ALARM SETPOINT WAS FOUND TO BE OUT OF RANGE	CAM	HA - CAM set-point improperly set	CAM alarm set-point incorrectly set. Found by personnel.	244-A Tank		Exhauster shutdown until analysis of sample paper is completed, ORPS Report did not define a restart time	
RL--PHMC-TANKFARM-1998-0013	02/06/98	Ventilation System/242-S Evaporator	LOSS OF VENTILATION SYSTEM AT THE 242-S EVAPORATOR (SHUTDOWN FACILITY) HAS NO ADVERSE EFFECTS ON PERSONNEL, THE FACILITY OR ENVIRONMENT	N/A	HA - Inattention to details	Loss of ventilation to process facility serving a confinement function	242-S Evaporator	1	Power restored to facility, power restored to building's Motor Control Center and ventilation system, tag hung on defective breaker	

APPENDIX E

RESULTS OF RAM ANALYSIS OF HIGH-LEVEL WASTE FEED DELIVERY ACTIVITIES

Figures

E-1 Simulation Results for the High Level Waste Transfer from AZ-101 to BNFL
E-2 Distribution of the Probability of Exceeding Various Batch Transfer Schedule Delay Durations

Tables

E-1 Waste Flowsheet Volume Summary for High Level Waste Transfer from AZ-101 to BNFL
E-2 Critical Items List for the High Level Waste Transfer Activities RAM B, Ranked by the Contribution of Unique Components to Expected Schedule Delay
E-3 Critical Items List for the High Level Waste Batch Transfer Pinned to the WTD Requested by BNFL, Ranked by the Contribution of Generic Component Type to Expected Schedule Delay
E-4 Critical Items List for the High Level Waste Transfer RAM B, Ranked by the Contribution of System Type to Expected Schedule Delay
E-5 Critical Items List for the High Level Waste Transfer Batch RAM B, Ranked by the Contribution of Mission Function to Expected Schedule Delay
E-6 Unique HLW RAM Components

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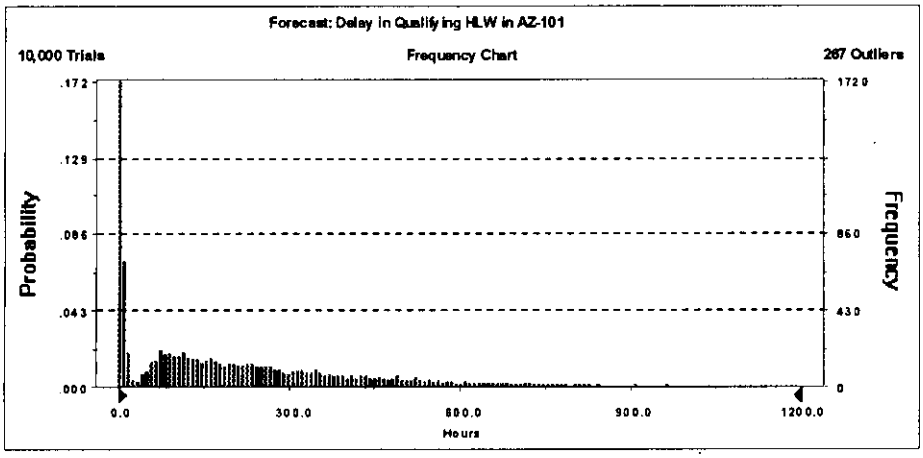
Crystal Ball Report
Simulation started on 6/10/99 at 7:54:27
Simulation stopped on 6/10/99 at 8:06:55

Forecast: Delay in Qualifying HLW in AZ-101 **Cell: Y2**

Summary:
Display Range is from 0.0 to 1200.0 Hours
Entire Range is from 0.0 to 6454.2 Hours
After 10,000 Trials, the Std. Error of the Mean is 3.6

Statistics:	Value	Days
Trials	10000	
Mean	258.0	10.8
Median	159.7	6.7
Mode	0.0	
Standard Deviation	360.6	
Variance	130021.0	
Skewness	3.98	
Kurtosis	30.88	
Coeff. of Variability	1.40	
Range Minimum	0.0	
Range Maximum	6454.2	
Range Width	6454.2	
Mean Std. Error	3.61	



Forecast: Delay in Qualifying HLW in AZ-101 (cont'd) **Cell: Y2**

Percentiles:

Percentile	Hours	Days
0%	0.0	0.0
5%	0.0	0.0
10%	0.0	0.0
15%	5.0	0.2
20%	9.9	0.4
25%	18.4	0.8
30%	64.7	2.7
35%	87.2	3.6
40%	109.1	4.5
45%	132.5	5.5
50%	159.7	6.7
55%	188.0	7.8
60%	220.4	9.2
65%	253.1	11
70%	292.5	12
75%	339.7	14
80%	395.8	16
85%	472.5	20
90%	579.8	24
95%	822.5	34
100%	6454.2	269

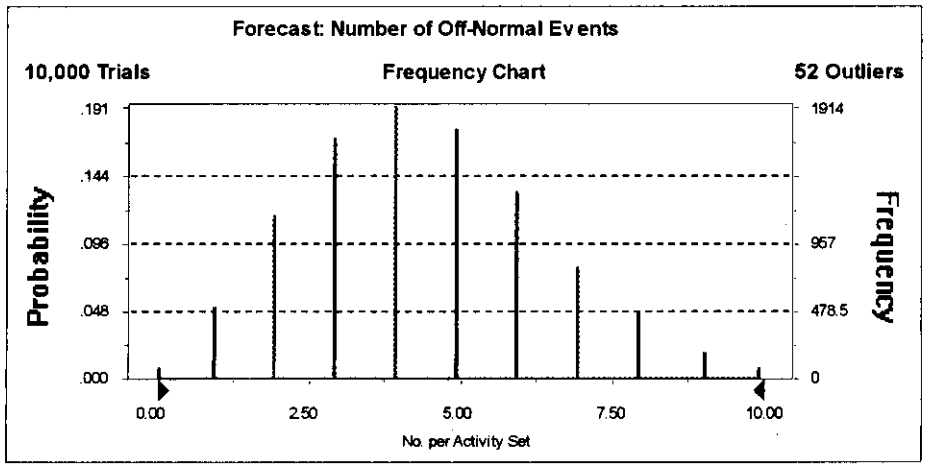
End of Forecast

Forecast: Number of Off-Normal Events **Cell: X2**

Summary:

Display Range is from 0.00 to 10.00 No. per Activity Set
Entire Range is from 0.00 to 13.00 No. per Activity Set
After 10,000 Trials, the Std. Error of the Mean is 0.02

Statistics:	Value
Trials	10000
Mean	4.46
Median	4.00
Mode	4.00
Standard Deviation	2.05
Variance	4.21
Skewness	0.43
Kurtosis	3.09
Coeff. of Variability	0.46
Range Minimum	0.00
Range Maximum	13.00
Range Width	13.00
Mean Std. Error	0.02



Forecast: Number of Off-Normal Events (cont'd) **Cell: X2**

Percentiles:

Percentile	No. per Activity Set
0%	0.00
5%	1.00
10%	2.00
15%	2.00
20%	3.00
25%	3.00
30%	3.00
35%	4.00
40%	4.00
45%	4.00
50%	4.00
55%	5.00
60%	5.00
65%	5.00
70%	5.00
75%	6.00
80%	6.00
85%	7.00
90%	7.00
95%	8.00
100%	13.00

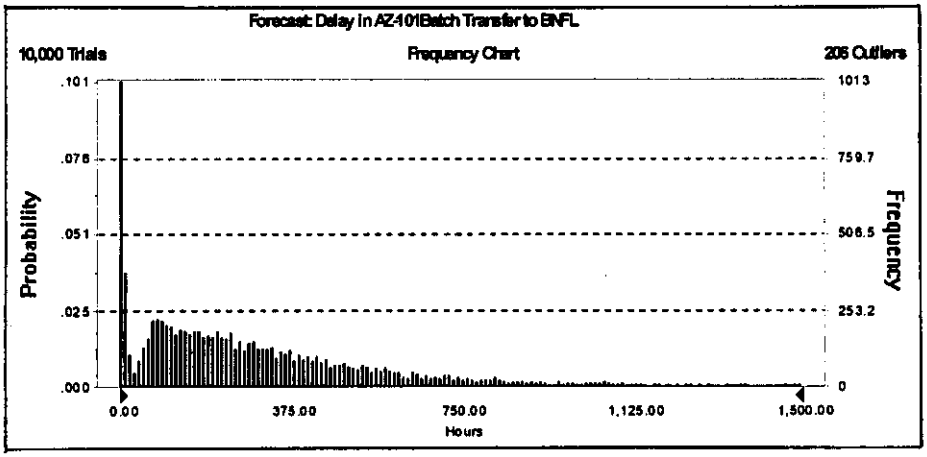
End of Forecast

Crystal Ball Report
Simulation started on 6/13/99 at 13:45:04
Simulation stopped on 6/13/99 at 14:09:38

Forecast: Delay in AZ-101Batch Transfer to BNFL **Cell: Y2**

Summary:
Display Range is from 0.00 to 1,500.00 Hours
Entire Range is from 0.00 to 7,009.93 Hours
After 10,000 Trials, the Std. Error of the Mean is 3.93

Statistics:	Value	Days
Trials	10000	
Mean	334.65	13.9
Median	233.56	9.7
Mode	0.00	
Standard Deviation	392.62	
Variance	154,150.02	
Skewness	3.77	
Kurtosis	30.95	
Coeff. of Variability	1.17	
Range Minimum	0.00	
Range Maximum	7,009.93	
Range Width	7,009.93	
Mean Std. Error	3.93	



Forecast: Delay in AZ-101Batch Transfer to BNFL (cont'd) **Cell: Y2**

Percentiles:

Percentile	Hours	Days
0%	0.00	
5%	1.53	0.1
10%	9.76	0.4
15%	31.38	1.3
20%	73.64	3.1
25%	96.48	4.0
30%	120.35	5.0
35%	146.88	6.1
40%	175.26	7.3
45%	204.29	8.5
50%	233.56	9.7
55%	266.87	11
60%	302.14	13
65%	340.92	14
70%	387.74	16
75%	439.42	18
80%	504.42	21
85%	587.21	24
90%	719.95	30
95%	993.46	41
100%	7,009.93	292

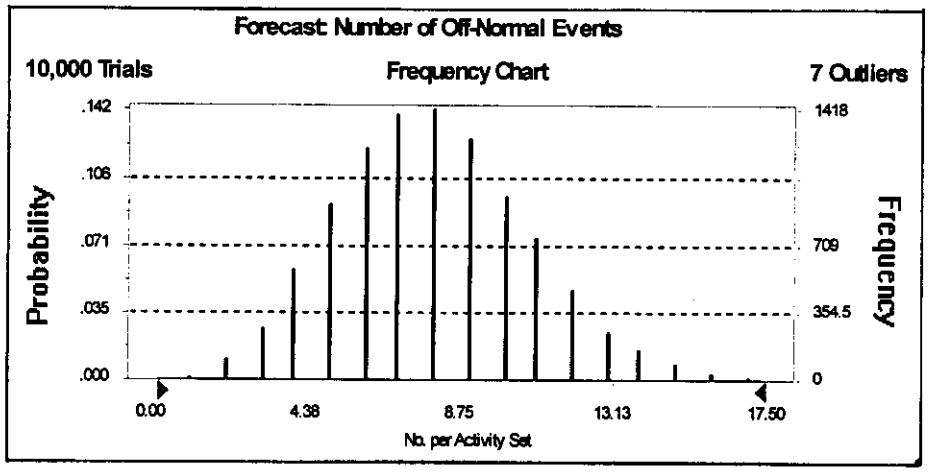
End of Forecast

Forecast: Number of Off-Normal Events **Cell: X2**

Summary:

Display Range is from 0.00 to 17.50 No. per Activity Set
Entire Range is from 0.00 to 19.00 No. per Activity Set
After 10,000 Trials, the Std. Error of the Mean is 0.03

Statistics:	Value
Trials	10000
Mean	7.96
Median	8.00
Mode	8.00
Standard Deviation	2.77
Variance	7.68
Skewness	0.30
Kurtosis	2.98
Coeff. of Variability	0.35
Range Minimum	0.00
Range Maximum	19.00
Range Width	19.00
Mean Std. Error	0.03

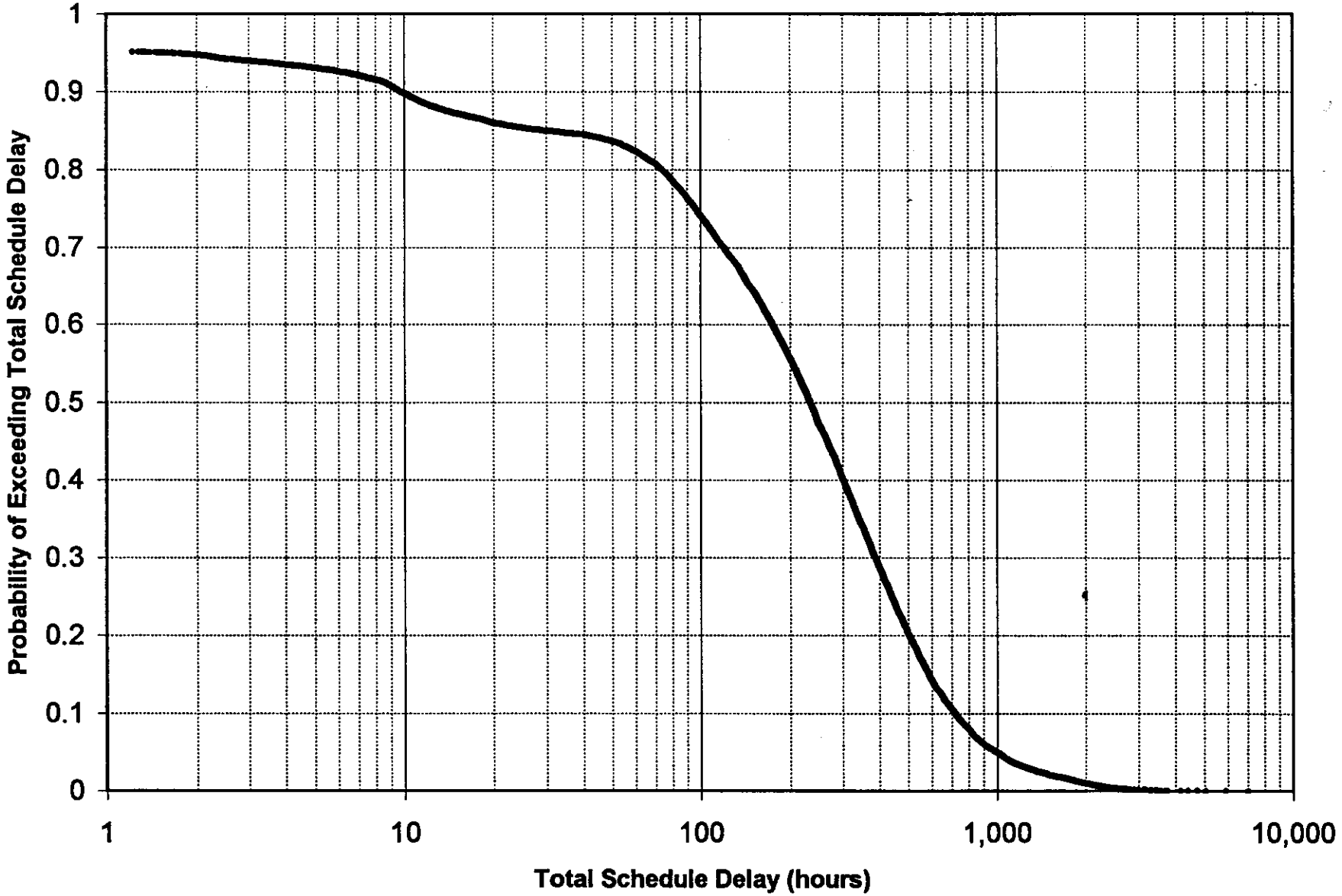


Forecast: Number of Off-Normal Events (cont'd) **Cell: X2**

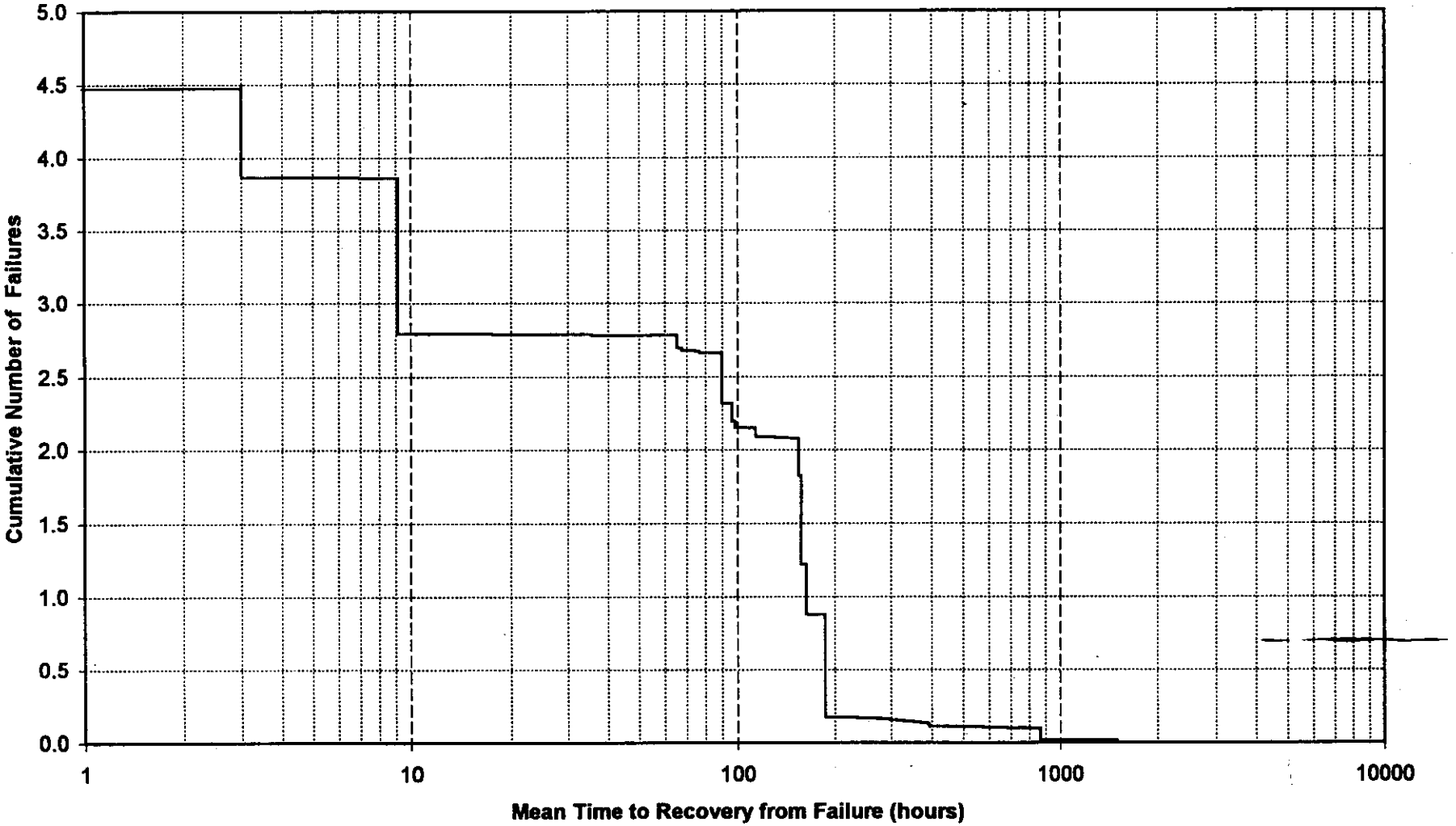
Percentiles:

Percentile	No. per Activity Set
0%	0.00
5%	4.00
10%	4.00
15%	5.00
20%	6.00
25%	6.00
30%	6.00
35%	7.00
40%	7.00
45%	7.00
50%	8.00
55%	8.00
60%	9.00
65%	9.00
70%	9.00
75%	10.00
80%	10.00
85%	11.00
90%	12.00
95%	13.00
100%	19.00

End of Forecast


Probability of Exceeding Total Schedule Delay
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1,000
10,000
Total Schedule Delay (hours)

Distribution of Times to Recover from Individual Failures During Qualification of HLW in 241-AZ-101



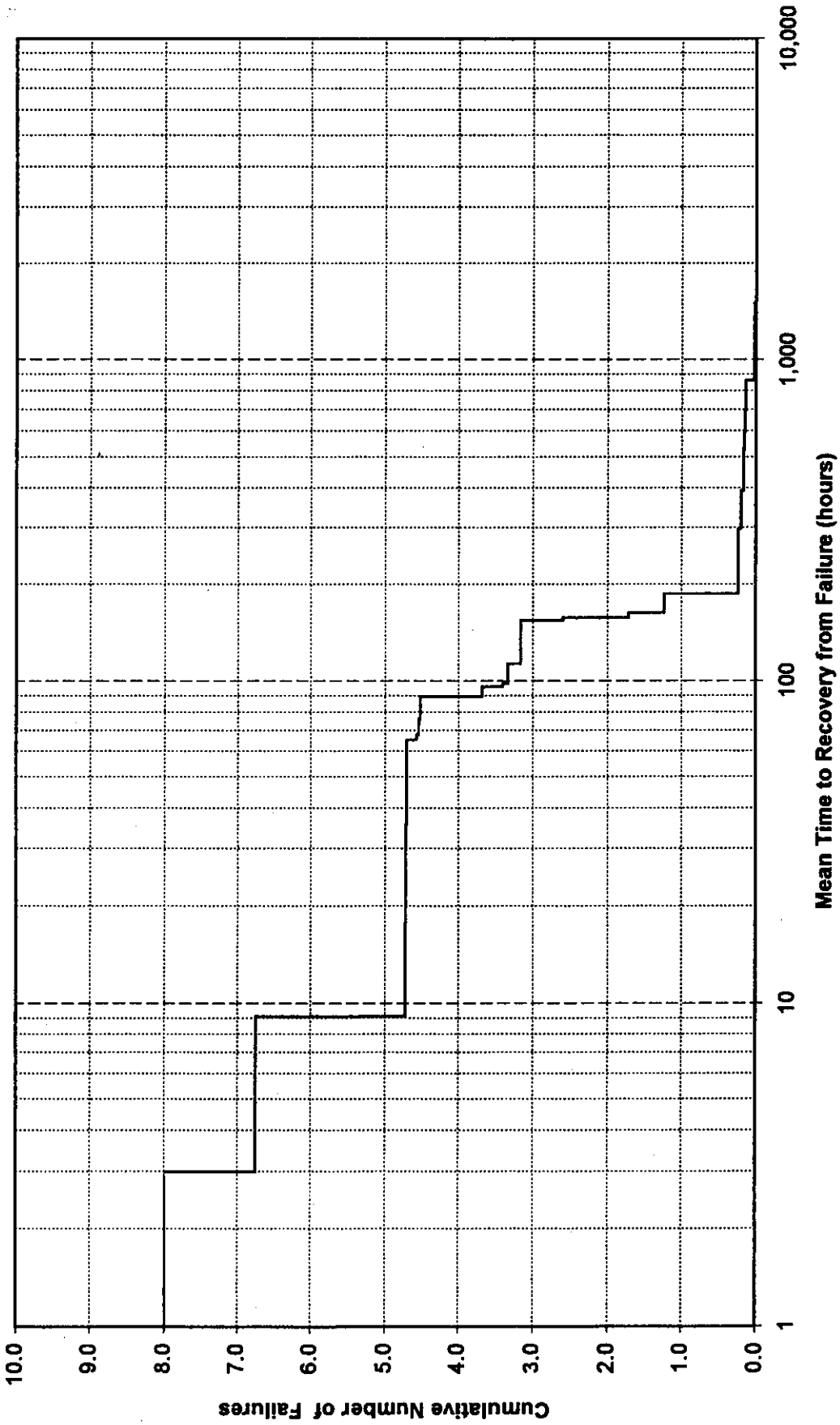

Distribution of Times to Recover from Individual Failures
During One Batch Transfer of HLW in 241-AZ-101 to BNFL
Cumulative Number of Failures
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1
10
100
1,000
10,000
Mean Time to Recovery from Failure (hours)

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Table E-1. Waste Flowsheet Volume Summary for the High Level Waste Batch Transfer from AZ-101 to BNFL

Activity	Volume (m3)	Volume (gal)	Time (hrs)	Inches of Waste	Comment	Reference
Starting Waste Volume in AZ-101	3200	845,344		296.6		Flowsheet, Section 1.1.1
Transfer AZ-101 to BNFL - Batch 1	600	158,502	18.9	55.6		Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 2	300	79,251	9.4	27.8		Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 3	300	79,251	9.4	27.8		Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 4	300	79,251	9.4	27.8		Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 5	300	79,251	9.4	27.8		Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 6	300	79,251	9.4	27.8		Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 7	300	79,251	9.4	27.8		Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 8	300	79,251	9.4	27.8	—	Flowsheet, Table 3-1
Transfer AZ-101 to BNFL - Batch 9	455	120,197	14.3	42.2		Flowsheet, Table 3-1
Total Waste Transferred	3155	833,456	99	292.4		
Heel Remaining in AZ-101 after all transfers of Batch 1	45	11888		4.2	Does not include approximately 18 m3 of flush water drainback.	Flowsheet, Table 3-1

Note: The deliveries from AZ-101 also have a very short duration flush at the end. These are modeled as one hour exposures for flush/dilution components

Note: Total waste transferred ignores small flush volumes.

Source: Orme, R.M., 1999, Waste Feed Delivery Technical Basis, HNF-1939-Vol. II, "Waste Feed Delivery Flowsheet for 241-AZ-101," Rev. 0a, Numatec Hanford Corporation, Richland, Washington

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Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
	Total	**8.0**	**43**	**341**	**100%**	**100%**
--WST-P-AZ101A	Mixer Pump	0.04	315	12	0.5%	3.6%
--WST-P-AZ101B	Mixer Pump	0.04	315	12	0.5%	3.6%
--WT-P-AZ101	Transfer Pump	0.07	101	7	0.9%	2.1%
AZ101-WT-HA-00223	Human Action	0.02	392	7	0.2%	1.9%
ALL-ALL-EE-TR1FL101	External Events	2.03	3	6	25.4%	1.8%
--AZ102 CAM Unit Vacuum Pump	Pump	0.11	54	6	1.4%	1.7%
--AZ101 CAM Unit Vacuum Pump	Pump	0.11	54	6	1.4%	1.7%
--AZ Record Sampler Vacuum Pump	Pump	0.11	54	6	1.4%	1.7%
--AZ-PC-P-1	Sample Pump	0.11	51	5	1.3%	1.6%
AZ101-WT-HA-00231	Human Action	0.01	392	4	0.1%	1.2%
--AZ101-K4-5-1	Recirculating Fan	0.04	98	4	0.5%	1.1%
AZ101-WT-HA-00026	Human Action	0.01	392	4	0.1%	1.1%
--AZ101-W-P-1	Pan Recirc Pump	0.09	29	3	1.1%	0.8%
--AZ101-EW-SP-1	Spray Pump, 2hp	0.09	29	3	1.1%	0.8%
--AZ101-CA-P-1	Chem-add Pump	0.09	29	3	1.1%	0.8%
--AZ-K1-9-1	High Efficiency Mist Eliminator	0.07	32	2	0.9%	0.7%
--CAM-102-AZ	Continuous Air Monitor	0.04	54	2	0.5%	0.7%
--CAM-101-AZ	Continuous Air Monitor	0.04	54	2	0.5%	0.7%
--VALVE 6 (TEMP)	Check Valve (Nitrogen line)	0.00	1006	2	0.0%	0.6%
--RA-AZK1-1B	Radiation Alarm Failure	0.03	61	2	0.4%	0.6%
--LAL-AZPCSP-1	Level Alarm Low	0.03	61	2	0.4%	0.6%
--LAL-AZCWTK-1	Level Alarm Low	0.03	61	2	0.4%	0.6%
--LAH-AZPCSP-1	Level Alarm High	0.03	61	2	0.4%	0.6%
--RA-101-AZ	Radiation Alarm	0.03	61	2	0.4%	0.6%
--RA-102-AZ	Radiation Alarm	0.03	61	2	0.4%	0.6%
--RIAS-AZK1-1	Radiation Alarm Indicating Switch	0.03	61	2	0.4%	0.6%
--FAL-AZK1-1A	Flow Alarm Low	0.03	61	2	0.4%	0.6%
--LDA-AZ2102-1	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--RA-AZK1-1A	Radiation Alarm	0.03	61	2	0.4%	0.6%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--UIC-AZCWR-1	Air Cooled Chiller Control Panel	0.03	61	2	0.4%	0.6%
--LDIS-AZ401-1	Leak Detector Indicator Switch	0.03	61	2	0.4%	0.6%
--RAX-AZK1-1	Radiation Alarm Failure	0.03	61	2	0.4%	0.6%
--FA-101/102-AZ	Flow Alarm	0.03	61	2	0.4%	0.6%
--FA-AZ Annulus	Flow Alarm	0.03	61	2	0.4%	0.6%
--FAL-AZK1-2A	Flow Alarm Low	0.03	61	2	0.4%	0.6%
--FA-AZ-RS	Flow Alarm	0.03	61	2	0.4%	0.6%
--RA-AZK1-1	Radiation Alarm	0.03	61	2	0.4%	0.6%
--LDA-702-1	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--LDA-AZ1202-1	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--LDA-AZ1200-1	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--LDA-702-2B	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--LDA-702-2A	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--LDA-AZ401-1	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--RAH-AZK1-1	Radiation Alarm High	0.03	61	2	0.4%	0.6%
--LDA-AZ503-1	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--XA-AZCWR-1	Failure Alarm	0.03	61	2	0.4%	0.6%
--LDA-V0608-1	Leak Detector Alarm	0.03	61	2	0.4%	0.6%
--XA-AZK1-1	Failure Alarm	0.03	61	2	0.4%	0.6%
--AZ-CW-R-1	Air Cooled Chiller	0.03	61	2	0.3%	0.5%
--RR-102-AZ	Radiation Recorder	0.03	54	1	0.3%	0.4%
--RR-101-AZ	Radiation Recorder	0.02	54	1	0.3%	0.4%
--TS-HST-K1-1-1	High Sheath Temperature Controller	0.02	52	1	0.3%	0.4%
--TS-HFT-K1-1-2	High Filter Temperature Controller	0.02	52	1	0.3%	0.4%
--TS-HFT-K1-1-1	High Filter Temperature Controller	0.02	52	1	0.3%	0.4%
--PI-AZ101PA-2	Pressure Indicating Controller	0.02	52	1	0.3%	0.4%
--SCR-K1-1-2	Silicon Controlled Rectifier Controller	0.02	52	1	0.3%	0.4%
--TC-K1-1-1	Temperature Controller	0.02	52	1	0.3%	0.4%
--DTC-K1-1-1	Delta T Controller	0.02	52	1	0.3%	0.4%
--DTC-K1-1-2	Delta T Controller	0.02	52	1	0.3%	0.4%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--FIC-AZ101PA-1	Flow Indicating Controller	0.02	52	1	0.3%	0.4%
--SCR-K1-1-1	Silicon Controlled Temperature Detector	0.02	52	1	0.3%	0.4%
--PI-AZ101PA-1	Pressure Indicating Controller	0.02	52	1	0.3%	0.4%
--UC-AZK1-1	Multivariable Controller	0.02	52	1	0.3%	0.4%
--UC-AZK1-2	Multivariable Controller	0.02	52	1	0.3%	0.4%
--TS-HST-K1-1-2	High Sheath Temperature Controller	0.02	52	1	0.3%	0.4%
HXA3	3-Way Ball Valve	0.00	672	1	0.0%	0.4%
HXA7	2-Way Ball Valve	0.00	672	1	0.0%	0.4%
--VALVE 3 (TEMP)	3-Way Ball Valve (Transfer line)	0.00	672	1	0.0%	0.4%
--VALVE 1 (TEMP)	3-Way Ball Valve (Transfer line)	0.00	672	1	0.0%	0.4%
HXA2	2-Way Ball Valve	0.00	672	1	0.0%	0.4%
HXA6	3-Way Ball Valve	0.00	672	1	0.0%	0.4%
--VALVE 2 (TEMP)	3-Way Ball Valve (Transfer line)	0.00	672	1	0.0%	0.4%
AZ801A-SA-SOV-101	Solenoid Operated Valve	0.01	86	1	0.2%	0.4%
Process Air	Compressor	0.04	29	1	0.5%	0.4%
Instrument Air	Compressor	0.04	29	1	0.5%	0.4%
--UIC-AZ101EWT-1	Fluid Cooler Control Panel	0.03	37	1	0.3%	0.3%
--LAL-AZ1EWTK-1	Level Alarm Low	0.03	37	1	0.3%	0.3%
--LALL-AZ1EWT-1	Level Alarm Low Low	0.03	37	1	0.3%	0.3%
--PDAH-AZ1WF-2	Pressure Differential Alarm High	0.03	37	1	0.3%	0.3%
AP-241-CHEMB-MOV-132	3-Way Ball Valve	0.01	148	1	0.1%	0.3%
--(EF)-K1-3-2	Exhaust Fan	0.02	29	1	0.3%	0.2%
--F1	Cooling Fan, 20 hp w/capacity control damper and motor	0.02	29	1	0.3%	0.2%
AZ101-SA-V-1009	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1010	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1109	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1110	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1209	Gate Valve	0.005	141	1	0.1%	0.2%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AZ101-SA-V-1309	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0610	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1310	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1210	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0509	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0109	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0110	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0210	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0309	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0310	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0710	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0410	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0910	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0510	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0609	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0709	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0809	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0810	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0909	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0409	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1709	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1409	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-0209	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-2210	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-2209	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1510	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-2109	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1509	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1610	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1710	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1809	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1810	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1910	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-2110	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1609	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-2010	Gate Valve	0.005	141	1	0.1%	0.2%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AZ101-SA-V-1410	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-2009	Gate Valve	0.005	141	1	0.1%	0.2%
AZ101-SA-V-1909	Gate Valve	0.005	141	1	0.1%	0.2%
-TC-AZ101EWT-1A2	Temperature Controller	0.021	31	1	0.3%	0.2%
-TE-101-AZ-56	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-57	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-54	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-101	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-65	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-66	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-67	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-58	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-73	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-42	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-43	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-44	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-41	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-45	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-46	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-47	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-99	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-68	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-72	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-71	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-70	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-53	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-100	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-52	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-69	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-98	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-38	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-104	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-55	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-51	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-49	Temperature Element	0.002	282	1	0.03%	0.2%
-TE-101-AZ-37	Temperature Element	0.002	282	1	0.03%	0.2%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--TE-101-AZ-39	Temperature Element	0.002	282	1	0.03%	0.2%
--TE-101-AZ-103	Temperature Element	0.002	282	1	0.03%	0.2%
--TE-101-AZ-40	Temperature Element	0.002	282	1	0.03%	0.2%
--TE-101-AZ-48	Temperature Element	0.002	282	1	0.03%	0.2%
--TE-101-AZ-50	Temperature Element	0.002	282	1	0.03%	0.2%
--TE-101-AZ-102	Temperature Element	0.002	282	1	0.03%	0.2%
--LDE-AZ1200-1	Leak Detector Element	0.01	61	1	0.1%	0.2%
--LDE-V0608-1	Leak Detector Element	0.01	61	1	0.1%	0.2%
--LDE-AZ702-2A	Leak Detector Element	0.01	61	1	0.1%	0.2%
--LDE-AZ702-1	Leak Detector Element	0.01	61	1	0.1%	0.2%
--LDE-AZ503-1	Leak Detector Element	0.01	61	1	0.1%	0.2%
--LDE-AZ2102-1	Leak Detector Element	0.01	61	1	0.1%	0.2%
--LDE-AZ1202-1	Leak Detector Element	0.01	61	1	0.1%	0.2%
--LDE-AZ401-1	Leak Detector Element	0.01	61	1	0.1%	0.2%
--RA-AZ-161	Radiation Alarm	0.01	37	0.5	0.2%	0.1%
--RIAS-AZ-161	Radiation Alarm Indicating Switch	0.01	37	0.5	0.2%	0.1%
--MK-AZ108-1A	Butterfly Valve	0.01	50	0.5	0.1%	0.1%
--MK-AZK109-1A	Butterfly Valve	0.01	50	0.5	0.1%	0.1%
--MK-AZ101K4-4	Butterfly Damper Valve w/Limit Switch	0.01	50	0.5	0.1%	0.1%
--MK-AZ101K4-3	Butterfly Damper Valve w/Limit Switch	0.01	50	0.5	0.1%	0.1%
--MK-AZ101K4-2	Butterfly Damper Valve w/Limit Switch	0.01	50	0.5	0.1%	0.1%
--FIQ-RS-AZ	Flow Totalizer	0.01	53	0.4	0.1%	0.1%
--VALVE 4 (TEMP)	3-Way Ball Valve (Dilution line)	0.001	694	0.4	0.0%	0.1%
--VALVE 5 (TEMP)	2-Way Ball Valve (Dilution line)	0.001	694	0.4	0.0%	0.1%
--PDI-AZK19-1	Pressure Differential Indicator	0.01	51	0.4	0.1%	0.1%
--TI-AZK18-1B	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--TI-K1-1-5	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--PDI-AZK18-1	Pressure Differential Indicator	0.01	51	0.4	0.1%	0.1%
--TI-K1-1-1	Temperature Indicator	0.01	51	0.4	0.1%	0.1%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--TI-K1-1-2	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--LI-AZCWTK-1	Level Indicator	0.01	51	0.4	0.1%	0.1%
--TI-K1-1-4	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--TI-K1-1-3	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--PDI-AZ1K45-1	Pressure Differential Indicator	0.01	51	0.4	0.1%	0.1%
--PDI-AZ1K48-1	Pressure Differential Indicator	0.01	51	0.4	0.1%	0.1%
--II-AZ1K451-1	Current Indicator	0.01	51	0.4	0.1%	0.1%
--TI-AZ1EWR-1	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-1-1	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-101-AZ	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--K-R-K1-PS-1-4	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--TI-AZ1EWS-1	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--K-R-K1-PS-1-3	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--K-R-K1-PS-1-2	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-4-2	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--TI-AZ1K48-1A	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--PI-RS-AZ	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--K-R-K1-PS-1-1	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--TI-AZK18-1A	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-102-AZ	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-2-1	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-3-3	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-4-1	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--YS-AZ1K45-1A1	Event/State Switch	0.01	51	0.4	0.1%	0.1%
--TI-AZCWR-1	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-4-3	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-4-4	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--TI-AZK1-3	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--PI-AZK1	Pressure Indicator	0.01	51	0.4	0.1%	0.1%
--TI-AZ1K48-1B	Temperature Indicator	0.01	51	0.4	0.1%	0.1%
--FI-AZK1-2	Flow Indicator	0.01	51	0.4	0.1%	0.1%
--FI-K1-1-1	Flow Indicator	0.01	51	0.4	0.1%	0.1%
--FI-AZCWR-1	Flow Indicator	0.01	51	0.4	0.1%	0.1%
--FI-RS-AZ	Flow Indicator	0.01	51	0.4	0.1%	0.1%
--RI-AZK1-1	Radiation Indicator	0.01	51	0.4	0.1%	0.1%
--PI-K1-3-4	Pressure Indicator	0.01	51	0.4	0.1%	0.1%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
–FI-AZK1-1	Flow Indicator	0.01	51	0.4	0.1%	0.1%
–FI-AZK1-3	Flow Indicator	0.01	51	0.4	0.1%	0.1%
–DPI-RS-41	Differential Pressure Indicator	0.01	51	0.4	0.1%	0.1%
–FI-AZPC-1	Flow Indicator	0.01	51	0.4	0.1%	0.1%
–AZ-PC-S-1	Sampler	0.01	50	0.4	0.1%	0.1%
AZ101-SA-V-0404	Check Valve	0.01	76	0.4	0.1%	0.1%
–PCV-AZCWS-1	Pressure Control Valve	0.01	50	0.4	0.1%	0.1%
–PCV-AZCWTK-1	Pressure Control Valve	0.01	50	0.4	0.1%	0.1%
–PCV-AZPC-1	Pressure Control Valve	0.01	50	0.4	0.1%	0.1%
–PCV-AZ101PA-1	Pressure Control Valve	0.01	50	0.4	0.1%	0.1%
–PCV-AZ101PA-2	Pressure Control Valve	0.01	50	0.4	0.1%	0.1%
AZ101-SA-V-1502	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0602	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1301	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1302	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1702	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0601	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0701	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0702	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1701	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0801	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1201	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1202	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-2202	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-2201	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1002	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1001	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0902	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0901	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1101	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ801A-SA-V-104	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1902	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1402	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1401	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1501	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1102	Globe Valve	0.005	82	0.4	0.1%	0.1%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AZ101-SA-V-0201	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0102	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0101	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0202	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1901	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-2001	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0502	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0301	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-2101	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0501	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0802	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1602	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1601	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-2102	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-2002	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1801	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ801A-SA-V-103	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-1802	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ801A-SA-V-101	Gate Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0302	Globe Valve	0.005	82	0.4	0.1%	0.1%
AZ801A-SA-V-102	Gate Valve	0.005	82	0.4	0.1%	0.1%
AZ101-SA-V-0401	2-Way Ball Valve	0.005	82	0.4	0.1%	0.1%
AZ101-WT-HA-00114	Human Action	0.001	392	0.4	0.0%	0.1%
--K1-9-1	Enclosure Fan	0.01	51	0.3	0.1%	0.1%
--PDIS-AZ101-WF-2	Pressure Differential Alarm High	0.01	37	0.3	0.1%	0.1%
--K1-5-3	Filter	0.01	50	0.3	0.1%	0.1%
--K1-5-4	Filter	0.01	50	0.3	0.1%	0.1%
--K1-12-3	Filter	0.01	50	0.3	0.1%	0.1%
--K1-5-2	Filter	0.01	50	0.3	0.1%	0.1%
--K1-1-2	Filter	0.01	50	0.3	0.1%	0.1%
--K1-11-2	Filter	0.01	50	0.3	0.1%	0.1%
--K-11-1	Filter	0.01	50	0.3	0.1%	0.1%
--K1-12-2	Filter	0.01	50	0.3	0.1%	0.1%
--K-1-1-1	Filter	0.01	50	0.3	0.1%	0.1%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--K1-12-4	Filter	0.01	50	0.3	0.1%	0.1%
--K1-13-1	Filter	0.01	50	0.3	0.1%	0.1%
--K1-13-2	Filter	0.01	50	0.3	0.1%	0.1%
--K1-2-1	Filter	0.01	50	0.3	0.1%	0.1%
--K1-5-1	Filter	0.01	50	0.3	0.1%	0.1%
--K1-12-1	Filter	0.01	50	0.3	0.1%	0.1%
--ZS-AZK18-1B	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZK18-1A	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZ1K4-2	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZK18-1C	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZK19-1A	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZK19-1B	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZK19-1C	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZ1K4-4	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZ1K4-3	Position Switch	0.005	51	0.3	0.1%	0.1%
--ZS-AZ1K4-1	Position Switch	0.005	51	0.3	0.1%	0.1%
--RY-AZK1-1	Radiation Equipment	0.004	53	0.2	0.1%	0.1%
--RE-AZK1-1	Radiation Sensing Element	0.004	53	0.2	0.1%	0.1%
--PI-AZRW-1B	Pressure Indicator	0.01	31	0.2	0.1%	0.1%
--PI-AZRW-1A	Pressure Indicator	0.01	31	0.2	0.1%	0.1%
--PDI-AZRWF-1	Pressure Differential Indicator	0.01	31	0.2	0.1%	0.1%
--PDIT-AZRWF-1	Pressure Differential Indicating Transmitter	0.01	31	0.2	0.1%	0.1%
--PI-AZRW-1	Pressure Indicator	0.01	31	0.2	0.1%	0.1%
--PI-AZ101WS-2	Pressure Indicator	0.01	31	0.2	0.1%	0.1%
--FI-AZRW-1	Flow Indicator	0.01	31	0.2	0.1%	0.1%
--CE-AZ101EWT-1	Conductivity Element	0.01	31	0.2	0.1%	0.1%
--FM-AZ101RW-1	Flow Meter	0.01	31	0.2	0.1%	0.1%
--LI-AZ101EWTK-1	Level Indicator	0.01	31	0.2	0.1%	0.1%
--FI-AZ1EWR-1	Flow Indicator	0.01	31	0.2	0.1%	0.1%
--PI-AZ101WS-1	Pressure Indicator	0.01	31	0.2	0.1%	0.1%
--CSH-AZ101EWT-1	Conductivity Switch High	0.01	31	0.2	0.1%	0.1%
--QQ-CAM-102-AZ	Timer	0.004	51	0.2	0.1%	0.1%
--AE-AZK1-1	Analysis Element	0.004	51	0.2	0.1%	0.1%
--AE-AZK1-3	Analysis Element	0.004	51	0.2	0.1%	0.1%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--QQ-CAM-101-AZ	Timer	0.004	51	0.2	0.1%	0.1%
--AE-AZK1-2	Analysis Element	0.004	51	0.2	0.1%	0.1%
--QQ-RS-AZ	Timer	0.004	51	0.2	0.1%	0.1%
RW	Raw Water System	0.01	29	0.2	0.1%	0.1%
--PCV-AZ101-WF-2	Pressure Control Valve	0.01	29	0.2	0.1%	0.1%
--PCV-AZRW-1	Pressure Control Valve	0.01	29	0.2	0.1%	0.1%
--PCV-AZ101EWTK-1	Pressure Control Valve	0.01	29	0.2	0.1%	0.1%
--PCV-AZ101EWS-1	Pressure Control Valve	0.01	29	0.2	0.1%	0.1%
--VALVE 8 (TEMP)	Check Valve (Flush connection)	0.001	147	0.2	0.0%	0.1%
--VALVE 7 (TEMP)	Check Valve (Flush connection)	0.001	147	0.2	0.0%	0.1%
--MK-8501	Louver	0.01	25	0.2	0.1%	0.1%
--MK-8502	Louver	0.01	25	0.2	0.1%	0.1%
--HT-RS-AZ	Heat Trace	0.01	21	0.2	0.1%	0.1%
--LDE-101-6C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-6B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-6A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-5C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-5B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-7A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-4C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-9A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-5A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-11A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-7C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-4B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-8C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-7B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-9B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-9C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-10C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-10B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-10A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-8B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--LDE-101-12A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-13C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-15B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-15A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-14C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-14B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-16A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-11C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-16B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-12B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-12C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-13A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-4A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-13B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-8A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-14A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-1C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-3C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-3B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-3A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-2C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-2B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-15C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-11B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-1B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-1A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-17C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-17B	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-17A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-16C	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--LDE-101-2A	Leak Detection Element	0.001	284	0.2	0.01%	0.05%
--FS-CAM-1-101-AZ	Flow Switch	0.002	53	0.1	0.03%	0.04%
--FS-CAM-1-102-AZ	Flow Switch	0.002	53	0.1	0.03%	0.04%
--ZS-AZ101EWT-1	Position Switch	0.004	31	0.1	0.05%	0.04%
--AZ101-W-S-1	Pan Separator	0.004	29	0.1	0.06%	0.04%
--AZ101-W-F-2	Pan Bag Filter	0.004	29	0.1	0.06%	0.04%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
–AZ101-W-F-1	Pan Strainer	0.004	29	0.1	0.06%	0.04%
–AZ101-RW-F-2	Chem-Add Cartridge (Iodine)	0.004	29	0.1	0.06%	0.04%
–STR1	Strainer	0.004	29	0.1	0.06%	0.04%
–PDT-AZ101K405-1	Pressure Differential Transmitter	0.002	51	0.1	0.03%	0.04%
–FE-AZK1-1	Flow Element	0.002	51	0.1	0.03%	0.04%
–FIT-AZK1-1	Flow Indicating Transmitter	0.002	51	0.1	0.03%	0.04%
–UE-AZK1-1	Multivariable Element	0.002	51	0.1	0.03%	0.04%
–PDT-AZK108-1	Pressure Differential Transmitter	0.002	51	0.1	0.03%	0.04%
–PDT-AZK109-1	Pressure Differential Transmitter	0.002	51	0.1	0.03%	0.04%
–FS-K1-1-1	Flow Switch	0.002	51	0.1	0.03%	0.04%
–FE-AZK1-2	Flow Element	0.002	51	0.1	0.03%	0.04%
–FT-AZCWR-1	Flow Transmitter	0.002	51	0.1	0.03%	0.04%
–FE-AZPC-1	Flow Element	0.002	51	0.1	0.03%	0.04%
–FIT-AZK1-2	Flow Indicating Transmitter	0.002	51	0.1	0.03%	0.04%
–FIT-AZK1-3	Flow Indicating Transmitter	0.002	51	0.1	0.03%	0.04%
–PIT-AZK1	Pressure Indicating Transmitter	0.002	51	0.1	0.03%	0.04%
–PDT-AZ101K408-1	Pressure Differential Transmitter	0.002	51	0.1	0.03%	0.04%
–FS-RS-AZ	Flow Switch	0.002	51	0.1	0.03%	0.04%
–IT-AZ101K405-1	Current Transmitter	0.002	51	0.1	0.03%	0.04%
–FT-AZPC-1	Flow Transmitter	0.002	51	0.1	0.03%	0.04%
–TI-AZCWS-1	Temperature Indicator	0.002	51	0.1	0.03%	0.04%
AZ101-SA-FI-1101	Flow Indicator	0.004	31	0.1	0.05%	0.03%
–PI-801-1	Pressure Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1501	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0201	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0301	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0501	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0901	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0701	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0801	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1001	Flow Indicator	0.004	31	0.1	0.05%	0.03%

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AZ101-SA-FI-1201	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0101	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1401	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0401	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1601	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1701	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1801	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1901	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-2001	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-2101	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-2201	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ801A-SA-PI-102	Pressure Indicator	0.004	31	0.1	0.05%	0.03%
AZ801A-SA-PI-103	Pressure Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-1301	Flow Indicator	0.004	31	0.1	0.05%	0.03%
AZ101-SA-FI-0601	Flow Indicator	0.004	31	0.1	0.05%	0.03%
--LDE-6	Leak Detection Element	0.001	194	0.1	0.01%	0.03%
--LDE-101-24	Leak Detection Element	0.001	194	0.1	0.01%	0.03%
--LDE-101-23	Leak Detection Element	0.001	194	0.1	0.01%	0.03%
--LDE-101-20	Leak Detection Element	0.001	194	0.1	0.01%	0.03%
--LDE-101-19	Leak Detection Element	0.001	194	0.1	0.01%	0.03%
--LDE-15	Leak Detection Element	0.001	194	0.1	0.01%	0.03%
--LDE-	Leak Detector Element	0.001	194	0.1	0.01%	0.03%
--LDE	Leak Detector Element (Encasement)	0.001	194	0.1	0.01%	0.03%
LDE-7	Leak Detection Element	0.001	194	0.1	0.01%	0.03%
AZ801A-SA-PI-101	Pressure Indicator	0.004	29	0.1	0.05%	0.03%
-IA-LLAS-101-1	Liquid Level Alarm Switch	0.002	51	0.1	0.03%	0.03%
--F-AZK1-1	Particulate Filter Iodine Filter	0.004	24	0.1	0.05%	0.03%
--AZ101-K4-8-1	Condenser	0.002	50	0.1	0.03%	0.03%
--AZ-K1-8-1	Condenser	0.002	50	0.1	0.03%	0.03%
--RE-AZ-161	Radiation Sensing Element	0.002	51	0.1	0.02%	0.03%
--MV-AZK1-5	Motor Operated Gate Valve	0.002	50	0.1	0.02%	0.03%
--MV-AZK1-2	Motor Operated Gate Valve	0.002	50	0.1	0.02%	0.03%
--MV-AZK1-1	Motor Operated Gate Valve	0.002	50	0.1	0.02%	0.03%
--MV-AZK1-4	Motor Operated Gate Valve	0.002	50	0.1	0.02%	0.03%

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--MV-AZK1-3	Motor Operated Gate Valve	0.002	50	0.1	0.02%	0.03%
AZ101-WT-HA-00272	Human Action	0.003	28	0.1	0.04%	0.03%
--AZ101-K4-1-1	Moisture Separator	0.003	25	0.1	0.04%	0.02%
--LDA-101-19	Leak Detected Alarm	0.002	37	0.1	0.03%	0.02%
--RA-101-1	Radiation Alarm	0.002	37	0.1	0.03%	0.02%
--LDA-101-1B	Leak Detected Alarm	0.002	37	0.1	0.03%	0.02%
--LDA-101-20	Leak Detected Alarm	0.002	37	0.1	0.03%	0.02%
--LDA-101-23	Leak Detected Alarm	0.002	37	0.1	0.03%	0.02%
--LDA-101-24A	Leak Detected Alarm	0.002	37	0.1	0.03%	0.02%
--LDA-151-1	Leak Detector Alarm	0.002	37	0.1	0.03%	0.02%
--LDI-101-1	Leak Detection Indicator	0.002	37	0.1	0.03%	0.02%
--LDA-4507/4508	Leak Detector Alarm	0.002	37	0.1	0.03%	0.02%
--PAD-101-1	Alarm	0.002	37	0.1	0.03%	0.02%
--LDA-101-1A	Leak Detector Alarm	0.002	37	0.1	0.03%	0.02%
--CASS-1303	Leak Detector Alarm	0.002	37	0.1	0.03%	0.02%
--Filter (Instr Air)	Filter	0.002	29	0.07	0.03%	0.02%
--K1-FV-1-1	Manual Butterfly Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK109-1A1	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-3A5	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-3A6	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-5	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--K1-FV-1-3	Manual Butterfly Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK108-1	3-Valve Manifold	0.001	50	0.07	0.02%	0.02%
--HV-AZK108-1A2	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPC-4	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK109-1	3-Valve Manifold	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-2	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK109-1A2	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK109-1D	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK109-1E	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPA-1	Gate Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPC-1	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPC-2	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPC-3	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK108-1D	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101PA-2	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--HV-2801-1	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101EWS-1A6	Gate Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101K4-1	3-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101K405-1A	3-Valve Manifold	0.001	50	0.07	0.02%	0.02%
--HV-AZ101K405-1A1	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101K405-1A2	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101K408-1A	3-Valve Manifold	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-2A6	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101PA-1	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-2A5	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101PA-3	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZCWR-1	Gate Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZCWS-1	Gate Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZCWTK-2	Gate Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-1A5	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-1A6	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK108-1A1	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZ101K408-1A1	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZK1-6	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--K1-FV-1-4	Manual Butterfly Valve	0.001	50	0.07	0.02%	0.02%
--K1-FV-2-1	Manual Butterfly Valve	0.001	50	0.07	0.02%	0.02%
--K1-FV-2-2	Manual Butterfly Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPC-5	Angle Gate Valve	0.001	50	0.07	0.02%	0.02%
--K1-FV-1-2	Manual Butterfly Valve	0.001	50	0.07	0.02%	0.02%
--HV1	Air Separating Trap	0.001	50	0.07	0.02%	0.02%
--HV-AZPCSP-1C	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPCSP-1B	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPCJ-1C	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPCJ-1B	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPCSP-1A	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--HV-AZPCJ-1A	2-Way Ball Valve	0.001	50	0.07	0.02%	0.02%
--FSL-AZ101WS-1	Flow Switch Low	0.002	31	0.07	0.03%	0.02%
--FT-AZ101EWR-1	Flow Transmitter	0.002	31	0.07	0.03%	0.02%
--FE-AZ101EWR-1	Flow Element	0.002	31	0.07	0.03%	0.02%
--FT-AZRW-1	Flow Transmitter	0.002	31	0.07	0.03%	0.02%
--AZ-CW-P-1B	Recirc Pump	0.07	1	0.07	0.8%	0.02%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--AZ-CW-P-1A	Recirc Pump	0.07	1	0.07	0.8%	0.02%
--AZ-K1-11-1	Vacuum Pump	0.07	1	0.07	0.8%	0.02%
--AZ-K1-11-2	Vacuum Pump	0.07	1	0.07	0.8%	0.02%
--AZ101-EW-P-1A	Recirc Pump	0.07	1	0.07	0.8%	0.02%
--AZ101-EW-P-1B	Recirc Pump	0.07	1	0.07	0.8%	0.02%
--CASS-1266	Computer Automated Surveillance Station	0.002	37	0.07	0.02%	0.02%
--CASS-1764	Computer Automated Surveillance Station	0.002	37	0.07	0.02%	0.02%
--CASS-1267	Computer Automated Surveillance Station	0.002	37	0.07	0.02%	0.02%
--CASS-1263	Computer Automated Surveillance Station	0.002	37	0.07	0.02%	0.02%
--CASS-1264	Computer Automated Surveillance Station	0.002	37	0.07	0.02%	0.02%
--RV-AZ101EWS-1	Relief Valve	0.001	50	0.06	0.02%	0.02%
--FA-101-1	Flow Alarm Switch	0.002	31	0.06	0.03%	0.02%
AP241-RW-V-441	Gate Valve (Flanged)	0.001	89	0.06	0.01%	0.02%
--1" Valve on RW-3648-M5	Gate Valve	0.001	89	0.06	0.01%	0.02%
--RE-101-1	Radiation Sensing Element	0.000	193	0.06	0.004%	0.02%
--I-123	Interlock	0.001	61	0.05	0.01%	0.02%
--I-124	Interlock	0.001	61	0.05	0.01%	0.02%
--I-204	Interlock	0.001	61	0.05	0.01%	0.02%
--I-205	Interlock	0.001	61	0.05	0.01%	0.02%
--K1-6-1	Filter	0.001	50	0.05	0.01%	0.02%
--K1-6-2	Filter	0.001	50	0.05	0.01%	0.02%
--EV-AZ101EWT-1A1	Solenoid Valve	0.002	29	0.05	0.02%	0.02%
--UE	Multivariable Element	0.0002	282	0.05	0.00%	0.01%
--FE	Flow Element	0.0002	282	0.05	0.00%	0.01%
--LDY-AZ1202-1	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%
--LDY-V0608-1	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%
--LDY-AZ702-2B	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%
--LDY-AZ702-2A	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%
--LDY-AZ702-1	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%
--LDY-AZ2102-1	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%

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COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--LDY-AZ1200-1	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%
--LDY-AZ503-1	Leak Detector Signal Relay	0.001	61	0.05	0.01%	0.01%
-SW-FI-751	Flow Indicator	0.001	31	0.05	0.02%	0.01%
-SW-PDIS-750	Pressure Differential Indicator Switch	0.001	31	0.05	0.02%	0.01%
-SW-PI-750	Pressure Indicator	0.001	31	0.05	0.02%	0.01%
-SW-PI-751	Pressure Indicator	0.001	31	0.05	0.02%	0.01%
--PI-720	Pressure Indicator	0.001	31	0.05	0.02%	0.01%
-SW-FI-750	Flow Indicator	0.001	31	0.05	0.02%	0.01%
AZ801A-SA-STR-101	Strainer	0.002	18	0.04	0.03%	0.01%
--RTD-K1-1-3	Resistance Temperature Detector	0.001	51	0.04	0.01%	0.01%
--TE-101-AZ-25	Temperature Element	0.001	51	0.04	0.01%	0.01%
--PS-K1-1-3	Pressure Switch	0.001	51	0.04	0.01%	0.01%
--PS-K1-1-2	Pressure Switch	0.001	51	0.04	0.01%	0.01%
--PS-K1-1-1	Pressure Switch	0.001	51	0.04	0.01%	0.01%
--PS-K1-1-4	Pressure Switch	0.001	51	0.04	0.01%	0.01%
--RTD-K1-1-2	Resistance Temperature Detector	0.001	51	0.04	0.01%	0.01%
--FY-AZK1-1	Flow Equipment	0.001	51	0.04	0.01%	0.01%
--RTD-K1-1-4	Resistance Temperature Detector	0.001	51	0.04	0.01%	0.01%
--TE-101-AZ-26	Temperature Element	0.001	51	0.04	0.01%	0.01%
--FY-AZK1-3	Flow Equipment	0.001	51	0.04	0.01%	0.01%
--FY-AZK1-2	Flow Equipment	0.001	51	0.04	0.01%	0.01%
--RTD-K1-1-1	Resistance Temperature Detector	0.001	51	0.04	0.01%	0.01%
--TE-AZK108-1B2	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TT-AZK108-1A	Temperature Transmitter	0.001	51	0.04	0.01%	0.01%
--TE-AZ101EWR-1	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TT-AZK1-3	Temperature Transmitter	0.001	51	0.04	0.01%	0.01%
--TT-AZCWS-1	Temperature Transmitter	0.001	51	0.04	0.01%	0.01%
--TT-AZCWR-1	Temperature Transmitter	0.001	51	0.04	0.01%	0.01%
--TE-K1-1-4	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-K1-1-3	Temperature Element	0.001	51	0.04	0.01%	0.01%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--TY-AZK1-3	Temperature Equipment	0.001	51	0.04	0.01%	0.01%
--TE-K1-1-1	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TT-AZK108-1B	Temperature Transmitter	0.001	51	0.04	0.01%	0.01%
--TE-AZK108-1B1	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-AZK108-1A2	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-AZK108-1A1	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-AZCWS-1	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-AZCWR-1	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-AZ101K408-1B	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-AZ101K408-1A	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-AZ101EWS-1	Temperature Element	0.001	51	0.04	0.01%	0.01%
--TE-K1-1-2	Temperature Element	0.001	51	0.04	0.01%	0.01%
-SW-PCV-750	Pressure Control Valve	0.001	29	0.04	0.02%	0.01%
AZ801A-SA-FIT-101	Flow Indicating Transmitter	0.001	31	0.03	0.01%	0.01%
AZ101-SA-V-0606	Check Valve	0.001	28	0.03	0.02%	0.01%
--HV-AZ101EWT-1A1	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZ101EWS-1A2	Globe Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZ101EWS-1A1	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZ101EWR-1A3	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZ101EWR-1A2	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-3	Multi-port Instrument Plug Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-4	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-5	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZ101EWTK-2	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-6A	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZ101EWT-1A3	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-7	Multi-port Instrument Plug Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-8	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-9	Gate Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-BP-1A	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
--HV-AZRW-BP-1B	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
--CV-AZ101RW-1	Check Valve	0.001	29	0.03	0.01%	0.01%
--AZ-RW-BP-1	Backflow Preventer	0.001	29	0.03	0.01%	0.01%

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COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
–HV-AZRW-6	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZRW-1	Gate Valve	0.001	29	0.03	0.01%	0.01%
–MV-AZ101EWT-1	Motor Operated 2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101W-6	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101W-4	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101W-1	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101RW-3	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101RW-2	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101RW-1	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101EWT-1A2	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101W-3	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZRW-2	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101EWTK-1A4	Angle Globe Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101EWTK-1A3	Angle Globe Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101EWTK-1A2	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101EWTK-1A1	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZRW-10	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZRW-12	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101EWT-1A4	Gate Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101W-7	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
-IA-801-AZ-2	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
–HV-AZ101W-5	2-Way Ball Valve	0.001	29	0.03	0.01%	0.01%
ELEC	Electric Power System	0.005	6	0.03	0.07%	0.009%
-IA-LLI-101-2	Liquid Level Indicator	0.001	51	0.03	0.007%	0.009%
–LDE-4508	Leak Detection Element	0.001	51	0.03	0.007%	0.009%
–LDE-4507	Leak Detection Element	0.001	51	0.03	0.007%	0.009%
–LDE-101/102-23	Leak Detection Element	0.001	51	0.03	0.007%	0.009%
AZ101–TC-3	2-Way Ball Valve	0.001	49	0.03	0.008%	0.009%
AZ101–TC-2	2-Way Ball Valve	0.001	49	0.03	0.008%	0.009%
AZ101–TC-1	2-Way Ball Valve	0.001	49	0.03	0.008%	0.009%
-SW-STR-720	Strainer	0.001	29	0.03	0.01%	0.008%
-SW-FLT-751	Filter	0.001	29	0.03	0.01%	0.008%
-SW-FLT-750	Filter	0.001	29	0.03	0.01%	0.008%
–HS-1-1	Hand Switch	0.001	22	0.03	0.02%	0.008%

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COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--HS-AZCWR-1	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-AZ101K405-1A	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-1-8	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-AZ1K45-1	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-AZK111-1C	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-AZK111-1B	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-AZK111-1A	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-AZK1-1A1	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-AZK109-1	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-AZK108-1	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-1-6	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-1-4	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-1-2	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-1-7	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-AZK1-1B1	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-1-3	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-AZ101K405-1A1	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-AZPCP-1	Hand Switch (2 position)	0.001	22	0.03	0.02%	0.008%
--HS-M	Hand Switch	0.001	22	0.03	0.02%	0.008%
--HS-1-5	Hand Switch	0.001	22	0.03	0.02%	0.008%
--TE-101-AZ-22	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-83	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-21	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-7	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-10	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-1	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-20	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-2	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-AZ101EWT-1A2	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-19	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-85	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-18	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-32	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-96	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-95	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-94	Temperature Element	0.001	31	0.02	0.009%	0.006%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--PT-AZRW-1	Pressure Transmitter	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-30	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-4	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-5	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-97	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-11	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-34	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-28	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-29	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-AZ101EWT-1A1	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-6	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-36	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-35	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-13	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-14	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-15	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-24	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-23	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-86	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-84	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-12	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-16	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-33	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-74	Temperature Element	0.001	31	0.02	0.009%	0.006%
--I-408	Programmable Logic Controller Field Mounted	0.001	31	0.02	0.009%	0.006%
--I-409	Interlock	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-77	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-78	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-75	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-8	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-17	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-89	Temperature Element	0.001	31	0.02	0.009%	0.006%
--I-410	Programmable Logic Controller Field Mounted	0.001	31	0.02	0.009%	0.006%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--TE-101-AZ-80	Temperature Element	0.001	31	0.02	0.009%	0.006%
--I-418	Interlock	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-88	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-87	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-79	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-3	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-9	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-81	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-90	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-76	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-93	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-82	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-92	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TS-AZ101EWT-1A1	Temperature Switch	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-31	Temperature Element	0.001	31	0.02	0.009%	0.006%
--TE-101-AZ-91	Temperature Element	0.001	31	0.02	0.009%	0.006%
--LY-AZPCSP-1A	Level Equipment	0.000	51	0.02	0.005%	0.006%
--LE-AZPCSP-1	Level Element	0.000	51	0.02	0.005%	0.006%
--LY-AZPCSP-1B	Level Equipment	0.000	51	0.02	0.005%	0.006%
--LSL-AZCWTK-1	Level Switch Low	0.000	51	0.02	0.005%	0.006%
--KFS-101-AZ-1	Indicator	0.001	31	0.02	0.007%	0.005%
--AZ-K1-5-1A	Exhaust Fan	0.02	1	0.02	0.2%	0.005%
--AZ-K1-5-1B	Exhaust Fan	0.02	1	0.02	0.2%	0.005%
-IA-V-746	2-Way Ball Valve	0.001	29	0.02	0.008%	0.005%
-IA-801-AZ-8	Needle Valve	0.001	29	0.02	0.008%	0.005%
-IA-801-AZ-1	Gate Valve	0.001	29	0.02	0.008%	0.005%
-IA-801-AZ-3	2-Way Ball Valve	0.001	29	0.02	0.008%	0.005%
AZ801A-SA-V-105	Gate Valve	0.001	29	0.02	0.008%	0.005%
--TA-AZ1K12-1	Temperature Alarm	0.02	1	0.02	0.2%	0.005%
--PDAH-AZ1K1-1	Pressure Differential Alarm High	0.02	1	0.02	0.2%	0.005%
AZ101-SA-V-2006	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1404	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0205	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2203	Globe Valve	0.001	28	0.02	0.008%	0.005%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AZ101-SA-V-2204	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1604	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2103	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2007	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1307	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1603	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1503	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0204	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1506	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1703	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2107	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0106	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1306	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1504	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1606	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1707	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1605	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2104	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2105	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1505	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2106	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1305	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1304	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1403	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1805	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1704	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2207	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1903	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1904	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1905	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1906	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1303	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0403	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1907	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2003	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2004	Check Valve	0.001	28	0.02	0.008%	0.005%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AZ101-SA-V-2206	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0203	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1806	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0107	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1407	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1804	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1406	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1803	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2205	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1607	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1405	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-2005	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0103	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0104	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0105	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1705	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1807	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0707	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1004	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1003	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0907	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0503	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0906	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0504	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0905	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0904	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0807	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0805	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0804	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1005	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1507	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0903	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ801A-SA-V-106	Gate Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0505	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1207	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0506	Check Valve	0.001	28	0.02	0.008%	0.005%

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COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AZ101-SA-V-0704	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0507	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0603	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0604	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0605	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1706	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0607	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0703	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0803	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0706	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0304	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0305	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0306	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0307	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1205	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0806	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1006	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1206	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0303	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1203	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1204	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0705	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1107	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1105	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0207	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1007	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0407	2-Way Ball Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0206	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1106	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1103	Globe Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-0405	Check Valve	0.001	28	0.02	0.008%	0.005%
AZ101-SA-V-1104	Check Valve	0.001	28	0.02	0.008%	0.005%
--SRV-801-A-1	Safety Relief Valve	0.001	29	0.02	0.007%	0.005%
--PRV-801-A-1	Pressure Relief Valve	0.001	29	0.02	0.007%	0.005%
--PE	Pressure Element	0.0001	281	0.02	0.001%	0.005%
--FIC-AZ101K1-1A	Flow Indicating Controller	0.02	1	0.01	0.2%	0.004%

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--TIC-AZK102-1B	Temperature Indicating Controller	0.02	1	0.01	0.2%	0.004%
--FIC-AZ1K1-2	Flow Indicating Controller	0.02	1	0.01	0.2%	0.004%
--TIC-AZK102-1A	Temperature Indicating Controller	0.02	1	0.01	0.2%	0.004%
--PIC-AZ1K1-1	Pressure Indicating Controller	0.02	1	0.01	0.2%	0.004%
--TDIC-AZ101K102-1	Temperature Differential Indicating Controller	0.02	1	0.01	0.2%	0.004%
--FIC-AZ101K1-2A	Flow Indicating Controller	0.02	1	0.01	0.2%	0.004%
--TDIC-AZK12-1A	Temperature Differential Indicating Controller	0.02	1	0.01	0.2%	0.004%
--PIC-AZK1-1B	Pressure Indicating Controller	0.02	1	0.01	0.2%	0.004%
--TDIC-AZK12-1B	Temperature Differential Indicating Controller	0.02	1	0.01	0.2%	0.004%
--PIC-AZK1-1A	Pressure Indicating Controller	0.02	1	0.01	0.2%	0.004%
--PI-AZ1K1-2	Pressure Indicating Controller	0.02	1	0.01	0.2%	0.004%
AZ101-WT-HA-00276	Human Action	0.0005	28	0.01	0.01%	0.004%
(HAX)	New AZ Valve Pit Jumper Assembly	0.0001	223	0.01	0.001%	0.004%
(BZ)	New AZ Valve Pit Jumper Assembly	0.0001	223	0.01	0.001%	0.004%
(GXYZ)	New AZ Valve Pit Jumper Assembly	0.0001	223	0.01	0.001%	0.004%
--(A,1,5)	AZ-01A Valve Pit Jumper Assembly	0.0001	223	0.01	0.001%	0.004%
--U12(A,B,C)	AZ-01A Valve Pit Jumper Assembly	0.0001	223	0.01	0.001%	0.004%
--ALC-101-11	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-10	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-1	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-13	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-5	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-12	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-8	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-7	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--ALC-101-21	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-20	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-2	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-3	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-14	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-6	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-22	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-9	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-19	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-17	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-18	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-16	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-15	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--ALC-101-4	Air Lift Circulators	0.0001	220	0.01	0.001%	0.004%
--HS-AZ101WP-1	Hand Switch	0.001	12	0.01	0.01%	0.004%
--HS-AZ1EWT-1	Hand Switch (2 position)	0.001	12	0.01	0.01%	0.004%
--HS-AZ101EWT-1A3	Hand Switch (2 position)	0.001	12	0.01	0.01%	0.004%
--HS-AZ101EWT-1A2	Hand Switch (2 position)	0.001	12	0.01	0.01%	0.004%
--HS-AZ101EWT-1A1	Hand Switch (3 position)	0.001	12	0.01	0.01%	0.004%
--HS-AZ101EWSP-1A	Hand Switch (3 position)	0.001	12	0.01	0.01%	0.004%
--HS-AZ1EWSP-1	Hand Switch (2 position)	0.001	12	0.01	0.01%	0.004%
--HS-AZ101EWT-1A4	Hand Switch	0.001	12	0.01	0.01%	0.004%
--CVT-K1-1-1	Converter	0.0002	51	0.01	0.00%	0.004%
--CVT-K1-1-2	Converter	0.0002	51	0.01	0.00%	0.004%
--VALVE 9 (TEMP)	Check Valve (Mixer pump WST-P-AZ101A Service Water)	0.0002	50	0.01	0.00%	0.004%
--VALVE 10 (TEMP)	Check Valve (Mixer Pump WST-P-101B Service Water)	0.0002	50	0.01	0.00%	0.004%
--MS	Electric Motor Starter	0.01	1	0.01	0.2%	0.004%
AP-241-CHEMB-P-002	Diluent/Flush Pump	0.0004	29	0.01	0.01%	0.003%
--TE-101-AZ-27	Temperature Element	0.0001	193	0.01	0.001%	0.003%
--AZ-PC-SP-1	Seal Pot (Condensate)	0.0001	97	0.01	0.001%	0.003%
--LSL-AZ101EWTK-1	Level Switch Low	0.0003	31	0.01	0.004%	0.003%
--LSL-AZ101EWT-1	Level Switch Low	0.0003	31	0.01	0.004%	0.003%
--LDK-	Leak Detector Relay	0.0001	193	0.01	0.001%	0.003%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--CRM-101-1	Count Rate Monitor	0.0003	31	0.01	0.004%	0.003%
--LIT-	Level Indicating Transmitter	0.0002	51	0.01	0.002%	0.003%
-SW-V-772	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-765	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-791	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-759	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-760	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-761	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-762	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-757	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-764	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-756	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-766	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-767	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-768	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-769	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-771	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-773	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-763	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-724	Gate Valve	0.0002	29	0.01	0.003%	0.002%
V-770	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-790	Globe Valve	0.0002	29	0.01	0.003%	0.002%
-IA-801-AZ-6	Gate Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-720	Gate Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-721	Gate Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-758	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-723	Gate Valve	0.0002	29	0.01	0.003%	0.002%
-IA-801-AZ-7	2-Way Ball Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-725	Gate Valve	0.0002	29	0.01	0.003%	0.002%
-SW-V-750	2-Way Ball Valve	0.0002	29	0.007	0.003%	0.002%
-SW-V-751	2-Way Ball Valve	0.0002	29	0.007	0.003%	0.002%
-SW-V-752	2-Way Ball Valve	0.0002	29	0.007	0.003%	0.002%
-SW-V-753	2-Way Ball Valve	0.0002	29	0.007	0.003%	0.002%
-SW-V-754	2-Way Ball Valve	0.0002	29	0.007	0.003%	0.002%
-SW-V-722	Check Valve	0.0002	29	0.007	0.003%	0.002%
-SW-SRV-750	Safety Relief Valve	0.0002	29	0.007	0.003%	0.002%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--MK-AZ101K1-2A3	Butterfly Valve	0.01	1	0.006	0.1%	0.002%
--MK-AZ101K1-1	Motor Operated Globe Valve	0.01	1	0.006	0.1%	0.002%
--MK-AZK105-1B2	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%
--MK-AZ101K1-2	Motor Operated Butterfly Valve	0.01	1	0.006	0.1%	0.002%
--MK-AZ101K1-2A1	Butterfly Valve	0.01	1	0.006	0.1%	0.002%
--MK-AZ101K1-2A2	Butterfly Valve	0.01	1	0.006	0.1%	0.002%
--MK-AZ102K1-2A3	Motor Operated Damper w/Limit Switches/Manual Handwheel	0.01	1	0.006	0.1%	0.002%
--MK-AZ105-1A1	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%
--MK-AZ105-1A3	Back Draft Damper	0.01	1	0.006	0.1%	0.002%
--MK-AZ105-1B3	Back Draft Damper	0.01	1	0.006	0.1%	0.002%
--MK-AZK1-1A	Motor Operated Damper w/Limit Switches/Manual Handwheel	0.01	1	0.006	0.1%	0.002%
--MK-AZK1-2A	Motor Operated Damper w/Limit Switches/Manual Handwheel	0.01	1	0.006	0.1%	0.002%
--MK-AZK1-2B	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%
--MK-AZK1-3A	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%
--MK-AZK1-3B	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%
--MK-AZK1-1B	Motor Operated Damper w/Limit Switches/Manual Handwheel	0.01	1	0.006	0.1%	0.002%
--MK-AZK105-1A2	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%
--MK-AZK105-1A1	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--MK-AZK105-1B1	Butterfly Damper Valve w/Limit Switch	0.01	1	0.006	0.1%	0.002%
--PDI-AZK14-1B	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--PDI-AZK110-1B	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--YS-AZCWP-1A1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--YS-AZK12-1B1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--PDI-AZK110-1A	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--YS-AZK15-1A1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--PDI-AZK14-2A	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--YS-AZK15-1B1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--PDI-AZK14-2B	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--PDI-AZK14-1A	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--YS-AZK12-1A1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--PDI-AZ101K103-1	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--LG-AZK104-2A	Level Glass	0.01	1	0.005	0.1%	0.001%
--YS-AZ1EWP-1B1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--PDI-AZ101K104-1	Pressure Differential Indicator	0.01	1	0.005	0.1%	0.001%
--PI-AZ101EWP-1A1	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--FI-AZ1K1-1	Flow Indicator	0.01	1	0.005	0.1%	0.001%
--PI-AZCWP-1A1	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--LG-AZK104-1B	Level Glass	0.01	1	0.005	0.1%	0.001%
--LG-AZK104-1A	Level Glass	0.01	1	0.005	0.1%	0.001%
--YS-AZ1EWP-1A1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--LG-AZK104-2B	Level Glass	0.01	1	0.005	0.1%	0.001%
--PI-AZCWP-1B1	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--SIT-AZK105-1B	Speed/Velocity Indicating Transmitter	0.01	1	0.005	0.1%	0.001%
--SIT-AZK105-1A	Speed/Velocity Indicating Transmitter	0.01	1	0.005	0.1%	0.001%
--SI-AZK15-1B	Speed/Velocity Indicator	0.01	1	0.005	0.1%	0.001%
--SI-AZK15-1A	Speed/Velocity Indicator	0.01	1	0.005	0.1%	0.001%
--ZI-AZ1K1-2	Position Indicator	0.01	1	0.005	0.1%	0.001%
--ZI-AZ1K1-1	Position Indicator	0.01	1	0.005	0.1%	0.001%
--TI-AZK12-1A	Temperature Indicator	0.01	1	0.005	0.1%	0.001%
--II-AZK15-1A	Current Indicator	0.01	1	0.005	0.1%	0.001%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--PI-AZCWP-1B2	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--PI-AZ101EWP-1A2	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--II-AZ1EWP-1A	Current Indicator	0.01	1	0.005	0.1%	0.001%
--TI-AZK12-3B	Temperature Indicator	0.01	1	0.005	0.1%	0.001%
--PI-AZCWP-1A2	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--II-AZCWP-1A	Current Indicator	0.01	1	0.005	0.1%	0.001%
--II-AZCWP-1B	Current Indicator	0.01	1	0.005	0.1%	0.001%
--TI-AZK12-3A	Temperature Indicator	0.01	1	0.005	0.1%	0.001%
--YS-AZCWP-1B1	Event/State Switch	0.01	1	0.005	0.1%	0.001%
--II-AZK15-1B	Current Indicator	0.01	1	0.005	0.1%	0.001%
--II-AZ1EWP-1B	Current Indicator	0.01	1	0.005	0.1%	0.001%
--TI-AZK12-1B	Temperature Indicator	0.01	1	0.005	0.1%	0.001%
--PI-AZ101K1-1	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--PI-AZ101EWP-1B2	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--PI-AZ101EWP-1B1	Pressure Indicator	0.01	1	0.005	0.1%	0.001%
--PCV-AZ101K1-1	Pressure Control Valve	0.005	1	0.005	0.1%	0.001%
--PCV-AZ101K1-2	Pressure Control Valve	0.005	1	0.005	0.1%	0.001%
--PCV-AZK111-2	Pressure Control Valve	0.005	1	0.005	0.1%	0.001%
--PCV-AZK111-1	Pressure Control Valve	0.005	1	0.005	0.1%	0.001%
-SW-PSL-750	Pressure Switch Low	0.0001	31	0.005	0.002%	0.001%
-SW-PSL-751	Pressure Switch Low	0.0001	31	0.005	0.002%	0.001%
-SW-FO-750	Flow Orifice	0.0001	29	0.004	0.002%	0.001%
-SW-FO-751	Flow Orifice	0.0001	29	0.004	0.002%	0.001%
--AZ-CW-TK-2	Thermal Storage Tank (500 Gal)	0.0001	50	0.004	0.001%	0.001%
--AZ-CW-TK-1	Tank (30 Gal)	0.0001	50	0.004	0.001%	0.001%
--MS-101-2	Manual Switch	0.0004	12	0.004	0.004%	0.001%
--MS-101-AZ-1	Manual Switch	0.0004	12	0.004	0.004%	0.001%
AP-241-CHEMB-RIAS-127A	Radiation Indicating Alarm Switch	0.0001	37	0.004	0.001%	0.001%
AP-271-CHEMB-RAH-125	Radiation Alarm High	0.0001	37	0.004	0.001%	0.001%
AP-ICE-CHEMB-RXA-127	Radiation Failure Alarm	0.0001	37	0.004	0.001%	0.001%
AP-241-CHEMB-RIAS-127B	Radiation Indicating Alarm Switch	0.0001	37	0.004	0.001%	0.001%
AP-ICE-CHEMB-RAH-125	Radiation Alarm High	0.0001	37	0.004	0.001%	0.001%
AP-ICE-CHEMB-RAH-127	Radiation Alarm High	0.0001	37	0.004	0.001%	0.001%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP-271-CHEMB-RAH-127	Radiation Alarm High	0.0001	37	0.004	0.001%	0.001%
AP-ICE-CHEMB-RXA-125	Radiation Failure Alarm	0.0001	37	0.004	0.001%	0.001%
AP-271-CHEMB-RXA-125	Radiation Failure Alarm	0.0001	37	0.004	0.001%	0.001%
AP-271-CHEMB-RXA-127	Radiation Failure Alarm	0.0001	37	0.004	0.001%	0.001%
AP-ICE-CHEMB-YA-549	Event/State Alarm Low	0.0001	37	0.004	0.001%	0.001%
AP-ICE-CHEMB-LAHH-126	Level Alarm High High	0.0001	37	0.004	0.001%	0.001%
AP-ICE-CHEMB-RIAS-125A	Radiation Alarm Indicating Switch	0.0001	37	0.004	0.001%	0.001%
--FAS-101-23		0.0001	31	0.003	0.001%	0.001%
--AZ-K1-10-1B	HEGA	0.003	1	0.003	0.04%	0.0009%
--AZ-K1-4-2B	HEPA Filter	0.003	1	0.003	0.04%	0.0009%
--AZ-K1-4-2A	HEPA Filter	0.003	1	0.003	0.04%	0.0009%
--AZ-K1-4-1B	HEPA Filter	0.003	1	0.003	0.04%	0.0009%
--AZ101-K1-3-1	Pre-Filter	0.003	1	0.003	0.04%	0.0009%
--AZ-CW-F-1B	Strainer	0.003	1	0.003	0.04%	0.0009%
--AZ-K1-4-1A	HEPA Filter	0.003	1	0.003	0.04%	0.0009%
--AZ101-EW-F-1A	Strainer	0.003	1	0.003	0.04%	0.0009%
--AZ-K1-10-1A	HEGA	0.003	1	0.003	0.04%	0.0009%
--AZ101K1-1	Filter Separator	0.003	1	0.003	0.04%	0.0009%
--AZ101-EW-F-1B	Strainer	0.003	1	0.003	0.04%	0.0009%
--AZ101-K1-4-1	HEPA Filter	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK1-3B	Position Switch	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK15-1B2	Position Switch	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK1-3A	Position Switch	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK15-1A1	Position Switch	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK15-1A2	Position Switch	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK15-1B1	Position Switch	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK15-1B3	Position Switch	0.003	1	0.003	0.04%	0.0009%
--ZS-AZK15-1A3	Position Switch	0.003	1	0.003	0.04%	0.0009%
AP-ICE-CHEMB-FIC-122	Flow Indicating Controller	0.0001	31	0.003	0.001%	0.0008%
AP-ICE-CHEMB-LIC-430	Level Indicating Controller	0.0001	31	0.003	0.001%	0.0008%
AP-ICE-CHEMB-TIC-457	Temperature Indicating Controller	0.0001	31	0.003	0.001%	0.0008%
AP-241-CHEMB-TC-101	Temperature Controller	0.0001	31	0.003	0.001%	0.0008%
AP-ICE-CHEMB-FIC-XXX	Flow Indicating Controller	0.0001	31	0.003	0.001%	0.0008%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP-ICE-CHEMB-FIC-456	Flow Indicating Controller	0.0001	31	0.003	0.001%	0.0008%
AP-ICE-CHEMB-ZC-132	Position Controller	0.0001	31	0.003	0.001%	0.0008%
AP-ICE-CHEMB-FI-456	Flow Indicating Controller	0.0001	31	0.003	0.001%	0.0008%
AP-241-CHEMB-ZC-131	Position Controller	0.0001	31	0.003	0.001%	0.0008%
AP241-POT-TC-101	Automatic Temperature Controller	0.0001	31	0.003	0.001%	0.0008%
AP-ICE-CHEMB-FC-456	Flow Controller	0.0001	31	0.003	0.001%	0.0008%
-IA-801-AZ-5	Gate Valve	0.0001	29	0.003	0.001%	0.0008%
--K1-3-2	Exhaust Plenum	0.0001	25	0.003	0.001%	0.0008%
AZVP-WT-SN-637	Pipe Segment	0.00001	249	0.002	0.0001%	0.0007%
X	New AZ Pump Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
Z	New AZ Pump Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
--B	AZ Valve Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
--C	AZ-01A Pump Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
--H	AZ Valve Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
--SN-631-M9	Tank Discharge Pipe Segment	0.00001	224	0.002	0.0001%	0.0006%
--A	AZ-01A Pump Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
--U12	AZ-01A Pump Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
--1	AZ-01A Pump Pit Jumper Connection	0.00001	224	0.002	0.0001%	0.0006%
--AZ101-EW-TK-2	Air Separator	0.0001	29	0.002	0.001%	0.0006%
--AZ101-EW-TK-1	Expansion Tank (30 Gal)	0.0001	29	0.002	0.001%	0.0006%
--LDK-151-1	Leak Detector Relay	0.0001	37	0.002	0.001%	0.0006%
--LDK-101-1	Leak Detector Relay	0.0001	37	0.002	0.001%	0.0006%
--LDK-101-18B	Leak Detected Relay	0.0001	37	0.002	0.001%	0.0006%
--LDK-101-19B	Leak Detected Relay	0.0001	37	0.002	0.001%	0.0006%
--LDK-101-20B	Leak Detected Relay	0.0001	37	0.002	0.001%	0.0006%
--TDK-101-AZ-2	Temperature Differential Relay	0.0001	31	0.002	0.001%	0.0005%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--TDK-101-AZ-1	Temperature Differential Relay	0.0001	31	0.002	0.001%	0.0005%
-IA-LLE-101-2	Liquid Level Element	0.00003	51	0.001	0.0004%	0.0004%
-IA-LLE-101-1	Liquid Level Element	0.00003	51	0.001	0.0004%	0.0004%
--PDT-AZK104-2A	Pressure Differential Transmitter	0.002	1	0.001	0.02%	0.0004%
--IT-AZ101EWP-1A	Current Equipment	0.002	1	0.001	0.02%	0.0004%
--IT-AZK105-1B	Current Transmitter	0.002	1	0.001	0.02%	0.0004%
--FT-AZ101K1-1	Flow Transmitter	0.002	1	0.001	0.02%	0.0004%
--FSL-AZK102-1B	Flow Switch Low	0.002	1	0.001	0.02%	0.0004%
--FSL-AZK102-1A	Flow Switch Low	0.002	1	0.001	0.02%	0.0004%
--ZT-AZ101K1-1	Position Transmitter	0.002	1	0.001	0.02%	0.0004%
--ZT-AZ101K1-2	Position Transmitter	0.002	1	0.001	0.02%	0.0004%
--FE-AZ101K1-2	Flow Element	0.002	1	0.001	0.02%	0.0004%
--PDT-AZK110-1A	Pressure Differential Transmitter	0.002	1	0.001	0.02%	0.0004%
--FE-AZ101K1-1	Flow Element	0.002	1	0.001	0.02%	0.0004%
--IT-AZ101EWP-1B	Current Equipment	0.002	1	0.001	0.02%	0.0004%
--PDT-AZK104-2B	Pressure Differential Transmitter	0.002	1	0.001	0.02%	0.0004%
--IT-AZCWP-1A	Current Equipment	0.002	1	0.001	0.02%	0.0004%
--IT-AZCWP-1B	Current Transmitter	0.002	1	0.001	0.02%	0.0004%
--IT-AZK105-1	Current Transmitter	0.002	1	0.001	0.02%	0.0004%
--PDT-AZK110-1B	Pressure Differential Transmitter	0.002	1	0.001	0.02%	0.0004%
--PDS-AZ101K1-1	Pressure Differential Switch	0.002	1	0.001	0.02%	0.0004%
--FT-AZ101K1-2	Flow Transmitter	0.002	1	0.001	0.02%	0.0004%
--PDT-AZK104-1B	Pressure Differential Transmitter	0.002	1	0.001	0.02%	0.0004%
--PDT-AZK104-1A	Pressure Differential Transmitter	0.002	1	0.001	0.02%	0.0004%
--AZ Record Sampler Cabinet	Enclosure	0.0001	21	0.001	0.001%	0.0004%
--AZ Annulus Instrument Enclosure	Enclosure	0.0001	21	0.001	0.001%	0.0004%
--102-AZ Heater Control Enclosure	Enclosure	0.0001	21	0.001	0.001%	0.0004%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--MCC #1 AZ Annulus Vent Panel	Enclosure	0.0001	21	0.001	0.001%	0.0004%
--SS-101-C	Selector Switch	0.0001	12	0.001	0.001%	0.0004%
--SS-101A	Selector Switch	0.0001	12	0.001	0.001%	0.0004%
--SS-101B	Selector Switch	0.0001	12	0.001	0.001%	0.0004%
--FI-101-23	Flow Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-AI-121	Analysis Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-FI-123	Flow Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-TI-124	Temperature Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-TI-120	Temperature Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-PI-546	Pressure Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-LI-548	Level Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-LI-126B	Level Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-ICE-CHEMB-FI-129	Flow Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-241-CHEMB-PI-106	Pressure Indicator	0.00003	31	0.001	0.0004%	0.0003%
AP-241-CHEMB-LI-126A	Level Indicator	0.00003	31	0.001	0.0004%	0.0003%
--HS-AZK1-2A	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZK104-1B	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZK104-2A	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZ101EWP-1A1	Hand Switch	0.001	1	0.001	0.01%	0.0003%
--HS-AZK1-2B	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZK1-1A	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZK1-1B5	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZK104-2B	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZK1-1B	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZ101EWP-1B1	Hand Switch	0.001	1	0.001	0.01%	0.0003%
--HS-AZK1-1A5	Hand Switch (2 position)	0.001	1	0.001	0.01%	0.0003%
--HS-AZK110-1A	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZK12-1A	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZK104-1A	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZCWP-1B1	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZCWP-1B	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZCWP-1A	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZK12-1B	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZK110-1B	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--HS-AZK15-1A	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZ1EWP-1A	Hand Switch	0.001	1	0.0009	0.01%	0.0003%
--HS-AZ1EWP-1B	Hand Switch	0.001	1	0.0009	0.01%	0.0003%
--HS-AZK15-1B	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
--HS-AZCWP-1A1	Hand Switch (2 position)	0.001	1	0.0009	0.01%	0.0003%
AP-241-CHEMB-FCV-131	2-Way Flow Control Valve	0.00003	29	0.0009	0.00%	0.0003%
AP241-RW-LCV-430	Flow Control Valve	0.00003	29	0.0009	0.00%	0.0003%
--HV-AZK104-1B	3-Valve Manifold	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1B	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1B4	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1B1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-2B2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1B2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-4	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1B3	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-1A	3-Valve Manifold	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-1A1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-1A2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1B5	3-Valve Manifold	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-1B1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-1B2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-2A	3-Valve Manifold	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-2A1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-2A2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-2B1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK110-1A	3-Valve Manifold	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK110-1B	3-Valve Manifold	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1A4	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWS-1A1	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--CV-AZCWP-1B1	Check Valve	0.0008	1	0.0008	0.01%	0.0002%
--CV-AZCWP-1A1	Check Valve	0.0008	1	0.0008	0.01%	0.0002%
--CV-AZ101EWP-1B1	Check Valve	0.0008	1	0.0008	0.01%	0.0002%
--CV-AZ101EWP-1A1	Check Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK104-2B	3-Valve Manifold	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1B5	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101PA-5	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--HV-AZK1-1A3	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWTK-1A1	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101K104-1A1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101K1-2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101K1-1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101IA-3	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101K104-1A2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101IA-1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101W-8A	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1A1	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1A3	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1B4	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1B3	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1A4	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1B1	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101EWP-1A5	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101IA-2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1B2	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1A2	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1A1	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZK1-1A	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWTK-1A4	Angle Globe Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWTK-1A3	Angle Globe Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWTK-1A2	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWS-1A2	Globe Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWR-1A1	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1B5	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101K104-1A3	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1B3	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZ101W-8B	2-Way Ball Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1B1	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1A5	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1A4	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1A3	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1A2	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--HV-AZCWP-1A1	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--HV-AZCWP-1B4	Gate Valve	0.0008	1	0.0008	0.01%	0.0002%
--PSV-AZ101K1-1	Pressure Safety Valve	0.0008	1	0.0008	0.01%	0.0002%
--U6(2,C)	AZ-01A Valve Pit Jumper Assembly	0.000003	223	0.0007	0.00%	0.0002%
--AZ-K1-2-1A	Heater	0.0007	1	0.0006	0.01%	0.0002%
--AZ-K1-2-1B	Heater	0.0007	1	0.0006	0.01%	0.0002%
--AZ101-K1-2-1	Heater	0.0007	1	0.0006	0.01%	0.0002%
AP-241-CHEMB-ZS-131	Position Switch	0.0000	31	0.0006	0.00%	0.0002%
AP-241-CHEMB-ZS-132	Position Switch	0.0000	31	0.0006	0.00%	0.0002%
AP241-RW-ZS-430	Position Switch	0.0000	31	0.0006	0.00%	0.0002%
--I-303	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--TE-AZK102-3A	Temperature Element	0.0005	1	0.0005	0.01%	0.0001%
--I-121	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--TE-AZK102-1A	Temperature Element	0.0005	1	0.0005	0.01%	0.0001%
--TE-AZK102-1A1	Temperature Element	0.0005	1	0.0005	0.01%	0.0001%
--TE-AZK102-1B	Temperature Element	0.0005	1	0.0005	0.01%	0.0001%
--TE-AZK102-1B1	Temperature Element	0.0005	1	0.0005	0.01%	0.0001%
--I-119	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--I-304	Programmable Logic Controller Field Mounted	0.0005	1	0.0005	0.01%	0.0001%
--I-302	Programmable Logic Controller Field Mounted	0.0005	1	0.0005	0.01%	0.0001%
--TE-AZK102-3B	Temperature Element	0.0005	1	0.0005	0.01%	0.0001%
--TT-AZK102-1A	Temperature Transmitter	0.0005	1	0.0005	0.01%	0.0001%
--TT-AZK102-1B	Temperature Transmitter	0.0005	1	0.0005	0.01%	0.0001%
--TT-AZK102-3A	Temperature Transmitter	0.0005	1	0.0005	0.01%	0.0001%
--TT-AZK102-3B	Temperature Transmitter	0.0005	1	0.0005	0.01%	0.0001%
--I-301	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--I-300	Programmable Logic Controller Field Mounted	0.0005	1	0.0005	0.01%	0.0001%
--PT-AZK1-1B	Pressure Transmitter	0.0005	1	0.0005	0.01%	0.0001%
--SE-AZK105-1B	Speed/Velocity Element	0.0005	1	0.0005	0.01%	0.0001%
--SE-AZK105-1A	Speed/Velocity Element	0.0005	1	0.0005	0.01%	0.0001%
--I-118	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--PT-AZK1-1A	Pressure Transmitter	0.0005	1	0.0005	0.01%	0.0001%

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COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--PT-AZ101K1-2	Pressure Transmitter	0.0005	1	0.0005	0.01%	0.0001%
--PT-AZ101K1-1	Pressure Transmitter	0.0005	1	0.0005	0.01%	0.0001%
--PS-AZK111-2	Pressure Switch	0.0005	1	0.0005	0.01%	0.0001%
--PS-AZK111-1	Pressure Switch	0.0005	1	0.0005	0.01%	0.0001%
--I-112	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--I-101	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--I-103	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--I-107	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--I-108	Interlock	0.0005	1	0.0005	0.01%	0.0001%
--I-110	Interlock	0.00051	1	0.0005	0.01%	0.0001%
--I-114	Interlock	0.0005	1	0.0005	0.01%	0.0001%
AP-241-CHEMB-RE-125A	Radiation Sensing Element	0.00002	31	0.0005	0.0002%	0.0001%
AP-241-CHEMB-RE-125B	Radiation Sensing Element	0.00002	31	0.0005	0.0002%	0.0001%
AP-241-CHEMB-RE-127B	Radiation Sensing Element	0.00002	31	0.0005	0.0002%	0.0001%
AP-241-CHEMB-AE-121	Analysis Element	0.00002	31	0.0005	0.0002%	0.0001%
AP-241-CHEMB-RE-127A	Radiation Sensing Element	0.00002	31	0.0005	0.0002%	0.0001%
-SW-TK-720	Water Tank	0.00002	29	0.0005	0.0002%	0.0001%
AP-241-CHEMB-MT-101	Static Mixer	0.00002	29	0.0004	0.0002%	0.0001%
AP-ICE-CHEMB-YL-130	Event/State Light	0.00003	12	0.0004	0.0004%	0.0001%
AP-ICE-CHEMB-YL-550	Event/State Light	0.00003	12	0.0004	0.0004%	0.0001%
AP-241-CHEMB-AIT-121	Analysis Indicating Transmitter	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-PIT-123	Pressure Indicating Transmitter	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-LT-126	Level Transmitter	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-FIT-129	Flow Indicating Transmitter	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-FIT-123	Flow Indicating Transmitter	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-FIT-122	Flow Indicating Transmitter	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-FE-129	Flow Element	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-FE-122	Flow Element	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-FE-123	Flow Element	0.00001	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-ZT-131	Position Transmitter	0.00001	31	0.0003	0.0001%	0.00008%
AP241-RW-TIT-457	Temperature Indicating Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP241-RW-FIT-456	Flow Indicating Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP241-RW-FE-456	Flow Element	0.000009	31	0.0003	0.0001%	0.00008%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP-241-CHEMB-RT-125A	Radiation Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP-ICE-CHEMB-FQIC-122	Flow Totalizer Indicator Controller	0.000009	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-RT-125B	Radiation Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-TIT-124	Temperature Indicating Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP241-RW-ZT-430	Position Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-RT-127A	Radiation Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-RT-127B	Radiation Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
AP-241-CHEMB-TIT-120	Temperature Indicating Transmitter	0.000009	31	0.0003	0.0001%	0.00008%
--MCC(241-AZ-01A)	Motor Control Center	0.000006	37	0.0002	0.0001%	0.00006%
AP241-POT-V-102	2-Way Ball Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP241-POT-V-109	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP241-POT-V-108	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP241-POT-V-107	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP241-POT-V-106	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-113	2-Way Ball Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP241-POT-V-103	Mixing Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-107	Globe Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-106	2-Way Ball Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-111	2-Way Ball Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-112	2-Way Ball Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-110	2-Way Ball Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-109	Automatic Recirc Valve	0.000005	29	0.0001	0.0001%	0.00004%
AP-241-CHEMB-V-108	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
--1" Gate Valve before By-pass on RW-3648-M5	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
--1" Valve before drain on RW-3648-M5	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
--1" Valve on RW-3548-M5 By-pass	Globe Valve	0.000005	29	0.0001	0.0001%	0.00004%
--1/2" Valve on DR-M5	Gate Valve	0.000005	29	0.0001	0.0001%	0.00004%
--U6	AZ-01A Pump Pit Jumper Connection	0.000000	224	0.0001	0.0000%	0.00003%

Table E-2	Critical Items List for the High Level Waste Transfer Activities RAM B Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
--2	AZ-01A Pump Pit Jumper Connection	0.000000	224	0.0001	0.0000%	0.00003%
AP-241-CHEMB-TE-101	Temperature Sensing Bulb	0.000003	31	0.0001	0.0000%	0.00003%
AP-ICE-CHEMB-SS-550	Selector Switch (3 or more positions)	0.000006	12	0.0001	0.0001%	0.00002%
AP-ICE-CHEMB-HS-130	2-Position Hand Switch	0.000006	12	0.0001	0.0001%	0.00002%
AP-241-CHEMB-LS-126	Level Switch	0.000002	31	0.00005	0.00002%	0.00001%
AP-241-CHEMB-LE-126	Level Element	0.000002	31	0.00005	0.00002%	0.00001%
AP241-RW-BOILER	BOILER	0.000001	29	0.00002	0.00001%	0.00001%
AP-241-CHEMB-103-M9	Dilution/Flush Discharge Pipe Segment	0.0000005	29	0.00001	0.00001%	0.000004%
AP241-PW-102-M9	Pipe Segment	0.0000005	29	0.00001	0.00001%	0.000004%
AP241-PW-104-M9	Pipe Segment	0.0000005	29	0.00001	0.00001%	0.000004%
AP-241-CHEMB-MSTR-002	Electric Motor Starter	0.0000003	37	0.00001	0.000004%	0.000004%
AP-241-CHEMB-TK-001	Diluent/Flush Tank	0.0000003	29	0.00001	0.000004%	0.000003%

Table E-3	Critical Items List for the High Level Waste Batch Transfer Activities Pinned to the WTD Requested by BNFL Ranked by the Contribution of Generic Component Types to Expected Schedule Delay				
Generic Component Type Description	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
	8.0	**43**	**341**	**100%**	**100%**
Instrumentation, other than leak and level	2.1	49	105	27%	31%
Valves	1.0	78	75	12%	22%
Instrumentation, Leak detection	0.4	77	34	6%	10%
Pumps, other than mixer and transfer	1.1	29	32	14%	9%
Mixer Pump	0.1	315	25	1%	7%
Human actions	0.0	360	15	1%	4%
Control Equipment	0.4	37	14	5%	4%
Waste Transfer Pump	0.1	101	7	1%	2%
Instrumentation, level	0.2	46	8	2%	2%
External events	2.0	3	6	25%	2%
Filters	0.1	49	4	1%	1%
Fans	0.04	98	4	0.5%	1%
Other	0.4	27	12	6%	4%

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Table E-4	**Critical Items List for the High Level Waste Transfer RAM B, Ranked by the Contribution of System Type to Expected Schedule**				
SYSTEM TYPE	**EXPECTED NUMBER OF DELAY EVENTS**	**EXPECTED DELAY PER EVENT (HR)**	**TOTAL EXPECTED DELAY TIME (HRS)**	**PERCENT CONTRIBUTION TO NUMBER OF EVENTS**	**PERCENT CONTRIBUTION TO TOTAL DELAY**
Total	**8.0**	**43**	**341**	**100%**	**100%**
HVAC Primary	2.32	37	85	29.0%	25.0%
HVAC Annulus	1.22	52	64	15.3%	18.7%
Transfer	2.23	28	62	28.0%	18.2%
Service Air	0.61	88	54	7.7%	15.9%
Monitoring	0.22	167	37	2.8%	10.9%
Recird Cond Cooling	0.77	23	18	9.7%	5.2%
Vent Cond Cooling System	0.38	27	10	4.8%	3.0%
Raw Water	0.10	31	3	1.2%	0.9%
Dilution/Flush	0.01	168	2	0.1%	0.6%
Nitrogen	0.00	1006	2	0.02%	0.6%
Instrument Air	0.06	30	2	0.7%	0.5%
Process Air	0.04	29	1	0.5%	0.4%
Service Water	0.003	131	0.4	0.04%	0.1%
Instrumentation	0.01	34	0.3	0.1%	0.1%
Electric Power	0.01	6	0.03	0.1%	0.01%

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Table E-5	Critical List for the High Level Waste Batch Transfer RAM B, Ranked by Contribution of Mission Function to Expected Schedule Delay				
BRIEF DESCRIPTION	**EXPECTED NUMBER OF DELAY EVENTS**	**EXPECTED DELAY PER EVENT (HRS)**	**TOTAL EXPECTED DELAY TIME (HRS)**	**PERCENT CONTRIBUTION TO NUMBER OF EVENTS**	**PERCENT CONTRIBUTION TO TOTAL DELAY**
Total	**8.0**	**43**	**341**	**100.0%**	**100.0%**
Safety	4.9	42	204	61.2%	60.0%
Cool HLW in AZ-101	0.7	85	56	8.2%	16.3%
Transfer AZ-101 HLW Feed to BNFL Batch 1	2.2	16	36	27.6%	10.6%
Mix AZ-101 Feed to Remobilize Solids	0.1	300	25	1.0%	7.3%
Mix AZ-101 Feed During Transfer	0.05	250	11	0.6%	3.3%
Flush	0.02	275	6	0.3%	1.7%
Support	0.1	28	3	1.2%	0.8%

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Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
(BZ)	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		JMP	New AZ Valve Pit Jumper Assembly	ES-314E-M40	1	8
(GXYZ)	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		JMP	New AZ Valve Pit Jumper Assembly	ES-314E-M40	1	8
(HAX)	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		JMP	New AZ Valve Pit Jumper Assembly	ES-314E-M40	1	8
--(A,1,5)	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		JMP	AZ-01A Valve Pit Jumper Assembly	D180B	1	0
--(EF)-K1-3-2	AZ Farm	AZ Farm	HVAC Annulus	E		EF	Exhaust Fan	H-2-92964	1	2
--1	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		NOZ	AZ-01A Pump Pit Jumper Connection	D180B	1	0
--1" Gate Valve before By-pass on RW-3648-M5	AZ-101	AZ-101 Raw Water Valve Pit 01A	Raw Water	E		V	Gate Valve	H-2-68335	7	9
--1" Valve before drain on RW-3648-M5	AZ-101	AZ-101 Raw Water Valve Pit 01A	Raw Water	E		V	Gate Valve	H-2-68335	7	9
--1" Valve on RW-3548-M5 By-pass	AZ-101	AZ-101 Raw Water Valve Pit 01A	Raw Water	E		V	Globe Valve	H-2-68335	7	9
--1" Valve on RW-3648-M5	AZ-101	AZ-101 Raw Water Valve Pit 01A	Raw Water	E		V	Gate Valve	H-2-68335	7	9
--1/2" Valve on DR-M5	AZ-101	AZ-101 Raw Water Valve Pit 01A	Raw Water	E		V	Gate Valve	H-2-68335	7	9
--102-AZ Heater Control Enclosure	AZ Farm	AZ Farm	HVAC Annulus	E		ENCL	Enclosure	H-2-92964	1	2
--2	AZ-101	AZ-01A VALVE PIT	Dilution/Flush	N/521		NOZ	AZ-01A Pump Pit Jumper Connection	D180B	1	0
--A	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		NOZ	AZ-01A Pump Pit Jumper Connection	D180B	1	0
--AE-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		AE	Analysis Element	H-2-68335	25	0
--AE-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		AE	Analysis Element	H-2-68335	25	0
--AE-AZK1-3	AZ-101	Tank AZ-101	HVAC Primary	N/030		AE	Analysis Element	H-2-68335	25	0
--ALC-101-1	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-10	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-11	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-12	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-13	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-14	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-15	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-16	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-17	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-18	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-19	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-2	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-20	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-21	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-22	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-3	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--ALC-101-4	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-5	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-6	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-7	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-8	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--ALC-101-9	AZ-101	Tank AZ-101	Service Air	E		ALC	Air Lift Circulators	H-2-68335	6	6
--AZ Annulus Instrument Enclosure	AZ Farm	AZ Farm	HVAC Annulus	E		ENCL	Enclosure	H-2-92964	1	2
--AZ Record Sampler Cabinet	AZ Farm	AZ Farm	HVAC Annulus	E		ENCL	Enclosure	H-2-92964	1	2
--AZ Record Sampler Vacuum Pump	AZ Farm	AZ Farm	HVAC Annulus	E		P	Pump	H-2-92964	1	2
--AZ-CW-F-1B	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		STR	Strainer	H-2-68335	16	0
--AZ-CW-P-1A	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		P	Recirc Pump	H-2-68335	16	0
--AZ-CW-P-1B	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		P	Recirc Pump	H-2-68335	16	0
--AZ-CW-R-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		CHILL	Air Cooled Chiller	H-2-68335	16	0
--AZ-CW-TK-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		TK	Tank (30 Gal)	H-2-68335	16	0
--AZ-CW-TK-2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		TK	Thermal Storage Tank (500 Gal)	H-2-68335	16	0
--AZ-K1-10-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		ABS	HEGA	H-2-68335	23	0
--AZ-K1-10-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		ABS	HEGA	H-2-68335	23	0
--AZ-K1-11-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		P	Vacuum Pump	H-2-68335	25	0
--AZ-K1-11-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		P	Vacuum Pump	H-2-68335	25	0
--AZ-K1-2-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HTR	Heater	H-2-68335	23	0
--AZ-K1-2-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HTR	Heater	H-2-68335	23	0
--AZ-K1-4-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		FLT	HEPA Filter	H-2-68335	23	0
--AZ-K1-4-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		FLT	HEPA Filter	H-2-68335	23	0
--AZ-K1-4-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		FLT	HEPA Filter	H-2-68335	23	0
--AZ-K1-4-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		FLT	HEPA Filter	H-2-68335	23	0
--AZ-K1-5-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		EF	Exhaust Fan	H-2-68335	23	0
--AZ-K1-5-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		EF	Exhaust Fan	H-2-68335	23	0
--AZ-K1-8-1	AZ Farm	AZ Farm	HVAC Primary	N/030		COND	Condenser	H-2-68335	22	0
--AZ-K1-9-1	AZ Farm	AZ Farm	HVAC Primary	N/030		HEME	High Efficiency Mist Eliminator	H-2-68335	22	0
--AZ-PC-P-1	AZ Farm	AZ Farm	HVAC Primary	N/030		P	Sample Pump	H-2-68335	17	0
--AZ-PC-S-1	AZ Farm	AZ Farm	HVAC Primary	N/030		S	Sampler	H-2-68335	17	0
--AZ-PC-SP-1	AZ Farm	AZ Farm	HVAC Primary	N/030		SP	Seal Pot (Condensate)	H-2-68335	17	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--AZ-RW-BP-1	AZ Farm	AZ Farm	Raw Water	N/030		BP	Backflow Preventer	H-2-68335	20	0
--AZ101 CAM Unit Vacuum Pump	AZ Farm	AZ Farm	HVAC Annulus	E		P	Pump	H-2-92964	1	2
--AZ101-CA-P-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		P	Chem-add Pump	H-2-68335	14	0
--AZ101-EW-F-1A	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		STR	Strainer	H-2-68335	14	0
--AZ101-EW-F-1B	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		STR	Strainer	H-2-68335	14	0
--AZ101-EW-P-1A	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		P	Recirc Pump	H-2-68335	14	0
--AZ101-EW-P-1B	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		P	Recirc Pump	H-2-68335	14	0
--AZ101-EW-SP-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		P	Spray Pump, 2hp	H-2-68335	14	0
--AZ101-EW-TK-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		TK	Expansion Tank (30 Gal)	H-2-68335	14	0
--AZ101-EW-TK-2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		TK	Air Separator	H-2-68335	14	0
--AZ101-K1-2-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		HTR	Heater	H-2-68335	21	0
--AZ101-K1-3-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		FLT	Pre-Filter	H-2-68335	21	0
--AZ101-K1-4-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		FLT	HEPA Filter	H-2-68335	21	0
--AZ101-K4-1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		MOSE	Moisture Separator	H-2-68335	12	0
--AZ101-K4-5-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		RF	Recirculating Fan	H-2-68335	12	0
--AZ101-K4-8-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		COND	Condenser	H-2-68335	12	0
--AZ101-RW-F-2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		FLT	Chem-Add Cartridge (Iodine)	H-2-68335	14	0
--AZ101-W-F-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		STR	Pan Strainer	H-2-68335	14	0
--AZ101-W-F-2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		FLT	Pan Bag Filter	H-2-68335	14	0
--AZ101-W-P-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		P	Pan Recirc Pump	H-2-68335	14	0
--AZ101-W-S-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		FLT	Pan Separator	H-2-68335	14	0
--AZ101K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		FLT	Filter Separator	H-2-68335	21	0
--AZ102 CAM Unit Vacuum Pump	AZ Farm	AZ Farm	HVAC Annulus	E		P	Pump	H-2-92964	1	2
--B	AZ Valve Pit	AZ Valve Pit	Transfer	N/314		NOZ	AZ Valve Pit Jumper Connection	ES-314E-M40	1	8
--C	AZ-101	AZ-01A VALVE PIT	Dilution/Flush	N/521		NOZ	AZ-01A Pump Pit Jumper Connection	D180B	1	0
--CAM-101-AZ	AZ-101	AZ-101 Cam Unit Enclosure	HVAC Annulus	E		CAM	Continuous Air Monitor	H-2-92964	1	2
--CAM-102-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		CAM	Continuous Air Monitor	H-2-92964	1	2
--CASS-1263	AZ-101	Bldg 2750E	Monitoring	E		CASS	Computer Automated Surveillance Station	H-2-68335	6	6
--CASS-1264	AZ-101	Bldg 2750E	Monitoring	E		CASS	Computer Automated Surveillance Station	H-2-68335	6	6
--CASS-1266	AZ-101	Bldg 2750E	Monitoring	E		CASS	Computer Automated Surveillance Station	H-2-68335	6	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--CASS-1267	AZ Farm	Bldg 2750E	Monitoring	E		CASS	Computer Automated Surveillance Station	H-2-68335	6	6
--CASS-1303	AZ-101	Bldg 2750E	Monitoring	E		LDA	Leak Detector Alarm	H-2-68335	6	6
--CASS-1764	AZ-101	Bldg 2750E	Monitoring	E		CASS	Computer Automated Surveillance Station	H-2-68335	6	6
--CE-AZ101EWT-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		CE	Conductivity Element	H-2-68335	14	0
--CRM-101-1	AZ-101	Instrument Bldg 241-AZ-801A	Instrumentation	E		CRM	Count Rate Monitor	H-2-68335	6	6
--CSH-AZ101EWT-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		CSH	Conductivity Switch High	H-2-68335	14	0
--CV-AZ101EWP-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		CV	Check Valve	H-2-68335	14	0
--CV-AZ101EWP-1B1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		CV	Check Valve	H-2-68335	14	0
--CV-AZ101RW-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		CV	Check Valve	H-2-68335	14	0
--CV-AZCWP-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		CV	Check Valve	H-2-68335	16	0
--CV-AZCWP-1B1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		CV	Check Valve	H-2-68335	16	0
--CVT-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		CVT	Converter	H-2-92964	1	2
--CVT-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		CVT	Converter	H-2-92964	1	2
--DPI-RS-41	AZ Farm	AZ Farm	HVAC Annulus	E		DPI	Differential Pressure Indicator	H-2-92964	1	2
--DTC-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		DTC	Delta T Controller	H-2-92964	1	2
--DTC-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		DTC	Delta T Controller	H-2-92964	1	2
--EV-AZ101EWT-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		SOV	Solenoid Valve	H-2-68335	14	0
--F-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FLT	Particulate Filter Iodine Filter	H-2-68335	25	0
--F1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		F	Cooling Fan, 20 hp w/capacity control damper and motor	H-2-68335	14	0
--FA-101-1	AZ-101	Control Bldg 241-A-271	Instrumentation	E		FAS	Flow Alarm Switch	H-2-68335	6	6
--FA-101/102-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		FA	Flow Alarm	H-2-92964	1	2
--FA-AZ Annulus	AZ Farm	AZ Farm	HVAC Annulus	E		FA	Flow Alarm	H-2-92964	1	2
--FA-AZ-RS	AZ Farm	AZ Farm	HVAC Annulus	E		FA	Flow Alarm	H-2-92964	1	2
--FAL-AZK1-1A	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FAL	Flow Alarm Low	H-2-68335	25	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--FAL-AZK1-2A	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FAL	Flow Alarm Low	H-2-68335	25	0
--FAS-101-23	AZ-101	AZ-101 Raw Water Valve Pit 01A	Raw Water	E		FAS		H-2-68335	7	9
--FE	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		FE	Flow Element	D180B	1	0
--FE-AZ101EWR-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		FE	Flow Element	H-2-68335	14	0
--FE-AZ101K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		FE	Flow Element	H-2-68335	21	0
--FE-AZ101K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		FE	Flow Element	H-2-68335	21	0
--FE-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FE	Flow Element	H-2-68335	25	0
--FE-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FE	Flow Element	H-2-68335	25	0
--FE-AZPC-1	AZ Farm	AZ Farm	HVAC Primary	N/030		FE	Flow Element	H-2-68335	17	0
--FI-101-23	AZ-101	AZ-101 Raw Water Valve Pit 01A	Raw Water	E		FI	Flow Indicator	H-2-68335	7	9
--FI-AZ1EWR-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		FI	Flow Indicator	H-2-68335	14	0
--FI-AZ1K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		FI	Flow Indicator	H-2-68335	21	0
--FI-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		FI	Flow Indicator	H-2-68335	16	0
--FI-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FI	Flow Indicator	H-2-68335	25	0
--FI-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FI	Flow Indicator	H-2-68335	25	0
--FI-AZK1-3	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FI	Flow Indicator	H-2-68335	25	0
--FI-AZPC-1	AZ Farm	AZ Farm	HVAC Primary	N/030		FI	Flow Indicator	H-2-68335	17	0
--FI-AZRW-1	AZ Farm	AZ Farm	Raw Water	N/030		FI	Flow Indicator	H-2-68335	20	0
--FI-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		FI	Flow Indicator	H-2-92964	1	2
--FI-RS-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		FI	Flow Indicator	H-2-92964	1	2
--FIC-AZ101K1-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		FIC	Flow Indicating Controller	H-2-68335	21	0
--FIC-AZ101K1-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		FIC	Flow Indicating Controller	H-2-68335	21	0
--FIC-AZ101PA-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		FIC	Flow Indicating Controller	H-2-68335	12	0
--FIC-AZ1K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		FIC	Flow Indicating Controller	H-2-68335	21	0
--Filter (Instr Air)	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E		FLT	Filter	H-2-68335	5	6
--FIQ-RS-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		FIQ	Flow Totalizer	H-2-92964	1	2
--FIT-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FIT	Flow Indicating Transmitter	H-2-68335	25	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--FIT-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FIT	Flow Indicating Transmitter	H-2-68335	25	0
--FIT-AZK1-3	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FIT	Flow Indicating Transmitter	H-2-68335	25	0
--FM-AZ101RW-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		FM	Flow Meter	H-2-68335	14	0
--FS-CAM-1-101-AZ	AZ-101	AZ-101 Cam Unit Enclosure	HVAC Annulus	E		FS	Flow Switch	H-2-92964	1	2
--FS-CAM-1-102-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		FS	Flow Switch	H-2-92964	1	2
--FS-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		FS	Flow Switch	H-2-92964	1	2
--FS-RS-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		FS	Flow Switch	H-2-92964	1	2
--FSL-AZ101WS-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		FSL	Flow Switch Low	H-2-68335	14	0
--FSL-AZK102-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		FSL	Flow Switch Low	H-2-68335	23	0
--FSL-AZK102-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		FSL	Flow Switch Low	H-2-68335	23	0
--FT-AZ101EWR-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		FT	Flow Transmitter	H-2-68335	14	0
--FT-AZ101K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		FT	Flow Transmitter	H-2-68335	21	0
--FT-AZ101K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		FT	Flow Transmitter	H-2-68335	21	0
--FT-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		FT	Flow Transmitter	H-2-68335	16	0
--FT-AZPC-1	AZ Farm	AZ Farm	HVAC Primary	N/030		FT	Flow Transmitter	H-2-68335	17	0
--FT-AZRW-1	AZ Farm	AZ Farm	Raw Water	N/030		FT	Flow Transmitter	H-2-68335	20	0
--FY-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FY	Flow Equipment	H-2-68335	25	0
--FY-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FY	Flow Equipment	H-2-68335	25	0
--FY-AZK1-3	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		FY	Flow Equipment	H-2-68335	25	0
--H	AZ Valve Pit	AZ Valve Pit	Transfer	N/314		NOZ	AZ Valve Pit Jumper Connection	ES-314E-M40	1	8
--HS-1-1	AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HS-1-2	AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HS-1-3	AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HS-1-4	AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HS-1-5	AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HS-1-6	AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--HS-1-7	AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HS-1-8	AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HS-AZ101EWP-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HS	Hand Switch	H-2-68335	14	0
--HS-AZ101EWP-1B1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HS	Hand Switch	H-2-68335	14	0
--HS-AZ101EWSP-1A	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HS	Hand Switch (3 position)	H-2-68335	14	0
--HS-AZ101EWT-1A1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HS	Hand Switch (3 position)	H-2-68335	14	0
--HS-AZ101EWT-1A2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HS	Hand Switch (2 position)	H-2-68335	14	0
--HS-AZ101EWT-1A3	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HS	Hand Switch (2 position)	H-2-68335	14	0
--HS-AZ101EWT-1A4	AZ-101	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HS	Hand Switch	H-2-68335	14	0
--HS-AZ101K405-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	12	0
--HS-AZ101K405-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	12	0
--HS-AZ101WP-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HS	Hand Switch	H-2-68335	14	0
--HS-AZ1EWP-1A	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HS	Hand Switch	H-2-68335	14	0
--HS-AZ1EWP-1B	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HS	Hand Switch	H-2-68335	14	0
--HS-AZ1EWSP-1	AZ Farm	AZ Farm	Recird Cond Cooling	N/030		HS	Hand Switch (2 position)	H-2-68335	14	0
--HS-AZ1EWT-1	AZ Farm	AZ Farm	Recird Cond Cooling	N/030		HS	Hand Switch (2 position)	H-2-68335	14	0
--HS-AZ1K45-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	12	0
--HS-AZCWP-1A	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HS	Hand Switch (2 position)	H-2-68335	16	0
--HS-AZCWP-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HS	Hand Switch (2 position)	H-2-68335	16	0
--HS-AZCWP-1B	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HS	Hand Switch (2 position)	H-2-68335	16	0
--HS-AZCWP-1B1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HS	Hand Switch (2 position)	H-2-68335	16	0
--HS-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HS	Hand Switch	H-2-68335	16	0
--HS-AZK1-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK1-1A1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	25	0
--HS-AZK1-1A5	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0

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Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--HS-AZK1-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK1-1B1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	25	0
--HS-AZK1-1B5	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK1-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK1-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK104-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK104-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK104-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK104-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK108-1	AZ Farm	AZ Farm	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	22	0
--HS-AZK109-1	AZ Farm	AZ Farm	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	22	0
--HS-AZK110-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK110-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK111-1A	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	25	0
--HS-AZK111-1B	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	25	0
--HS-AZK111-1C	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	25	0
--HS-AZK12-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK12-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK15-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZK15-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	23	0
--HS-AZPCP-1	AZ Farm	AZ Farm	HVAC Primary	N/030		HS	Hand Switch (2 position)	H-2-68335	17	0
--HS-M	AZ Farm	MCC #1 AZ Annulus Vent Panel	HVAC Annulus	E		HS	Hand Switch	H-2-92964	1	2
--HT-RS-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		HT	Heat Trace	H-2-92964	1	2
--HV-2801-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZ101EWP-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWP-1A3	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWP-1A4	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWP-1A5	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWP-1B1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWP-1B3	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWP-1B4	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWP-1B5	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0

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--HV-AZ101EWR-1A2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWR-1A3	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWS-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWS-1A2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Globe Valve	H-2-68335	14	0
--HV-AZ101EWS-1A6	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	Gate Valve	H-2-68335	12	0
--HV-AZ101EWT-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101EWT-1A2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWT-1A3	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101EWT-1A4	AZ-101	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWTK-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWTK-1A2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101EWTK-1A3	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Angle Globe Valve	H-2-68335	14	0
--HV-AZ101EWTK-1A4	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Angle Globe Valve	H-2-68335	14	0
--HV-AZ101EWTK-2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101IA-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101IA-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101IA-3	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101K1-1	AZ-101	AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101K1-2	AZ-101	AZ-102	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101K104-1A1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101K104-1A2	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101K104-1A3	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101K4-1	AZ-101	AZ-101	HVAC Primary	N/030		HV	3-Way Ball Valve	H-2-68335	12	0
--HV-AZ101K405-1A	AZ-101	AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	12	0
--HV-AZ101K405-1A1	AZ-101	AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	12	0
--HV-AZ101K405-1A2	AZ-101	AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	12	0
--HV-AZ101K408-1A	AZ-101	AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	12	0
--HV-AZ101K408-1A1	AZ-101	AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	12	0
--HV-AZ101PA-1	AZ-101	AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	12	0
--HV-AZ101PA-2	AZ-101	AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	12	0
--HV-AZ101PA-3	AZ-101	AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	12	0
--HV-AZ101PA-5	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	21	0
--HV-AZ101RW-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101RW-2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101RW-3	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--HV-AZ101W-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101W-3	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	Gate Valve	H-2-68335	14	0
--HV-AZ101W-4	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101W-5	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101W-6	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101W-7	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101W-8A	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZ101W-8B	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		HV	2-Way Ball Valve	H-2-68335	14	0
--HV-AZCWP-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1A2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1A3	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1A4	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1A5	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1B1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1B2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1B3	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1B4	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWP-1B5	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--HV-AZCWR-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWS-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWS-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWS-1A2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Globe Valve	H-2-68335	16	0
--HV-AZCWTK-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWTK-1A2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZCWTK-1A3	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Angle Globe Valve	H-2-68335	16	0
--HV-AZCWTK-1A4	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Angle Globe Valve	H-2-68335	16	0
--HV-AZCWTK-2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Gate Valve	H-2-68335	16	0
--HV-AZK1-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1A2	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1A3	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1A4	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1A5	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK1-1A6	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK1-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1B2	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1B3	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1B4	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-1B5	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	23	0
--HV-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK1-2A5	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0

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Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--HV-AZK1-2A6	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK1-3A5	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK1-3A6	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK1-4	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK1-5	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK1-6	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	25	0
--HV-AZK104-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	23	0
--HV-AZK104-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK104-1A2	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK104-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	23	0
--HV-AZK104-1B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK104-1B2	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK104-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	23	0
--HV-AZK104-2A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK104-2A2	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK104-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	23	0
--HV-AZK104-2B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK104-2B2	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	23	0
--HV-AZK108-1	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	22	0
--HV-AZK108-1A1	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZK108-1A2	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZK108-1D	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZK109-1	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	22	0
--HV-AZK109-1A1	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZK109-1A2	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZK109-1D	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZK109-1E	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	22	0
--HV-AZK110-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	23	0
--HV-AZK110-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	3-Valve Manifold	H-2-68335	23	0
--HV-AZPA-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		HV	Gate Valve	H-2-68335	12	0
--HV-AZPC-1	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPC-2	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPC-3	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPC-4	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPC-5	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	Angle Gate Valve	H-2-68335	17	0
--HV-AZPCJ-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPCJ-1B	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPCJ-1C	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPCSP-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPCSP-1B	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZPCSP-1C	AZ Farm	AZ Farm	HVAC Primary	N/030		HV	2-Way Ball Valve	H-2-68335	17	0
--HV-AZRW-1	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-10	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-12	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-2	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--HV-AZRW-3	AZ Farm	AZ Farm	Raw Water	N/030		HV	Multi-port Instrument Plug Valve	H-2-68335	20	0
--HV-AZRW-4	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-5	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-6	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-6A	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-7	AZ Farm	AZ Farm	Raw Water	N/030		HV	Multi-port Instrument Plug Valve	H-2-68335	20	0
--HV-AZRW-8	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-9	AZ Farm	AZ Farm	Raw Water	N/030		HV	Gate Valve	H-2-68335	20	0
--HV-AZRW-BP-1A	AZ Farm	AZ Farm	Raw Water	N/030		HV	2-Way Ball Valve	H-2-68335	20	0
--HV-AZRW-BP-1B	AZ Farm	AZ Farm	Raw Water	N/030		HV	2-Way Ball Valve	H-2-68335	20	0
--HV1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		HV	Air Separating Trap	H-2-68335	16	0
--I-101	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-103	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-107	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-108	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-110	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-112	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-114	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-118	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-119	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-121	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	23	0
--I-123	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		I	Interlock	H-2-68335	25	0
--I-124	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		I	Interlock	H-2-68335	25	0
--I-204	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	12	0
--I-205	AZ-101	Tank AZ-101	HVAC Primary	N/030		I	Interlock	H-2-68335	12	0
--I-300	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		I	Programmable Logic Controller Field Mounted	H-2-68335	16	0
--I-301	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		I	Interlock	H-2-68335	16	0
--I-302	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		I	Programmable Logic Controller Field Mounted	H-2-68335	16	0
--I-303	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		I	Interlock	H-2-68335	16	0
--I-304	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		I	Programmable Logic Controller Field Mounted	H-2-68335	16	0
--I-408	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		I	Programmable Logic Controller Field Mounted	H-2-68335	14	0
--I-409	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		I	Interlock	H-2-68335	14	0

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Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--I-410	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		I	Programmable Logic Controller Field Mounted	H-2-68335	14	0
--I-418	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		I	Interlock	H-2-68335	14	0
--II-AZ1EWP-1A	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		II	Current Indicator	H-2-68335	14	0
--II-AZ1EWP-1B	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		II	Current Indicator	H-2-68335	14	0
--II-AZ1K451-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		II	Current Indicator	H-2-68335	12	0
--II-AZCWP-1A	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		II	Current Indicator	H-2-68335	16	0
--II-AZCWP-1B	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		II	Current Indicator	H-2-68335	16	0
--II-AZK15-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		II	Current Indicator	H-2-68335	23	0
--II-AZK15-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		II	Current Indicator	H-2-68335	23	0
--IT-AZ101EWP-1A	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		IT	Current Equipment	H-2-68335	14	0
--IT-AZ101EWP-1B	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		IT	Current Equipment	H-2-68335	14	0
--IT-AZ101K405-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		IT	Current Transmitter	H-2-68335	12	0
--IT-AZCWP-1A	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		IT	Current Equipment	H-2-68335	16	0
--IT-AZCWP-1B	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		IT	Current Transmitter	H-2-68335	16	0
--IT-AZK105-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		IT	Current Transmitter	H-2-68335	23	0
--IT-AZK105-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		IT	Current Transmitter	H-2-68335	23	0
--K-1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K-11-1	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K-R-K1-PS-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--K-R-K1-PS-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--K-R-K1-PS-1-3	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--K-R-K1-PS-1-4	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-11-2	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-12-1	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-12-2	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2

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Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--K1-12-3	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-12-4	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-13-1	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-13-2	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-2-1	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-3-2	AZ Farm	AZ Farm	HVAC Annulus	E		PLN	Exhaust Plenum	H-2-92964	1	2
--K1-5-1	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-5-2	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-5-3	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-5-4	AZ Farm	AZ Farm	HVAC Annulus	E		FLT	Filter	H-2-92964	1	2
--K1-6-1	AZ Farm	AZ Farm	HVAC Annulus	E		HTR	Filter	H-2-92964	1	2
--K1-6-2	AZ Farm	AZ Farm	HVAC Annulus	E		HTR	Filter	H-2-92964	1	2
--K1-9-1	AZ Farm	AZ Annulus Instrument Enclosure	HVAC Annulus	E		FLT	Enclosure Fan	H-2-92964	1	2
--K1-FV-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		FV	Manual Butterfly Valve	H-2-92964	1	2
--K1-FV-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		FV	Manual Butterfly Valve	H-2-92964	1	2
--K1-FV-1-3	AZ Farm	AZ Farm	HVAC Annulus	E		FV	Manual Butterfly Valve	H-2-92964	1	2
--K1-FV-1-4	AZ Farm	AZ Farm	HVAC Annulus	E		FV	Manual Butterfly Valve	H-2-92964	1	2
--K1-FV-2-1	AZ Farm	AZ Farm	HVAC Annulus	E		FV	Manual Butterfly Valve	H-2-92964	1	2
--K1-FV-2-2	AZ Farm	AZ Farm	HVAC Annulus	E		FV	Manual Butterfly Valve	H-2-92964	1	2
--KFS-101-AZ-1	AZ-101	Control Bldg 241-A-271	Instrumentation	E		KFS	Indicator	H-2-68335	6	6
--LAH-AZPCSP-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LAH	Level Alarm High	H-2-68335	17	0
--LAL-AZ1EWTK-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		LALL	Level Alarm Low	H-2-68335	14	0
--LAL-AZCWTK-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		LAL	Level Alarm Low	H-2-68335	16	0
--LAL-AZPCSP-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LAL	Level Alarm Low	H-2-68335	17	0
--LALL-AZ1EWT-1	AZ Farm	AZ Farm	Recird Cond Cooling	N/030		LALL	Level Alarm Low Low	H-2-68335	14	0
--LDA-101-19	AZ-101	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detected Alarm	H-2-68335	6	6
--LDA-101-1A	AZ-101	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detector Alarm	H-2-68335	6	6
--LDA-101-1B	AZ-101	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detected Alarm	H-2-68335	6	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--LDA-101-20	AZ-101	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detected Alarm	H-2-68335	6	6
--LDA-101-23	AZ-101	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detected Alarm	H-2-68335	6	6
--LDA-101-24A	AZ-101	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detected Alarm	H-2-68335	6	6
--LDA-151-1	AZ Farm	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detector Alarm	H-2-68335	6	6
--LDA-4507/4508	AZ-101	Control Bldg 241-A-271	Monitoring	E		LDA	Leak Detector Alarm	H-2-68335	6	6
--LDA-702-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	17	0
--LDA-702-2A	AZ Farm	AZ Farm Primary Vent Filter Room A	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	17	0
--LDA-702-2B	AZ Farm	AZ Farm Primary Vent Filter Room B	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	17	0
--LDA-AZ1200-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	12	0
--LDA-AZ1202-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	12	0
--LDA-AZ2102-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	22	0
--LDA-AZ401-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	12	0
--LDA-AZ503-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	17	0
--LDA-V0608-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDA	Leak Detector Alarm	H-2-68335	22	0
--LDE	AZ-101	AZ-01A VALVE PIT	Monitoring	N/521		LDE	Leak Detector Element (Encasement)	D180A	1	0
--LDE-	AZ-101	AZ-01A VALVE PIT	Monitoring	N/521		LDE	Leak Detector Element	D180A	1	0
--LDE-101-10A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-10B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-10C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-11A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-11B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-11C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-12A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-12B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-12C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-13A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-13B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-13C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-14A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-14B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-14C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-15A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-15B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-15C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-16A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-16B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-16C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-17A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-17B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-17C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-19	AZ-101	Sluice Pit 241-AZ-01C	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-1A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-1B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-1C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-20	AZ-101	Pump Pit 241-AZ-01A	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-23	AZ-101	Leak Detection Pit 241-AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-24	AZ-101	Annulus Pump Pit 241-AZ-01F	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-2A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-2B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--LDE-101-2C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-3A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-3B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-3C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-4A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-4B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-4C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-5A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-5B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-5C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-6A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-6B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-6C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-7A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-7B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-7C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-8A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-8B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-8C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-9A	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-9B	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101-9C	AZ-101	Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-101/102-23	AZ Farm	Encasement Leak Detection Pit 101/102	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-15	AZ-101	Annulus Pump Pit 241-AZ-01F	Monitoring	E		LDE	Leak Detection Element	H-2-68335	6	6
--LDE-4507	AZ-101	Outside Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-4508	AZ-101	Outside Tank AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	7	9
--LDE-6	AZ-101	Leak Detection Pit 241-AZ-101	Monitoring	E		LDE	Leak Detection Element	H-2-68335	6	6
--LDE-AZ1200-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	12	0
--LDE-AZ1202-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	12	0
--LDE-AZ2102-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	22	0
--LDE-AZ401-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	12	0
--LDE-AZ503-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	17	0
--LDE-AZ702-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	17	0
--LDE-AZ702-2A	AZ Farm	AZ Farm Primary Vent Filter Room A	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	17	0
--LDE-V0608-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDE	Leak Detector Element	H-2-68335	22	0
--LDI-101-1	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		LDI	Leak Detection Indicator	H-2-68335	6	6
--LDIS-AZ401-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDIS	Leak Detector Indicator Switch	H-2-68335	12	0
--LDK-	AZ-101	AZ-01A VALVE PIT	Monitoring	N/521		LDK	Leak Detector Relay	D180A	1	0
--LDK-101-1	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		LDK	Leak Detector Relay	H-2-68335	6	6
--LDK-101-18B	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		LDK	Leak Detected Relay	H-2-68335	6	6
--LDK-101-19B	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		LDK	Leak Detected Relay	H-2-68335	6	6
--LDK-101-20B	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		LDK	Leak Detected Relay	H-2-68335	6	6
--LDK-151-1	AZ Farm	Instrument Bldg 241-AZ-801A	Monitoring	E		LDK	Leak Detector Relay	H-2-68335	6	6
--LDY-AZ1200-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	12	0
--LDY-AZ1202-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	12	0
--LDY-AZ2102-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	22	0
--LDY-AZ503-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	17	0
--LDY-AZ702-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	17	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--LDY-AZ702-2A	AZ Farm	AZ Farm Primary Vent Filter Room A	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	17	0
--LDY-AZ702-2B	AZ Farm	AZ Farm Primary Vent Filter Room B	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	17	0
--LDY-V0608-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		LDY	Leak Detector Signal Relay	H-2-68335	22	0
--LE-AZPCSP-1	AZ Farm	AZ Farm	HVAC Primary	N/030		LE	Level Element	H-2-68335	17	0
--LG-AZK104-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		LG	Level Glass	H-2-68335	23	0
--LG-AZK104-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		LG	Level Glass	H-2-68335	23	0
--LG-AZK104-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		LG	Level Glass	H-2-68335	23	0
--LG-AZK104-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		LG	Level Glass	H-2-68335	23	0
--LI-AZ101EWTK-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		LI	Level Indicator	H-2-68335	14	0
--LI-AZCWTK-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		LI	Level Indicator	H-2-68335	16	0
--LIT-	AZ-101	Tank AZ-101	Monitoring	E		LIT	Level Indicating Transmitter	D180B	1	0
--LSL-AZ101EWT-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		LSL	Level Switch Low	H-2-68335	14	0
--LSL-AZ101EWTK-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		LSL	Level Switch Low	H-2-68335	14	0
--LSL-AZCWTK-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		LSL	Level Switch Low	H-2-68335	16	0
--LY-AZPCSP-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		LY	Level Equipment	H-2-68335	17	0
--LY-AZPCSP-1B	AZ Farm	AZ Farm	HVAC Primary	N/030		LY	Level Equipment	H-2-68335	17	0
--MCC #1 AZ Annulus Vent Panel	AZ Farm	AZ Farm	HVAC Annulus	E		ENCL	Enclosure	H-2-92964	1	2
--MCC(241-AZ-01A)	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		MCC	Motor Control Center	H-2-68335	6	6
--MK-8501	AZ Farm	AZ Farm	HVAC Annulus	E		MK	Louver	H-2-92964	1	2
--MK-8502	AZ Farm	AZ Farm	HVAC Annulus	E		MK	Louver	H-2-92964	1	2
--MK-AZ101K1-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		MK	Motor Operated Globe Valve	H-2-68335	21	0
--MK-AZ101K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Motor Operated Butterfly Valve	H-2-68335	21	0
--MK-AZ101K1-2A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Valve	H-2-68335	21	0
--MK-AZ101K1-2A2	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Valve	H-2-68335	21	0
--MK-AZ101K1-2A3	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Valve	H-2-68335	21	0
--MK-AZ101K4-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	12	0
--MK-AZ101K4-3	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	12	0
--MK-AZ101K4-4	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	12	0
--MK-AZ102K1-2A3	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Motor Operated Damper w/Limit Switches/Manual Handwheel	H-2-68335	21	0
--MK-AZ105-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZ105-1A3	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Back Draft Damper	H-2-68335	23	0
--MK-AZ105-1B3	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Back Draft Damper	H-2-68335	23	0
--MK-AZ108-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		MK	Butterfly Valve	H-2-68335	22	0
--MK-AZK1-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Motor Operated Damper w/Limit Switches/Manual Handwheel	H-2-68335	23	0
--MK-AZK1-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Motor Operated Damper w/Limit Switches/Manual Handwheel	H-2-68335	23	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--MK-AZK1-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Motor Operated Damper w/Limit Switches/Manual Handwheel	H-2-68335	23	0
--MK-AZK1-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZK1-3A	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZK1-3B	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZK105-1A1	AZ Farm	AZ Farm	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZK105-1A2	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZK105-1B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZK105-1B2	AZ-101	Tank AZ-101	HVAC Primary	N/030		MK	Butterfly Damper Valve w/Limit Switch	H-2-68335	23	0
--MK-AZK109-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		MK	Butterfly Valve	H-2-68335	22	0
--MS	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		MS	Electric Motor Starter	H-2-68335	14	0
--MS	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		MS	Electric Motor Starter	H-2-68335	14	0
--MS	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		MS	Electric Motor Starter	H-2-68335	16	0
--MS	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		MS	Motor Starter (Electric)	H-2-68335	16	0
--MS-101-2	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		MS	Manual Switch	H-2-68335	6	6
--MS-101-AZ-1	AZ-101	Control Bldg 241-A-271	Instrumentation	E		MS	Manual Switch	H-2-68335	6	6
--MV-AZ101EWT-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		MV	Motor Operated 2-Way Ball Valve	H-2-68335	14	0
--MV-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		MOV	Motor Operated Gate Valve	H-2-68335	25	0
--MV-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		MOV	Motor Operated Gate Valve	H-2-68335	25	0
--MV-AZK1-3	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		MOV	Motor Operated Gate Valve	H-2-68335	25	0
--MV-AZK1-4	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		MOV	Motor Operated Gate Valve	H-2-68335	25	0
--MV-AZK1-5	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		MOV	Motor Operated Gate Valve	H-2-68335	25	0
--PAD-101-1	AZ-101	Instrument Bldg 241-AZ-801A	Instrumentation	E		PAD	Alarm	H-2-68335	6	6
--PCV-AZ101-WF-2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		PCV	Pressure Control Valve	H-2-68335	14	0
--PCV-AZ101EWS-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		PCV	Pressure Control Valve	H-2-68335	14	0
--PCV-AZ101EWTK-1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		PCV	Pressure Control Valve	H-2-68335	14	0
--PCV-AZ101K1-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		PCV	Pressure Control Valve	H-2-68335	21	0
--PCV-AZ101K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		PCV	Pressure Control Valve	H-2-68335	21	0
--PCV-AZ101PA-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PCV	Pressure Control Valve	H-2-68335	12	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--PCV-AZ101PA-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		PCV	Pressure Control Valve	H-2-68335	12	0
--PCV-AZCWS-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		PCV	Pressure Control Valve	H-2-68335	16	0
--PCV-AZCWTK-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		PCV	Pressure Control Valve	H-2-68335	16	0
--PCV-AZK111-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		PCV	Pressure Control Valve	H-2-68335	25	0
--PCV-AZK111-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		PCV	Pressure Control Valve	H-2-68335	25	0
--PCV-AZPC-1	AZ Farm	AZ Farm	HVAC Primary	N/030		PCV	Pressure Control Valve	H-2-68335	17	0
--PCV-AZRW-1	AZ Farm	AZ Farm	Raw Water	N/030		PCV	Pressure Control Valve	H-2-68335	20	0
--PDAH-AZ1K1-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		PDAH	Pressure Differential Alarm High	H-2-68335	21	0
--PDAH-AZ1WF-2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		PDAH	Pressure Differential Alarm High	H-2-68335	14	0
--PDI-AZ101K103-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	21	0
--PDI-AZ101K104-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	21	0
--PDI-AZ1K45-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	12	0
--PDI-AZ1K48-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	12	0
--PDI-AZK110-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	23	0
--PDI-AZK110-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	23	0
--PDI-AZK14-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	23	0
--PDI-AZK14-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	23	0
--PDI-AZK14-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	23	0
--PDI-AZK14-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	23	0
--PDI-AZK18-1	AZ Farm	AZ Farm	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	22	0
--PDI-AZK19-1	AZ Farm	AZ Farm	HVAC Primary	N/030		PDI	Pressure Differential Indicator	H-2-68335	22	0
--PDI-AZRWF-1	AZ Farm	AZ Farm	Raw Water	N/030		PDI	Pressure Differential Indicator	H-2-68335	20	0
--PDIS-AZ101-WF-2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		PDIS	Pressure Differential Alarm High	H-2-68335	14	0
--PDIT-AZRWF-1	AZ Farm	AZ Farm	Raw Water	N/030		PDIT	Pressure Differential Indicating Transmitter	H-2-68335	20	0
--PDS-AZ101K1-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		PDS	Pressure Differential Switch	H-2-68335	21	0
--PDT-AZ101K405-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	12	0
--PDT-AZ101K408-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	12	0
--PDT-AZK104-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	23	0
--PDT-AZK104-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	23	0
--PDT-AZK104-2A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	23	0
--PDT-AZK104-2B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	23	0
--PDT-AZK108-1	AZ Farm	AZ Farm	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	22	0
--PDT-AZK109-1	AZ Farm	AZ Farm	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	22	0
--PDT-AZK110-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	23	0
--PDT-AZK110-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PDT	Pressure Differential Transmitter	H-2-68335	23	0
--PE	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		PE	Pressure Element	D180B	1	0
--PI-720	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E		PI	Pressure Indicator	H-2-68335	5	6
--PI-801-1	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E		PI	Pressure Indicator	H-2-68335	5	6
--PI-AZ101EWP-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		PI	Pressure Indicator	H-2-68335	14	0

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Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--PI-AZ101EWP-1A2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		PI	Pressure Indicator	H-2-68335	14	0
--PI-AZ101EWP-1B1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		PI	Pressure Indicator	H-2-68335	14	0
--PI-AZ101EWP-1B2	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		PI	Pressure Indicator	H-2-68335	14	0
--PI-AZ101K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PI	Pressure Indicator	H-2-68335	21	0
--PI-AZ101PA-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PIC	Pressure Indicating Controller	H-2-68335	12	0
--PI-AZ101PA-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		PIC	Pressure Indicating Controller	H-2-68335	12	0
--PI-AZ101WS-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		PI	Pressure Indicator	H-2-68335	14	0
--PI-AZ101WS-2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		PI	Pressure Indicator	H-2-68335	14	0
--PI-AZ1K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		PIC	Pressure Indicating Controller	H-2-68335	21	0
--PI-AZCWP-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		PI	Pressure Indicator	H-2-68335	16	0
--PI-AZCWP-1A2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		PI	Pressure Indicator	H-2-68335	16	0
--PI-AZCWP-1B1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		PI	Pressure Indicator	H-2-68335	16	0
--PI-AZCWP-1B2	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		PI	Pressure Indicator	H-2-68335	16	0
--PI-AZK1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		PI	Pressure Indicator	H-2-68335	25	0
--PI-AZRW-1	AZ Farm	AZ Farm	Raw Water	N/030		PI	Pressure Indicator	H-2-68335	20	0
--PI-AZRW-1A	AZ Farm	AZ Farm	Raw Water	N/030		PI	Pressure Indicator	H-2-68335	20	0
--PI-AZRW-1B	AZ Farm	AZ Farm	Raw Water	N/030		PI	Pressure Indicator	H-2-68335	20	0
--PI-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-101-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-102-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-2-1	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-3-3	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-3-4	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-4-1	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-4-2	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-K1-4-3	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2

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Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--PI-K1-4-4	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PI-RS-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		PI	Pressure Indicator	H-2-92964	1	2
--PIC-AZ1K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PIC	Pressure Indicating Controller	H-2-68335	21	0
--PIC-AZK1-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PIC	Pressure Indicating Controller	H-2-68335	23	0
--PIC-AZK1-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PIC	Pressure Indicating Controller	H-2-68335	23	0
--PIT-AZK1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		PIT	Pressure Indicating Transmitter	H-2-68335	25	0
--PRV-801-A-1	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E		PRV	Pressure Relief Valve	H-2-68335	5	6
--PS-AZK111-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		PS	Pressure Switch	H-2-68335	25	0
--PS-AZK111-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		PS	Pressure Switch	H-2-68335	25	0
--PS-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		PS	Pressure Switch	H-2-92964	1	2
--PS-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		PS	Pressure Switch	H-2-92964	1	2
--PS-K1-1-3	AZ Farm	AZ Farm	HVAC Annulus	E		PS	Pressure Switch	H-2-92964	1	2
--PS-K1-1-4	AZ Farm	AZ Farm	HVAC Annulus	E		PS	Pressure Switch	H-2-92964	1	2
--PSV-AZ101K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PSV	Pressure Safety Valve	H-2-68335	21	0
--PT-AZ101K1-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		PT	Pressure Transmitter	H-2-68335	21	0
--PT-AZ101K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		PT	Pressure Transmitter	H-2-68335	21	0
--PT-AZK1-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		PT	Pressure Transmitter	H-2-68335	23	0
--PT-AZK1-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		PT	Pressure Transmitter	H-2-68335	23	0
--PT-AZRW-1	AZ Farm	AZ Farm	Raw Water	N/030		PT	Pressure Transmitter	H-2-68335	20	0
--QQ-CAM-101-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		QQ	Timer	H-2-92964	1	2
--QQ-CAM-102-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		QQ	Timer	H-2-92964	1	2
--QQ-RS-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		QQ	Timer	H-2-92964	1	2
--RA-101-1	AZ-101	Control Bldg 241-A-271	Instrumentation	E		RA	Radiation Alarm	H-2-68335	6	6
--RA-101-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		RA	Radiation Alarm	H-2-92964	1	2
--RA-102-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		RA	Radiation Alarm	H-2-92964	1	2
--RA-AZ-161	AZ-101	Control Bldg 241-A-271	Monitoring	E		RA	Radiation Alarm	H-2-68335	5	6
--RA-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RA	Radiation Alarm	H-2-68335	25	0
--RA-AZK1-1A	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RA	Radiation Alarm	H-2-68335	25	0

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--RA-AZK1-1B	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RAX	Radiation Alarm Failure	H-2-68335	25	0
--RAH-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RAH	Radiation Alarm High	H-2-68335	25	0
--RAX-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RAX	Radiation Alarm Failure	H-2-68335	25	0
--RE-101-1	AZ-101	Leak Detection Pit 241-AZ-101	Monitoring	E		RE	Radiation Sensing Element	H-2-68335	6	6
--RE-AZ-161	AZ-101	Check Valve Caisson 241-AZ-161	Monitoring	E		RE	Radiation Sensing Element	H-2-68335	5	6
--RE-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RE	Radiation Sensing Element	H-2-68335	25	0
--RI-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RI	Radiation Indicator	H-2-68335	25	0
--RIAS-AZ-161	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		RIAS	Radiation Alarm Indicating Switch	H-2-68335	5	6
--RIAS-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RIAS	Radiation Alarm Indicating Switch	H-2-68335	25	0
--RR-101-AZ	AZ-101	AZ-101 Cam Unit Enclosure	HVAC Annulus	E		RR	Radiation Recorder	H-2-92964	1	2
--RR-102-AZ	AZ Farm	AZ Farm	HVAC Annulus	E		RR	Radiation Recorder	H-2-92964	1	2
--RTD-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		RTD	Resistance Temperature Detector	H-2-92964	1	2
--RTD-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		RTD	Resistance Temperature Detector	H-2-92964	1	2
--RTD-K1-1-3	AZ Farm	AZ Farm	HVAC Annulus	E		RTD	Resistance Temperature Detector	H-2-92964	1	2
--RTD-K1-1-4	AZ Farm	AZ Farm	HVAC Annulus	E		RTD	Resistance Temperature Detector	H-2-92964	1	2
--RV-AZ101EWS-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		RV	Relief Valve	H-2-68335	12	0
--RY-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		RY	Radiation Equipment	H-2-68335	25	0
--SCR-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		SCR	Silicon Controlled Temperature Detector	H-2-92964	1	2
--SCR-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		SCR	Silicon Controlled Rectifier Controller	H-2-92964	1	2
--SE-AZK105-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		SE	Speed/Velocity Element	H-2-68335	23	0
--SE-AZK105-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		SE	Speed/Velocity Element	H-2-68335	23	0
--SI-AZK15-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		SI	Speed/Velocity Indicator	H-2-68335	23	0
--SI-AZK15-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		SI	Speed/Velocity Indicator	H-2-68335	23	0
--SIT-AZK105-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		SIT	Speed/Velocity Indicating Transmitter	H-2-68335	23	0
--SIT-AZK105-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		SIT	Speed/Velocity Indicating Transmitter	H-2-68335	23	0
--SN-631-M9	AZ-101	AZ-01A VALVE PIT	Transfer	N/314		PIPE	Tank Discharge Pipe Segment	D180B	1	0
--SRV-801-A-1	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E		SRV	Safety Relief Valve	H-2-68335	5	6

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Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--SS-101-C	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		SS	Selector Switch	H-2-68335	6	6
--SS-101A	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		SS	Selector Switch	H-2-68335	6	6
--SS-101B	AZ-101	Instrument Bldg 241-AZ-801A	Monitoring	E		SS	Selector Switch	H-2-68335	6	6
--STR1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		STR	Strainer	H-2-68335	14	0
--TA-AZ1K12-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		TA	Temperature Alarm	H-2-68335	21	0
--TC-AZ101EWT-1A2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		TC	Temperature Controller	H-2-68335	14	0
--TC-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		TC	Temperature Controller	H-2-92964	1	2
--TDIC-AZ101K102-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		TDIC	Temperature Differential Indicating Controller	H-2-68335	21	0
--TDIC-AZK12-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TDIC	Temperature Differential Indicating Controller	H-2-68335	23	0
--TDIC-AZK12-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TDIC	Temperature Differential Indicating Controller	H-2-68335	23	0
--TDK-101-AZ-1	AZ-101	Control Bldg 241-A-271	Instrumentation	E		TDK	Temperature Differential Relay	H-2-68335	6	6
--TDK-101-AZ-2	AZ-101	Control Bldg 241-A-271	Instrumentation	E		TDK	Temperature Differential Relay	H-2-68335	6	6
--TE-101-AZ-1	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-10	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-100	AZ-101	Tank AZ-101, Riser 14F	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-101	AZ-101	Tank AZ-101, Riser 14G	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-102	AZ-101	Tank AZ-101, Riser 15C	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-103	AZ-101	Tank AZ-101, Riser 15C	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-104	AZ-101	Tank AZ-101, Riser 15C	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-11	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-12	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-13	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-14	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-15	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-16	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-17	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-18	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-19	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-2	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-20	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-21	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-22	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-23	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-24	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-25	AZ-101	AZ-101 Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-26	AZ-101	AZ-101 Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-27	AZ-101	Leak Detection Pit 241-AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-28	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-29	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-3	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-30	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-31	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-32	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--TE-101-AZ-33	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-34	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-35	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-36	AZ-101	AZ-101 Concrete Foundation	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-37	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-38	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-39	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-4	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-40	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-41	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-42	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-43	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-44	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-45	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-46	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-47	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-48	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-49	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-5	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-50	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-51	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-52	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-53	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-54	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-55	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-56	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-57	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-58	AZ-101	Tank AZ-101	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-6	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-65	AZ-101	Tank AZ-101, Riser 15B	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-66	AZ-101	Tank AZ-101, Riser 15B	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-67	AZ-101	Tank AZ-101, Riser 15B	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-68	AZ-101	Tank AZ-101, Riser 15I	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-69	AZ-101	Tank AZ-101, Riser 15I	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-7	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-70	AZ-101	Tank AZ-101, Riser 15I	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-71	AZ-101	Tank AZ-101, Riser 14B	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-72	AZ-101	Tank AZ-101, Riser 14C	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-73	AZ-101	Tank AZ-101, Riser 14A	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-74	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-75	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-76	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-77	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-78	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-79	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-8	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-80	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-81	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-82	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-83	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-84	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-85	AZ-101	Tank AZ-101, Concrete Dome	Monitoring	E		TE	Temperature Element	H-2-68335	7	9

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--TE-101-AZ-86	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-87	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-88	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-89	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-9	AZ-101	AZ-101 Insulating Concrete	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-90	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-91	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-92	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-93	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-94	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-95	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-96	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-97	AZ-101	Tank AZ-101, outside Annulus	Monitoring	E		TE	Temperature Element	H-2-68335	7	9
--TE-101-AZ-98	AZ-101	Tank AZ-101, Riser 14D	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-101-AZ-99	AZ-101	Tank AZ-101, Riser 14E	Monitoring	E		TE	Temperature Element	H-2-68335	6	6
--TE-AZ101EWR-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	12	0
--TE-AZ101EWS-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	12	0
--TE-AZ101EWT-1A1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		TE	Temperature Element	H-2-68335	14	0
--TE-AZ101EWT-1A2	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		TE	Temperature Element	H-2-68335	14	0
--TE-AZ101K408-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	12	0
--TE-AZ101K408-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	12	0
--TE-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		TE	Temperature Element	H-2-68335	16	0
--TE-AZCWS-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		TE	Temperature Element	H-2-68335	16	0
--TE-AZK102-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	23	0
--TE-AZK102-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	23	0
--TE-AZK102-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	23	0
--TE-AZK102-1B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	23	0
--TE-AZK102-3A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	23	0
--TE-AZK102-3B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	23	0
--TE-AZK108-1A1	AZ Farm	AZ Farm	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	22	0
--TE-AZK108-1A2	AZ Farm	AZ Farm	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	22	0
--TE-AZK108-1B1	AZ Farm	AZ Farm	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	22	0
--TE-AZK108-1B2	AZ Farm	AZ Farm	HVAC Primary	N/030		TE	Temperature Element	H-2-68335	22	0
--TE-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		TE	Temperature Element	H-2-92964	1	2
--TE-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		TE	Temperature Element	H-2-92964	1	2
--TE-K1-1-3	AZ Farm	AZ Farm	HVAC Annulus	E		TE	Temperature Element	H-2-92964	1	2
--TE-K1-1-4	AZ Farm	AZ Farm	HVAC Annulus	E		TE	Temperature Element	H-2-92964	1	2
--TI-AZ1EWR-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	12	0
--TI-AZ1EWS-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	12	0
--TI-AZ1K48-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	12	0
--TI-AZ1K48-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	12	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--TI-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		TI	Temperature Indicator	H-2-68335	16	0
--TI-AZCWS-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		IT	Temperature Indicator	H-2-68335	16	0
--TI-AZK1-3	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	25	0
--TI-AZK12-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	23	0
--TI-AZK12-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	23	0
--TI-AZK12-3A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	23	0
--TI-AZK12-3B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	23	0
--TI-AZK18-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	22	0
--TI-AZK18-1B	AZ Farm	AZ Farm	HVAC Primary	N/030		TI	Temperature Indicator	H-2-68335	22	0
--TI-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		TI	Temperature Indicator	H-2-92964	1	2
--TI-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		TI	Temperature Indicator	H-2-92964	1	2
--TI-K1-1-3	AZ Farm	AZ Farm	HVAC Annulus	E		TI	Temperature Indicator	H-2-92964	1	2
--TI-K1-1-4	AZ Farm	AZ Farm	HVAC Annulus	E		TI	Temperature Indicator	H-2-92964	1	2
--TI-K1-1-5	AZ Farm	AZ Farm	HVAC Annulus	E		TI	Temperature Indicator	H-2-92964	1	2
--TIC-AZK102-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TIC	Temperature Indicating Controller	H-2-68335	23	0
--TIC-AZK102-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TIC	Temperature Indicating Controller	H-2-68335	23	0
--TS-AZ101EWT-1A1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		TS	Temperature Switch	H-2-68335	14	0
--TS-HFT-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		TC	High Filter Temperature Controller	H-2-92964	1	2
--TS-HFT-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		TC	High Filter Temperature Controller	H-2-92964	1	2
--TS-HST-K1-1-1	AZ Farm	AZ Farm	HVAC Annulus	E		TC	High Sheath Temperature Controller	H-2-92964	1	2
--TS-HST-K1-1-2	AZ Farm	AZ Farm	HVAC Annulus	E		TC	High Sheath Temperature Controller	H-2-92964	1	2
--TT-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		TT	Temperature Transmitter	H-2-68335	16	0
--TT-AZCWS-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		TT	Temperature Transmitter	H-2-68335	16	0
--TT-AZK1-3	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		TT	Temperature Transmitter	H-2-68335	25	0
--TT-AZK102-1A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TT	Temperature Transmitter	H-2-68335	23	0
--TT-AZK102-1B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TT	Temperature Transmitter	H-2-68335	23	0
--TT-AZK102-3A	AZ-101	Tank AZ-101	HVAC Primary	N/030		TT	Temperature Transmitter	H-2-68335	23	0
--TT-AZK102-3B	AZ-101	Tank AZ-101	HVAC Primary	N/030		TT	Temperature Transmitter	H-2-68335	23	0
--TT-AZK108-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		TT	Temperature Transmitter	H-2-68335	22	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--TT-AZK108-1B	AZ Farm	AZ Farm	HVAC Primary	N/030		TT	Temperature Transmitter	H-2-68335	22	0
--TY-AZK1-3	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		TY	Temperature Equipment	H-2-68335	25	0
--U12	AZ-101	AZ-01A VALVE PIT	Transfer	N/314		NOZ	AZ-01A Pump Pit Jumper Connection	D180B	1	0
--U12(A,B,C)	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		JMP	AZ-01A Valve Pit Jumper Assembly	D180B	1	0
--U6	AZ-101	AZ-01A VALVE PIT	Dilution/Flush	N/521		NOZ	AZ-01A Pump Pit Jumper Connection	D180B	1	0
--U6(2,C)	AZ-101	AZ-01A VALVE PIT	Dilution/Flush	N/521		JMP	AZ-01A Valve Pit Jumper Assembly	D180B	1	0
--UC-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		UC	Multivariable Controller	H-2-68335	25	0
--UC-AZK1-2	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		UC	Multivariable Controller	H-2-68335	25	0
--UE	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		UE	Multivariable Element	D180B	1	0
--UE-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		UE	Multivariable Element	H-2-68335	25	0
--UIC-AZ101EWT-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		CP	Fluid Cooler Control Panel	H-2-68335	14	0
--UIC-AZCWR-1	AZ Farm	Air Cooled Chiller AZ-CW-R-1	Vent Cond Cooling System	N/030		CP	Air Cooled Chiller Control Panel	H-2-68335	16	0
--VALVE 1 (TEMP)	AZ-101	Tank AZ-101	Transfer	N/521		V	3-Way Ball Valve (Transfer line)	D180B	1	0
--VALVE 10 (TEMP)	AZ-101	Tank AZ-101	Service Water			V	Check Valve (Mixer Pump WST-P-101B Service Water)	D180B	1	0
--VALVE 2 (TEMP)	AZ-101	Tank AZ-101	Transfer	N/521		V	3-Way Ball Valve (Transfer line)	D180B	1	0
--VALVE 3 (TEMP)	AZ-101	Tank AZ-101	Transfer	N/521		V	3-Way Ball Valve (Transfer line)	D180B	1	0
--VALVE 4 (TEMP)	AZ-101	Tank AZ-101	Dilution/Flush	N/521		V	3-Way Ball Valve (Dilution line)	D180B	1	0
--VALVE 5 (TEMP)	AZ-101	Tank AZ-101	Dilution/Flush	N/521		V	2-Way Ball Valve (Dilution line)	D180B	1	0
--VALVE 6 (TEMP)	AZ-101	Tank AZ-101	Nitrogen	N/521		V	Check Valve (Nitrogen line)	D180B	1	0
--VALVE 7 (TEMP)	AZ-101	Tank AZ-101	Service Water	N/521		V	Check Valve (Flush connection)	D180B	1	0
--VALVE 8 (TEMP)	AZ-101	Tank AZ-101	Service Water	N/521		V	Check Valve (Flush connection)	D180B	1	0
--VALVE 9 (TEMP)	AZ-101	Tank AZ-101	Service Water			V	Check Valve (Mixer pump WST-P-AZ101A Service Water)	D180B	1	0
--WST-P-AZ101A	AZ-101	Tank AZ-101	Transfer	E		WMP	Mixer Pump	D180B	1	0
--WST-P-AZ101B	AZ-101	Tank AZ-101	Transfer	E		WMP	Mixer Pump	D180B	1	0
--WT-P-AZ101	AZ-101	AZ-01A VALVE PIT	Transfer	N/521		P	Transfer Pump	D180B	1	0
--XA-AZCWR-1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		XA	Failure Alarm	H-2-68335	16	0
--XA-AZK1-1	AZ Farm	AZ Farm K1 Primary Vent Exhaust Radiation Monitoring Ventilation Building	HVAC Primary	N/030		XA	Failure Alarm	H-2-68335	25	0
--YS-AZ1EWP-1A1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		YS	Event/State Switch	H-2-68335	14	0
--YS-AZ1EWP-1B1	AZ Farm	Tank AZ-101	Recird Cond Cooling	N/030		YS	Event/State Switch	H-2-68335	14	0
--YS-AZ1K45-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		YS	Event/State Switch	H-2-68335	12	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
--YS-AZCWP-1A1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		YS	Event/State Switch	H-2-68335	16	0
--YS-AZCWP-1B1	AZ Farm	AZ Farm	Vent Cond Cooling System	N/030		YS	Event/State Switch	H-2-68335	16	0
--YS-AZK12-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		YS	Event/State Switch	H-2-68335	23	0
--YS-AZK12-1B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		YS	Event/State Switch	H-2-68335	23	0
--YS-AZK15-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		YS	Event/State Switch	H-2-68335	23	0
--YS-AZK15-1B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		YS	Event/State Switch	H-2-68335	23	0
--ZI-AZ1K1-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		ZI	Position Indicator	H-2-68335	21	0
--ZI-AZ1K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZI	Position Indicator	H-2-68335	21	0
--ZS-AZ101EWT-1	AZ Farm	Evaporative Fluid Cooling Tower AZ101-EW-T-1	Recird Cond Cooling	N/030		ZS	Position Switch	H-2-68335	14	0
--ZS-AZ1K4-1	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	12	0
--ZS-AZ1K4-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	12	0
--ZS-AZ1K4-3	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	12	0
--ZS-AZ1K4-4	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	12	0
--ZS-AZK1-3A	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK1-3B	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK15-1A1	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK15-1A2	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK15-1A3	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK15-1B1	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK15-1B2	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK15-1B3	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	23	0
--ZS-AZK18-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	22	0
--ZS-AZK18-1B	AZ Farm	AZ Farm	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	22	0
--ZS-AZK18-1C	AZ Farm	AZ Farm	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	22	0
--ZS-AZK19-1A	AZ Farm	AZ Farm	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	22	0
--ZS-AZK19-1B	AZ Farm	AZ Farm	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	22	0
--ZS-AZK19-1C	AZ Farm	AZ Farm	HVAC Primary	N/030		ZS	Position Switch	H-2-68335	22	0
--ZT-AZ101K1-1	AZ-101	AZ101K1 Air Inlet Station	HVAC Primary	N/030		ZT	Position Transmitter	H-2-68335	21	0
--ZT-AZ101K1-2	AZ-101	Tank AZ-101	HVAC Primary	N/030		ZT	Position Transmitter	H-2-68335	21	0
-IA-801-AZ-1	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	Gate Valve	H-2-68335	5	6
-IA-801-AZ-2	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	2-Way Ball Valve	H-2-68335	5	6
-IA-801-AZ-3	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	2-Way Ball Valve	H-2-68335	5	6
-IA-801-AZ-5	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	Gate Valve	H-2-68335	5	6
-IA-801-AZ-6	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	Gate Valve	H-2-68335	5	6
-IA-801-AZ-7	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	2-Way Ball Valve	H-2-68335	5	6
-IA-801-AZ-8	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	Needle Valve	H-2-68335	5	6
-IA-LLAS-101-1	AZ-101	Tank AZ-101	Instrument Air	E	IA	LLAS	Liquid Level Alarm Switch	H-2-68335	7	9
-IA-LLE-101-1	AZ-101	Tank AZ-101	Instrument Air	E	IA	LLE	Liquid Level Element	H-2-68335	7	9
-IA-LLE-101-2	AZ-101	Tank AZ-101	Instrument Air	E	IA	LLE	Liquid Level Element	H-2-68335	7	9
-IA-LLI-101-2	AZ-101	Tank AZ-101	Instrument Air	E	IA	LLI	Liquid Level Indicator	H-2-68335	7	9
-IA-V-746	AZ Farm	Instrument Bldg 241-AZ-801A	Instrument Air	E	IA	V	2-Way Ball Valve	H-2-68335	5	6
-SW-FI-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	FI	Flow Indicator	H-2-68335	5	6
-SW-FI-751	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	FI	Flow Indicator	H-2-68335	5	6
-SW-FLT-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	FLT	Filter	H-2-68335	5	6
-SW-FLT-751	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	FLT	Filter	H-2-68335	5	6
-SW-FO-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	FO	Flow Orifice	H-2-68335	5	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
-SW-FO-751	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	FO	Flow Orifice	H-2-68335	5	6
-SW-PCV-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	PCV	Pressure Control Valve	H-2-68335	5	6
-SW-PDIS-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	PDIS	Pressure Differential Indicator Switch	H-2-68335	5	6
-SW-PI-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	PI	Pressure Indicator	H-2-68335	5	6
-SW-PI-751	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	PI	Pressure Indicator	H-2-68335	5	6
-SW-PSL-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	PSL	Pressure Switch Low	H-2-68335	5	6
-SW-PSL-751	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	PSL	Pressure Switch Low	H-2-68335	5	6
-SW-SRV-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	SRV	Safety Relief Valve	H-2-68335	5	6
-SW-STR-720	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	STR	Strainer	H-2-68335	5	6
-SW-TK-720	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	TK	Water Tank	H-2-68335	5	6
-SW-V-720	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	Gate Valve	H-2-68335	5	6
-SW-V-721	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	Gate Valve	H-2-68335	5	6
-SW-V-722	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	CKV	Check Valve	H-2-68335	5	6
-SW-V-723	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	Gate Valve	H-2-68335	5	6
-SW-V-724	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	Gate Valve	H-2-68335	5	6
-SW-V-725	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	Gate Valve	H-2-68335	5	6
-SW-V-750	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-751	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-752	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-753	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-754	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-756	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-757	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-758	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-759	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-760	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-761	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-762	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-763	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-764	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-765	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-766	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-767	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-768	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-769	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-771	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-772	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-773	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
-SW-V-790	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	Globe Valve	H-2-68335	5	6
-SW-V-791	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E	SW	V	2-Way Ball Valve	H-2-68335	5	6
AP-241-CHEMB-103-M9	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	PIPE	Dilution/Flush Discharge Pipe Segment	H-14-102304	2	0
AP-241-CHEMB-AE-121	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	AE	Analysis Element	H-14-102304	2	0
AP-241-CHEMB-AIT-121	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	AIT	Analysis Indicating Transmitter	H-14-102304	2	0
AP-241-CHEMB-FCV-131	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FCV	2-Way Flow Control Valve	H-14-102304	2	0
AP-241-CHEMB-FE-122	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FE	Flow Element	H-14-102304	2	0
AP-241-CHEMB-FE-123	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FE	Flow Element	H-14-102304	2	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AP-241-CHEMB-FE-129	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FE	Flow Element	H-14-102304	2	0
AP-241-CHEMB-FIT-122	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FIT	Flow Indicating Transmitter	H-14-102304	2	0
AP-241-CHEMB-FIT-123	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FIT	Flow Indicating Transmitter	H-14-102304	2	0
AP-241-CHEMB-FIT-129	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FIT	Flow Indicating Transmitter	H-14-102304	2	0
AP-241-CHEMB-LE-126	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	LE	Level Element	H-14-102304	2	0
AP-241-CHEMB-LI-126A	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	LI	Level Indicator	H-14-102304	2	0
AP-241-CHEMB-LS-126	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	LS	Level Switch	H-14-102304	2	0
AP-241-CHEMB-LT-126	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	LT	Level Transmitter	H-14-102304	2	0
AP-241-CHEMB-MOV-132	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	MOV	3-Way Ball Valve	H-14-102304	2	0
AP-241-CHEMB-MSTR-002	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	ENCL	Electric Motor Starter	H-14-102304	2	0
AP-241-CHEMB-MT-101	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	MT	Static Mixer	H-14-102304	2	0
AP-241-CHEMB-P-002	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	P	Diluent/Flush Pump	H-14-102304	2	0
AP-241-CHEMB-PI-106	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	PI	Pressure Indicator	H-14-102304	2	0
AP-241-CHEMB-PIT-123	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	PIT	Pressure Indicating Transmitter	H-14-102304	2	0
AP-241-CHEMB-RE-125A	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RE	Radiation Sensing Element	H-14-102304	2	0
AP-241-CHEMB-RE-125B	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RE	Radiation Sensing Element	H-14-102304	2	0
AP-241-CHEMB-RE-127A	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RE	Radiation Sensing Element	H-14-102304	2	0
AP-241-CHEMB-RE-127B	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RE	Radiation Sensing Element	H-14-102304	2	0
AP-241-CHEMB-RIAS-127A	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RIAS	Radiation Indicating Alarm Switch	H-14-102304	2	0
AP-241-CHEMB-RIAS-127B	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RIAS	Radiation Indicating Alarm Switch	H-14-102304	2	0
AP-241-CHEMB-RT-125A	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RT	Radiation Transmitter	H-14-102304	2	0
AP-241-CHEMB-RT-125B	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RT	Radiation Transmitter	H-14-102304	2	0
AP-241-CHEMB-RT-127A	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RT	Radiation Transmitter	H-14-102304	2	0
AP-241-CHEMB-RT-127B	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RT	Radiation Transmitter	H-14-102304	2	0
AP-241-CHEMB-TC-101	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	TC	Temperature Controller	H-14-102304	2	0
AP-241-CHEMB-TE-101	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	TE	Temperature Sensing Bulb	H-14-102304	2	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AP-241-CHEMB-TIT-120	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	TIT	Temperature Indicating Transmitter	H-14-102304	2	0
AP-241-CHEMB-TIT-124	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	TIT	Temperature Indicating Transmitter	H-14-102304	2	0
AP-241-CHEMB-TK-001	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	TK	Diluent/Flush Tank	H-14-102304	2	0
AP-241-CHEMB-V-106	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	V	2-Way Ball Valve	H-14-102304	2	0
AP-241-CHEMB-V-107	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	V	Globe Valve	H-14-102304	2	0
AP-241-CHEMB-V-108	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	V	Gate Valve	H-14-102304	2	0
AP-241-CHEMB-V-109	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	V	Automatic Recirc Valve	H-14-102304	2	0
AP-241-CHEMB-V-110	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	V	2-Way Ball Valve	H-14-102304	2	0
AP-241-CHEMB-V-111	AP Farm	AP Farm	Dilution/Flush	N/211	CHEMB	V	2-Way Ball Valve	H-14-102304	2	0
AP-241-CHEMB-V-112	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	V	2-Way Ball Valve	H-14-102304	2	0
AP-241-CHEMB-V-113	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	V	2-Way Ball Valve	H-14-102304	2	0
AP-241-CHEMB-ZC-131	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	ZC	Position Controller	H-14-102304	2	0
AP-241-CHEMB-ZS-131	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	ZS	Position Switch	H-14-102304	2	0
AP-241-CHEMB-ZS-132	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	ZS	Position Switch	H-14-102304	2	0
AP-241-CHEMB-ZT-131	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	ZT	Position Transmitter	H-14-102304	2	0
AP-271-CHEMB-RAH-125	AP Farm	Rad Monitor Panel	Dilution/Flush	N/211	CHEMB	RAH	Radiation Alarm High	H-14-102304	2	0
AP-271-CHEMB-RAH-127	AP Farm	Rad Monitor Panel	Dilution/Flush	N/211	CHEMB	RAH	Radiation Alarm High	H-14-102304	2	0
AP-271-CHEMB-RXA-125	AP Farm	Rad Monitor Panel	Dilution/Flush	N/211	CHEMB	RXA	Radiation Failure Alarm	H-14-102304	2	0
AP-271-CHEMB-RXA-127	AP Farm	Rad Monitor Panel	Dilution/Flush	N/211	CHEMB	RXA	Radiation Failure Alarm	H-14-102304	2	0
AP-ICE-CHEMB-AI-121	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	N/211	CHEMB	AI	Analysis Indicator	H-14-102304	2	0
AP-ICE-CHEMB-FC-456	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	FC	Flow Controller	H-14-102304	2	0
AP-ICE-CHEMB-FI-123	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	N/211	CHEMB	FI	Flow Indicator	H-14-102304	2	0
AP-ICE-CHEMB-FI-129	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	N/211	CHEMB	FI	Flow Indicator	H-14-102304	2	0
AP-ICE-CHEMB-FI-456	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	FIC	Flow Indicating Controller	H-14-102304	2	0
AP-ICE-CHEMB-FIC-122	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	N/211	CHEMB	FIC	Flow Indicating Controller	H-14-102304	2	0
AP-ICE-CHEMB-FIC-456	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	FIC	Flow Indicating Controller	H-14-102304	2	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AP-ICE-CHEMB-FIC-XXX	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	N/211	CHEMB	FIC	Flow Indicating Controller	H-14-102304	2	0
AP-ICE-CHEMB-FQIC-122	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	FQIC	Flow Totalizer Indicator Controller	H-14-102304	2	0
AP-ICE-CHEMB-HS-130	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	HS	2-Position Hand Switch	H-14-102304	2	0
AP-ICE-CHEMB-LAHH-126	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	LAHH	Level Alarm High High	H-14-102304	2	0
AP-ICE-CHEMB-LI-126B	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	LI	Level Indicator	H-14-102304	2	0
AP-ICE-CHEMB-LI-548	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	LI	Level Indicator	H-14-102304	2	0
AP-ICE-CHEMB-LIC-430	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	LIC	Level Indicating Controller	H-14-102304	2	0
AP-ICE-CHEMB-PI-546	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	PI	Pressure Indicator	H-14-102304	2	0
AP-ICE-CHEMB-RAH-125	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	N/211	CHEMB	RAH	Radiation Alarm High	H-14-102304	2	0
AP-ICE-CHEMB-RAH-127	AP Farm	AP-271 Annex	Dilution/Flush	N/211	CHEMB	RAH	Radiation Alarm High	H-14-102304	2	0
AP-ICE-CHEMB-RIAS-125A	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	RAIS	Radiation Alarm Indicating Switch	H-14-102304	2	0
AP-ICE-CHEMB-RXA-125	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	N/211	CHEMB	RXA	Radiation Failure Alarm	H-14-102304	2	0
AP-ICE-CHEMB-RXA-127	AP Farm	AP-271 Annex	Dilution/Flush	N/211	CHEMB	RXA	Radiation Failure Alarm	H-14-102304	2	0
AP-ICE-CHEMB-SS-550	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	SS	Selector Switch (3 or more positions)	H-14-102304	2	0
AP-ICE-CHEMB-TI-120	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	TI	Temperature Indicator	H-14-102304	2	0
AP-ICE-CHEMB-TI-124	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	TI	Temperature Indicator	H-14-102304	2	0
AP-ICE-CHEMB-TIC-457	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	TIC	Temperature Indicating Controller	H-14-102304	2	0
AP-ICE-CHEMB-YA-549	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	YAL	Event/State Alarm Low	H-14-102304	2	0
AP-ICE-CHEMB-YL-130	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	YL	Event/State Light	H-14-102304	2	0
AP-ICE-CHEMB-YL-550	AP Farm	Dilution Pad	Dilution/Flush	E	CHEMB	YL	Event/State Light	H-14-102304	2	0
AP-ICE-CHEMB-ZC-132	AP Farm	Dilution Pad	Dilution/Flush	N/211	CHEMB	ZC	Position Controller	H-14-102304	2	0
AP241-POT-TC-101	AP Farm	Dilution Pad	Dilution/Flush	N/211	POT	TC	Automatic Temperature Controller	H-14-102304	2	0
AP241-POT-V-102	AP Farm	Dilution Pad Safety Shower	Dilution/Flush	N/211	POT	V	2-Way Ball Valve	H-14-102304	2	0
AP241-POT-V-103	AP Farm	Dilution Pad	Dilution/Flush	N/211	POT	V	Mixing Valve	H-14-102304	2	0
AP241-POT-V-106	AP Farm	Safety Shower	Dilution/Flush	N/211	POT	V	Gate Valve	H-14-102304	2	0
AP241-POT-V-107	AP Farm	Safety Shower	Dilution/Flush	N/211	POT	V	Gate Valve	H-14-102304	2	0
AP241-POT-V-108	AP Farm	Safety Shower	Dilution/Flush	N/211	POT	V	Gate Valve	H-14-102304	2	0
AP241-POT-V-109	AP Farm	Safety Shower	Dilution/Flush	N/211	POT	V	Gate Valve	H-14-102304	2	0
AP241-PW-102-M9	AP Farm	Dilution Pad	Dilution/Flush	N/211	PW	PIPE	Pipe Segment	H-14-102304	2	0
AP241-PW-104-M9	AP Farm	Dilution Pad	Dilution/Flush	N/211	PW	PIPE	Pipe Segment	H-14-102304	2	0

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AP241-RW-BOILER	AP Farm	Dilution Pad	Dilution/Flush	E	RW	BOILER	BOILER	H-14-102304	2	0
AP241-RW-FE-456	AP Farm	Dilution Pad	Dilution/Flush	E	RW	FE	Flow Element	H-14-102304	2	0
AP241-RW-FIT-456	AP Farm	Dilution Pad	Dilution/Flush	E	RW	FIT	Flow Indicating Transmitter	H-14-102304	2	0
AP241-RW-LCV-430	AP Farm	Dilution Pad	Dilution/Flush	E	RW	FCV	Flow Control Valve	H-14-102304	2	0
AP241-RW-TIT-457	AP Farm	Dilution Pad	Dilution/Flush	E	RW	TIT	Temperature Indicating Transmitter	H-14-102304	2	0
AP241-RW-V-441	AP Farm	Dilution Pad	Dilution/Flush	N/211	RW	V	Gate Valve (Flanged)	H-14-102304	2	0
AP241-RW-ZS-430	AP Farm	Dilution Pad	Dilution/Flush	E	RW	ZS	Position Switch	H-14-102304	2	0
AP241-RW-ZT-430	AP Farm	Dilution Pad	Dilution/Flush	E	RW	ZT	Position Transmitter	H-14-102304	2	0
AZ101--TC-1	AZ-101	Check Valve Caisson 241-AZ-161	Service Air	E		V	2-Way Ball Valve	H-2-68335	5	6
AZ101--TC-2	AZ-101	Check Valve Caisson 241-AZ-161	Service Air	E		V	2-Way Ball Valve	H-2-68335	5	6
AZ101--TC-3	AZ-101	Check Valve Caisson 241-AZ-161	Service Air	E		V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-FI-0101	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0201	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0301	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0401	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0501	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0601	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0701	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0801	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-0901	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1001	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1101	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1201	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1301	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1401	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1501	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1601	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1701	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1801	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-1901	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-2001	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-2101	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-FI-2201	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FI	Flow Indicator	H-2-68335	5	6
AZ101-SA-V-0101	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0102	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0103	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0104	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0105	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0106	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0107	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0109	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0110	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0201	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0202	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0203	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0204	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0205	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0206	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AZ101-SA-V-0207	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0209	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0210	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0301	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0302	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0303	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0304	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0305	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0306	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0307	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0309	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0310	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0401	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0403	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0404	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0404	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0405	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0407	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0409	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0410	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0501	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0502	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0503	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0504	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0505	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0506	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0507	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0509	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0510	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0601	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0602	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0603	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0604	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0605	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0606	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0606	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0607	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0609	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0610	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0701	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0702	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0703	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0704	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0705	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0706	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0707	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0709	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0710	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0801	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0802	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0803	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0804	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AZ101-SA-V-0805	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0806	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0807	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0809	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0810	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0901	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0902	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0903	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-0904	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0905	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0906	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-0907	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-0909	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-0910	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1001	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1002	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1003	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1004	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1005	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1006	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1007	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1009	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1010	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1101	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1102	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1103	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1104	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1105	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1106	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1107	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1109	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1110	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1201	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1202	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1203	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1204	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1205	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1206	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1207	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1209	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1210	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1301	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1302	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1303	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1304	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1305	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1306	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1307	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1309	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1310	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1401	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1402	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AZ101-SA-V-1403	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1404	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1405	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1406	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1407	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1409	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1410	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1501	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1502	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1503	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1504	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1505	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1506	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1507	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1509	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1510	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1601	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1602	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1603	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1604	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1605	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1606	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1607	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1609	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1610	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1701	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1702	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1703	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1704	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1705	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1706	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1707	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1709	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1710	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1801	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1802	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1803	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1804	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1805	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1806	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1807	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1809	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1810	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1901	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1902	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1903	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-1904	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1905	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1906	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-1907	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-1909	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-1910	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
AZ101-SA-V-2001	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-2002	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-2003	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-2004	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2005	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2006	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2007	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-2009	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-2010	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-2101	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-2102	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-2103	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-2104	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2105	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2106	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2107	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-2109	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-2110	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-2201	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-2202	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-2203	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ101-SA-V-2204	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2205	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2206	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	CKV	Check Valve	H-2-68335	5	6
AZ101-SA-V-2207	AZ-101	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	2-Way Ball Valve	H-2-68335	5	6
AZ101-SA-V-2209	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ101-SA-V-2210	AZ-101	Tank AZ-101	Service Air	E	SA	V	Gate Valve	H-2-68335	6	6
AZ801A-SA-FIT-101	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	FIT	Flow Indicating Transmitter	H-2-68335	5	6
AZ801A-SA-PI-101	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	PI	Pressure Indicator	H-2-68335	5	6
AZ801A-SA-PI-102	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	PI	Pressure Indicator	H-2-68335	5	6
AZ801A-SA-PI-103	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	PI	Pressure Indicator	H-2-68335	5	6
AZ801A-SA-SOV-101	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	SOV	Solenoid Operated Valve	H-2-68335	5	6
AZ801A-SA-STR-101	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	STR	Strainer	H-2-68335	5	6
AZ801A-SA-V-101	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Gate Valve	H-2-68335	5	6
AZ801A-SA-V-102	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Gate Valve	H-2-68335	5	6
AZ801A-SA-V-103	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ801A-SA-V-104	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Globe Valve	H-2-68335	5	6
AZ801A-SA-V-105	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Gate Valve	H-2-68335	5	6
AZ801A-SA-V-106	AZ Farm	Instrument Bldg 241-AZ-801A	Service Air	E	SA	V	Gate Valve	H-2-68335	5	6
AZVP-WT-SN-637	AZ Farm	AZ Farm	Transfer	N/314	WT	PIPE	Pipe Segment	ES-314E-M40	1	8
ELEC	Site	Site	Electric Power	E		ELEC	Electric Power System	UNKNOWN	UNKNOWN	UNKNOWN
HXA2	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		V	2-Way Ball Valve	ES-314E-M40	1	8
HXA3	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		V	3-Way Ball Valve	ES-314E-M40	1	8
HXA6	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		V	3-Way Ball Valve	ES-314E-M40	1	8
HXA7	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		V	2-Way Ball Valve	ES-314E-M40	1	8
Instrument Air	AZ Farm		Instrument Air		IA	CMP	Compressor	H-2-68335	5	6

Table E-6	Unique HLW RAM Components									
Complete EIN	Farm-Tank	Equipment Location	System Type	Equip Origin	System	Comp. Type	Component Description	Drawing Number	Sheet No.	Rev.
LDE-7	AZ Farm	Catch Tank 241-AZ-151	Monitoring	E		LDE	Leak Detection Element	H-2-68335	4	8
Process Air	AZ Farm		Process Air		PA	CMP	Compressor	H-2-68335	5	6
RW	Site	Site	Raw Water	E		RW	Raw Water System	Unknown	Unknown	Unknown
V-770	AZ Farm	Instrument Bldg 241-AZ-801A	Raw Water	E		V	2-Way Ball Valve	H-2-68335	5	6
X	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		NOZ	New AZ Pump Pit Jumper Connection	ES-314E-M40	1	8
Z	AZ Valve Pit	AZ Valve Pit	Transfer	ES-314E-M40		NOZ	New AZ Pump Pit Jumper Connection	ES-314E-M40	1	8

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APPENDIX F

RESULTS OF RAM ASSESSMENT OF LOW ACTIVITY WASTE FEED DELIVERY ACTIVITIES

Figures

F-1 Simulation Results for the Low Activity Waste Batch Transfer from AP-102 to BNFL

F-2 Distribution of the Probability of Exceeding Various Batch Transfer Schedule Delay Durations

F-3 Frequency of Delays of Varying Durations During Qualification Activities

F-4 Frequency of Delays of Varying Durations During Final Transfer to BNFL

Tables

F-1 Mission Profile Summary for Low Activity Waste Transfers from AN-105 to BNFL

F-2 Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD Requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay

F-3 Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD Requested by BNFL, Ranked by the Contribution of Generic Components to Expected Schedule Delay

F-4 Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD Requested by BNFL, Ranked by the Contribution of System Type to Expected Schedule Delay

F-5 Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD Requested by BNFL, Ranked by the Contribution of Mission Function to Expected Schedule Delay

F-6 Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105

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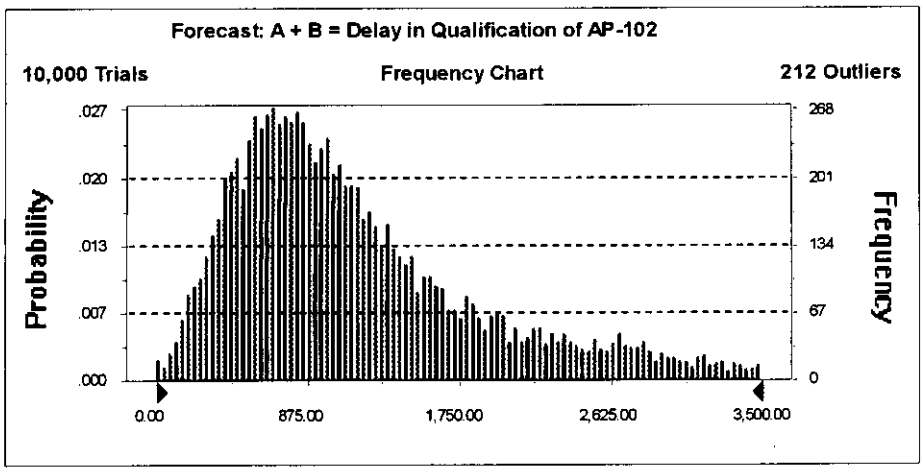
Crystal Ball Report
Simulation started on 6/7/99 at 21:59:47
Simulation stopped on 6/7/99 at 22:18:01

Forecast: A + B = Delay in Qualification of Supernate in AP-102 **Cell: B8**

Summary:
Display Range is from 0.00 to 3,500.00
Entire Range is from 0.00 to 14,108.48
After 10,000 Trials, the Std. Error of the Mean is 8.64

Statistics:	Value	Days
Trials	10000	
Mean	1,216.39	51
Median	990.77	41
Mode	---	
Standard Deviation	864.03	
Variance	746,554.69	
Skewness	2.25	
Kurtosis	15.63	
Coeff. of Variability	0.71	
Range Minimum	0.00	
Range Maximum	14,108.48	
Range Width	14,108.48	
Mean Std. Error	8.64	



Forecast: A + B = Delay in Qualification of Supernate in AP-102 (cont'd)

Percentiles:

Percentile	Value	Days
0%	0.00	
5%	296.62	12
10%	409.83	17
15%	490.98	20
20%	573.13	24
25%	641.24	27
30%	706.59	29
35%	774.61	32
40%	841.60	35
45%	913.70	38
50%	990.77	41
55%	1,068.61	45
60%	1,160.73	48
65%	1,262.99	53
70%	1,382.82	58
75%	1,537.65	64
80%	1,730.24	72
85%	1,997.25	83
90%	2,381.60	99
95%	2,909.01	121
100%	14,108.48	588

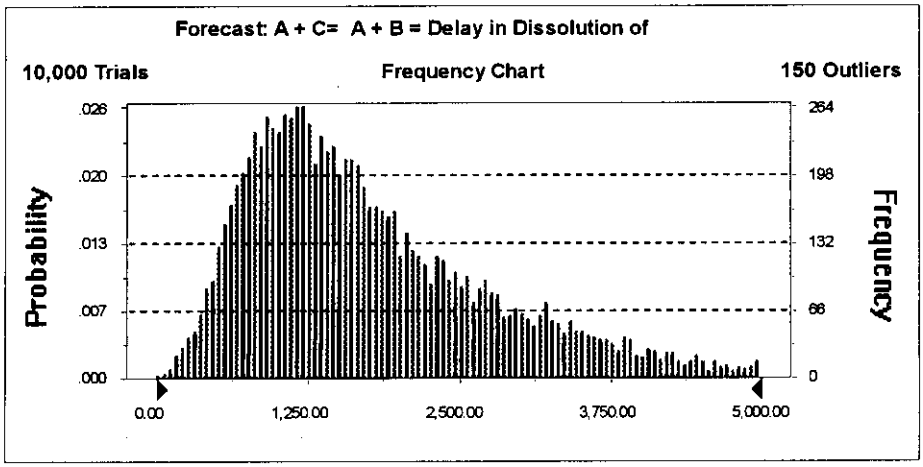
End of Forecast

Forecast: A + C = Delay in Dissolution of Salts in AN-105 **Cell: B9**

Summary:

Display Range is from 0.00 to 5,000.00
Entire Range is from 40.24 to 15,164.85
After 10,000 Trials, the Std. Error of the Mean is 11.22

Statistics:	Value	Days
Trials	10000	
Mean	1,814.25	75.6
Median	1,540.30	64.2
Mode	---	
Standard Deviation	1,122.22	
Variance	1,259,380.82	
Skewness	1.69	
Kurtosis	9.49	
Coeff. of Variability	0.62	
Range Minimum	40.24	
Range Maximum	15,164.85	
Range Width	15,124.60	
Mean Std. Error	11.22	



Forecast: A + C = Delay in Dissolution of Salts in AN-105 (cont'd)

Percentiles:

Percentile	Value	Days
0%	40.24	1.7
5%	539.46	22
10%	692.19	29
15%	811.36	34
20%	918.55	38
25%	1,017.92	42
30%	1,116.49	47
35%	1,214.32	51
40%	1,315.26	55
45%	1,427.56	59
50%	1,540.30	64
55%	1,660.36	69
60%	1,794.23	75
65%	1,948.43	81
70%	2,130.21	89
75%	2,355.27	98
80%	2,603.48	108
85%	2,920.16	122
90%	3,332.70	139
95%	3,945.87	164
100%	15,164.85	632

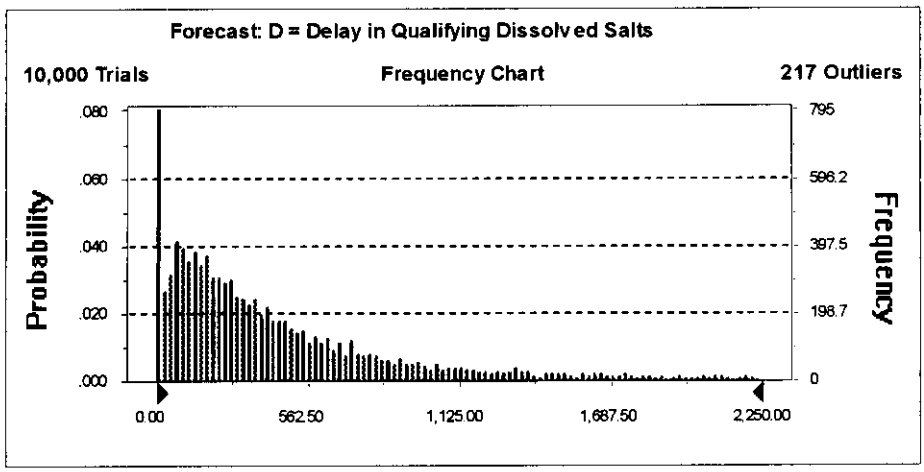
End of Forecast

Crystal Ball Report
Simulation started on 6/7/99 at 22:53:31
Simulation stopped on 6/7/99 at 23:11:54

Forecast: D = Delay in Qualifying Dissolved Salts in AP-104 **Cell: X2**

Summary:
Display Range is from 0.00 to 2,250.00
Entire Range is from 0.00 to 9,823.51
After 10,000 Trials, the Std. Error of the Mean is 5.96

Statistics:	Value	Days
Trials	10000	
Mean	495.33	21
Median	311.01	13
Mode	0.00	
Standard Deviation	596.38	
Variance	355,666.34	
Skewness	3.42	
Kurtosis	25.58	
Coeff. of Variability	1.20	
Range Minimum	0.00	
Range Maximum	9,823.51	
Range Width	9,823.51	
Mean Std. Error	5.96	



Forecast: D = Delay in Qualifying Dissolved Salts in AP-104 (cont'd)

Percentiles:

Percentile	Value	Days
0%	0.00	
5%	8.98	0.4
10%	40.71	1.7
15%	75.04	3.1
20%	103.26	4.3
25%	133.53	5.6
30%	164.00	6.8
35%	196.25	8.2
40%	230.76	9.6
45%	268.96	11
50%	311.01	13
55%	358.24	15
60%	409.42	17
65%	468.78	20
70%	539.70	22
75%	627.84	26
80%	736.93	31
85%	896.61	37
90%	1,158.20	48
95%	1,659.80	69
100%	9,823.51	409

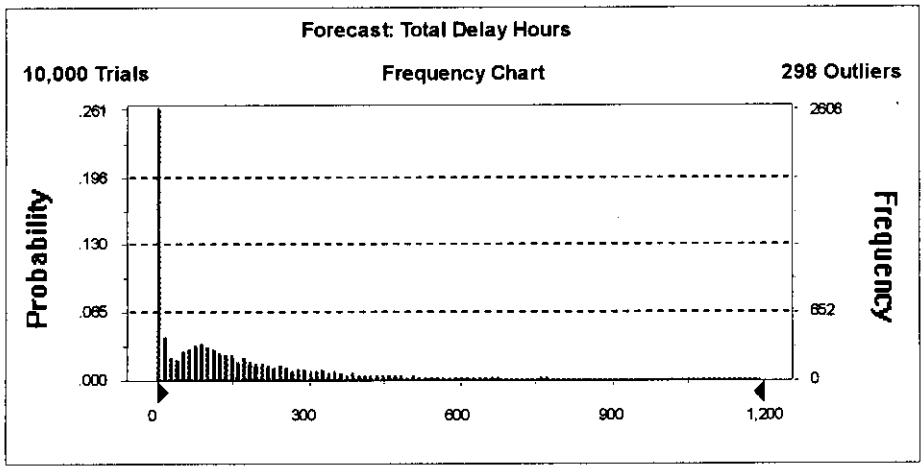
End of Forecast

Crystal Ball Report
Simulation started on 6/18/99 at 11:15:52
Simulation stopped on 6/18/99 at 11:31:03

Forecast: E = Delay in Batch Transfer to BNFL **Cell: AB2**

Summary:
Display Range is from 0 to 1,200
Entire Range is from 0 to 5,588
After 10,000 Trials, the Std. Error of the Mean is 4

Statistics:	Value
Trials	10000
Mean	225
Median	108
Mode	0
Standard Deviation	370
Variance	136,865
Skewness	4.21
Kurtosis	31.61
Coeff. of Variability	1.64
Range Minimum	0
Range Maximum	5,588
Range Width	5,588
Mean Std. Error	3.70



Forecast: E = Delay in Batch Transfer to BNFL (continued) **Cell: AB2**

Percentiles:

Percentile	Value
0%	0
5%	0
10%	0
15%	2
20%	7
25%	11
30%	23
35%	51
40%	72
45%	89
50%	108
55%	129
60%	154
65%	185
70%	220
75%	267
80%	330
85%	418
90%	561
95%	865
100%	5,588

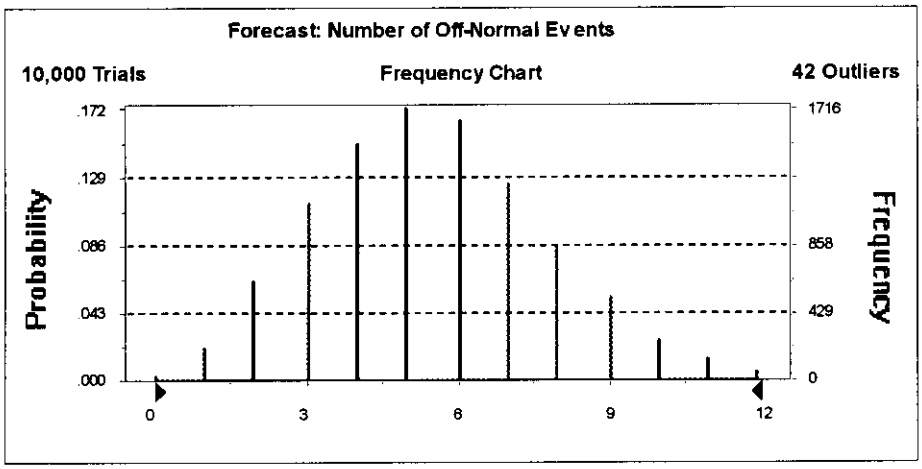
End of Forecast

Forecast: Number of Off-Normal Events **Cell: AA2**

Summary:

Display Range is from 0 to 12
Entire Range is from 0 to 18
After 10,000 Trials, the Std. Error of the Mean is 0

Statistics:	Value
Trials	10000
Mean	6
Median	5
Mode	5
Standard Deviation	2
Variance	5
Skewness	0.39
Kurtosis	3.12
Coeff. of Variability	0.42
Range Minimum	0
Range Maximum	18
Range Width	18
Mean Std. Error	0.02

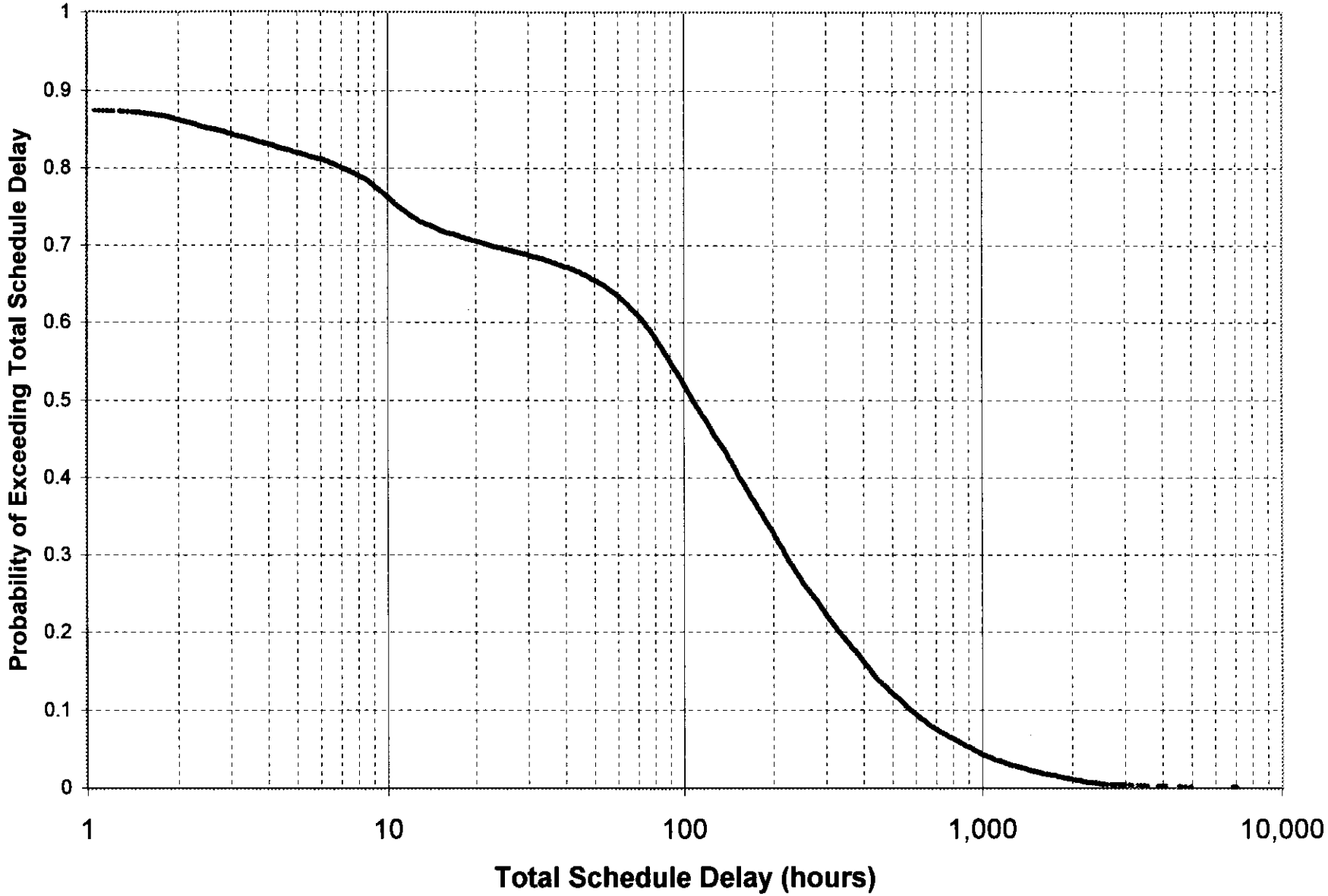


Forecast: Number of Off-Normal Events (cont'd) **Cell: AA2**

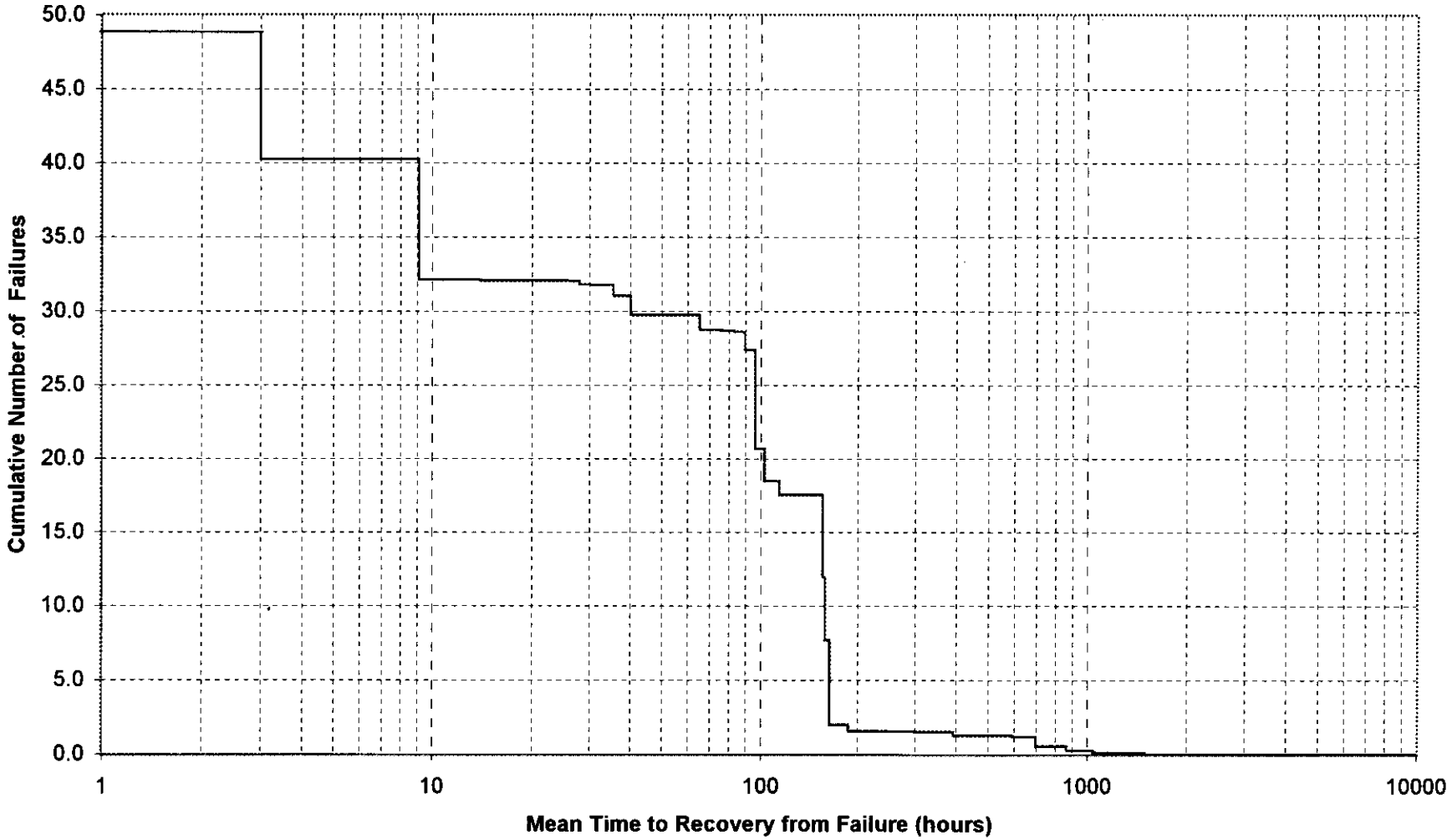
Percentiles:

Percentile	Value
0%	0
5%	2
10%	3
15%	3
20%	4
25%	4
30%	4
35%	5
40%	5
45%	5
50%	5
55%	6
60%	6
65%	6
70%	7
75%	7
80%	7
85%	8
90%	9
95%	10
100%	18

End of Forecast


Probability of Exceeding Total Schedule Delay
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
1,000
10,000
Total Schedule Delay (hours)

Distribution of Times to Recover from Individual Failures During Qualification of LAW Batches from 241-AN-105



Distribution of Times to Recover from Individual Failures During One Batch Transfer of LAW in 241-AP-102/104 to BNFL

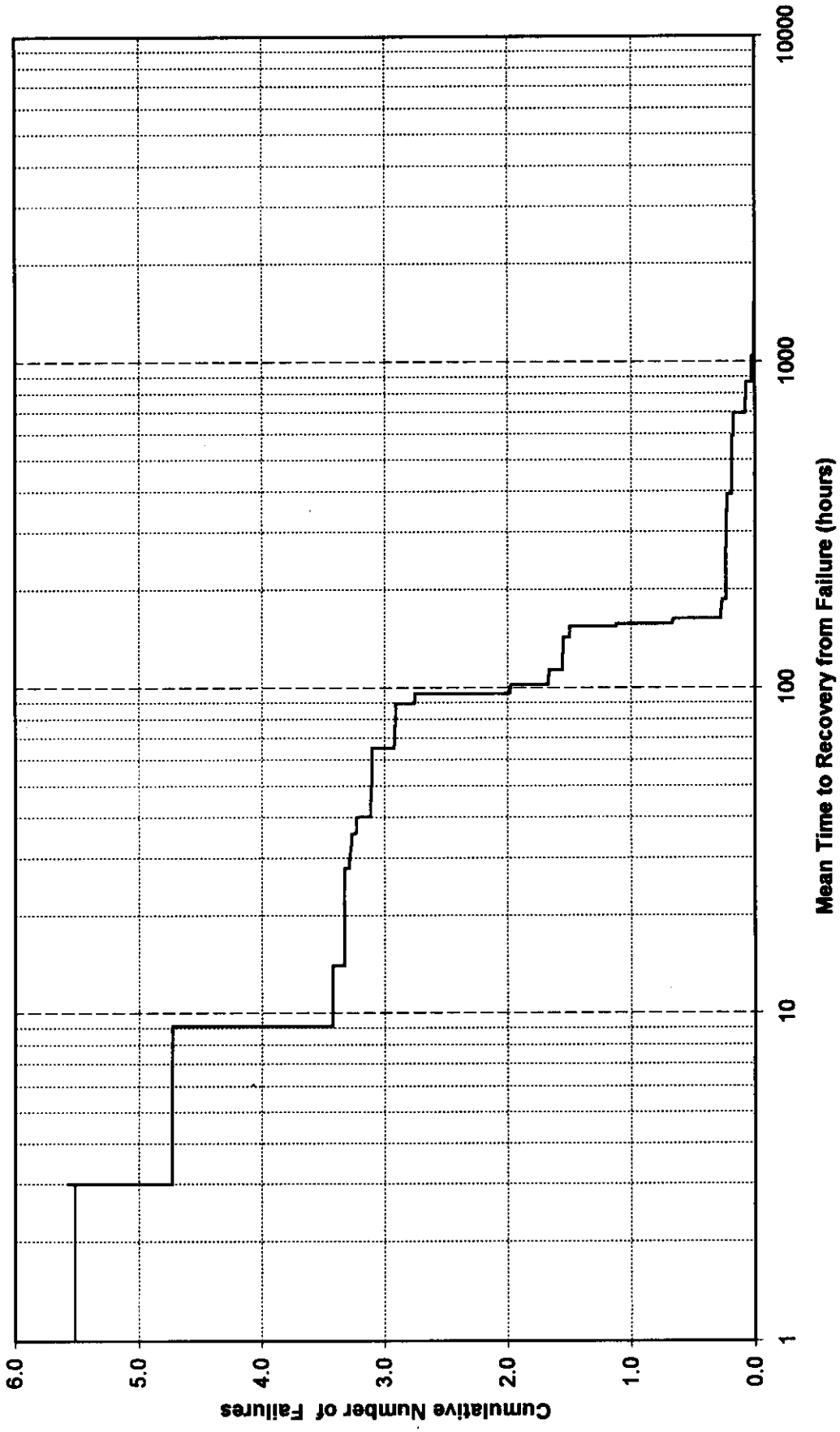


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TABLE F-1. Mission Profile Summary for Low Activity Waste Transfers from AN-105 to BNFL

Activity	Volume (m3)	Volume (gal)	Time (hrs)	Inches of Waste	Comment	Reference
Starting Waste Volume in AN-105 - Phase 1	4170	1,101,589		386.5	Calculated expected volume after of existing waste after degassing 100 m3 of gas.	Flowsheet, Section 1.1.1
Supernate Decanted to AP-102	2182	576,419		202.3	Based on transfer pump position	Flowsheet, Section 3.1.5
In-line dilution during AN-105 to AP-102 Transfer	800	211,336	94		AN-105 is too full for dilution prior to transfer - Risk issue -Loss of diluent flow could result in precipitation and line pluggage	Flowsheet, Section 3.1.5
Total transfer to AP-102	2982	**787,755**	94	276.4		
Waste Volume in AN-105 After Decant	1988	525,170		184.3		
Diluent addition into AN-105	1000	264,170	31	92.7	Added to dissolve salts	
Total in AN-105 after dissolution of salts	2988	789,340		277.0		
Total transfer to AP-104	2549	**673,369**	80	236.3		
Heel Remaining in AN-105	439	115,971		40.7	Primarily contains insoluble solids mixed with some supernate.	Flowsheet, Table 2-2.
Starting Waste Volume in AP-102	0					
Volume in AP-102 During Qualification	2982	787,755		276.4		
Transfer AP-102 to AP-106	2882	**761,338**	91	267.1		Flowsheet, Section 3.1.16
Heel Remaining in AP-102 after transfer	100	26,417		9.3	Heel required to maintain minimum level allowed by pump NPSH requirements	
Starting Waste Volume in AP-104	0					
Volume in AP-104 During Qualification	2549	673,369		236.3		
Transfer AP-104 to AP-106	2449	**646,952**	77	227.0		Flowsheet, Section 3.1.16
Heel Remaining in AP-104 after transfer	100	26,417		9.3	Heel required to maintain minimum level allowed by pump NPSH requirements	

Source: Orme, R.M., 1999, Waste Feed Delivery Technical Basis, HNF-1939-Vol. II, "Waste Feed Delivery Flowsheet for 241-An-105" Rev. 0b, Numatec Hanford Corporation, Richland, Washington (Orme, 1999b)

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Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
	Total	**5.6**	**42**	**236**	**100%**	**100%**
AP02D-WT-P-002	Transfer Pump	0.19	115	22	3.4%	9.3%
AP102-WT-HA-8A002	Human Action	0.03	392	13	0.6%	5.4%
AP02D-WT-V-209	Service Water Check Valve	0.01	964	5	0.1%	2.1%
AP02D-WT-V-210	Service Water Check Valve	0.01	964	5	0.1%	2.1%
AP02D-WT-V-211	Service Water Check Valve	0.01	964	5	0.1%	2.1%
ALL-ALL-EE-9A9B01	External Events	1.31	3	3	23.4%	1.5%
AP02D-WT-MOV-261	3-Way Ball Valve	0.05	74	3	0.8%	1.4%
AP02D-WT-MOV-253	3-Way Ball Valve	0.05	74	3	0.8%	1.4%
AP02D-WT-MOV-245	3-Way Ball Valve	0.05	74	3	0.8%	1.4%
AP02D-WT-MOV-242	3-Way Ball Valve	0.05	74	3	0.8%	1.4%
AP02D-WT-MOV-244	3-Way Ball Valve	0.05	74	3	0.8%	1.4%
AP02D-WT-MOV-243	3-Way Ball Valve	0.05	74	3	0.8%	1.4%
AP02D-WT-V-806	Check Valve	0.01	644	3	0.1%	1.4%
AP901-WSTA-P-104	Pump	0.06	47	3	1.2%	1.3%
AP241-VTA-P-914	Pump	0.06	47	3	1.2%	1.3%
AP241-VTA-P-924	Pump	0.06	47	3	1.2%	1.3%
AP901-WSTA-P-102	Pump	0.06	47	3	1.2%	1.3%
APVP-WT-V-620	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-802	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-804	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-803	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-612	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-610	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-609	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-606	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-619	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-601	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-616	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-603	Ball Valve	0.004	637	3	0.1%	1.2%
APVP-WT-V-602	Ball Valve	0.004	637	3	0.1%	1.2%
AP296-VTP-P-524	Pump	0.06	44	3	1.1%	1.2%
AP296-VTP-P-514	Pump	0.06	44	3	1.1%	1.2%
AP102-WT-HA-8A001	Human Action	0.003	392	1	0.1%	0.5%
AP296-VTP-CAM-510	HVAC Continuous Air Monitor	0.02	46	1	0.4%	0.5%
AP901-WSTA-CAM-104	Continuous Air Monitor	0.02	46	1	0.4%	0.5%
AP241-VTA-CAM-910	Continuous Air Monitor	0.02	46	1	0.4%	0.5%
AP901-WSTA-CAM-102	Continuous Air Monitor	0.02	46	1	0.4%	0.5%
AP241-CHEMB-P-002	Diluent/Flush Pump	0.04	25	1	0.8%	0.5%
AP241-CHEMB-(P-1)	Pump	0.04	25	1	0.8%	0.5%
AP271-VTP-XA-510A	Failure Alarm	0.02	53	1	0.3%	0.4%
AP241-VTA-XA-910A	Failure Alarm	0.02	53	1	0.3%	0.4%
AP102-WT-HA-8A004	Human Action	0.03	28	1	0.6%	0.4%
ANA-WT-LDE-335	Element	0.003	245	1	0.1%	0.3%
AP04D-WT-LDE-287A	Detector Element	0.003	245	1	0.1%	0.3%
AP04D-WT-LDE-287B	Detector Element	0.003	245	1	0.1%	0.3%
AP02D-WT- LDE-283	Leak Detector Element	0.003	245	1	0.1%	0.3%
ANVPA-WT-LDE-331	Element	0.003	245	1	0.1%	0.3%
ANVPA-WT-LDE-163	Leak Detector Element	0.003	245	1	0.1%	0.3%
ANVPA-WT-LDE-162	Leak Detector Element	0.003	245	1	0.1%	0.3%
AP02D-WT-LDE-205	Detector Element	0.003	245	1	0.1%	0.3%
AN05A-WT-LDE-137	Leak Detector Element	0.003	245	1	0.1%	0.3%
AP04A-WST-211	Detector Element	0.003	245	1	0.1%	0.3%
AP102-WT-LDE-282	Detector Element	0.003	245	1	0.1%	0.3%
AP102-WT-LDE-281	Detector Element	0.003	245	1	0.1%	0.3%
AN05B-WT-LDE-138	Leak Detection Element	0.003	245	1	0.1%	0.3%
AP04A-WST-LDE-285	Leak Detector Element	0.003	245	1	0.1%	0.3%
AP296-VTP-RAH-510A	Radiation Alarm High	0.02	46	1	0.3%	0.3%
AP241-VTA-RAH-910A	Radiation Alarm High	0.02	46	1	0.3%	0.3%
AP102-VTP-TAHL-501A	Temperature Alarm High Low	0.02	45	1	0.3%	0.3%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP296-VTP-FAL-522A	Flow Alarm Low	0.02	45	1	0.3%	0.3%
AP241-VTA-TAHL-901A	Temperature Alarm High Low	0.02	45	1	0.3%	0.3%
AP296-VTP-FAL-512A	Flow Alarm Low	0.02	45	1	0.3%	0.3%
AP241-VTA-FAL-912A	Flow Alarm Low	0.02	45	1	0.3%	0.3%
AP241-VTA-FAL-922A	Flow Alarm Low	0.02	45	1	0.3%	0.3%
AP901-WSTA-F-133A	Fan	0.02	44	1	0.3%	0.3%
AP901-WSTA-F-133B	Fan	0.02	44	1	0.3%	0.3%
AP296-VTP-F-506A	Cabinet Cooling Fan	0.02	44	1	0.3%	0.3%
AP296-VTP-F-506B	Cabinet Cooling Fan	0.02	44	1	0.3%	0.3%
AP241-VTA-F-906B	Fan	0.02	44	1	0.3%	0.3%
AP241-VTA-F-906A	Fan	0.02	44	1	0.3%	0.3%
AP102-WST-V-142	Service Water Check Valve	0.01	143	1	0.1%	0.3%
AP102-WST-V-141	Gate Valve	0.01	143	1	0.1%	0.3%
AP102-WST-V-145	3-Way Ball Valve	0.01	143	1	0.1%	0.3%
AP241-VTA-TC-261	Temperature Controller	0.01	45	1	0.3%	0.3%
AP241-VTA-TC-251	Temperature Controller	0.01	45	1	0.3%	0.3%
AP06A-WT-LDE-216	Detector Element	0.003	167	1	0.1%	0.2%
AP02A-WT-LDE-203	Detector Element	0.003	167	1	0.1%	0.2%
AP102-WT-HA-8A003	Human Action	0.02	28	1	0.4%	0.2%
ANVPA-WT-LDA-163	Leak Detected Alarm	0.01	44	1	0.2%	0.2%
ANVPA-WT-LDA-162	Leak Detected Alarm	0.01	44	1	0.2%	0.2%
AN241-WT-LDSTA-149	Leak Detector Station	0.01	44	1	0.2%	0.2%
AN241-WT-LDSTA-146	Leak Detector Station	0.01	44	1	0.2%	0.2%
AN05C-WT-LDSTA-139	Leak Detector Station	0.01	44	1	0.2%	0.2%
AN05A-WT-LDSTA-138	Leak Detector Station	0.01	44	1	0.2%	0.2%
AN05A-WT-LDSTA-137	Leak Detector Station	0.01	44	1	0.2%	0.2%
AN241-WT-LDSTA-148	Leak Detector Station	0.01	44	1	0.2%	0.2%
AP271-WSTA-RXA-102	Radiation Failure Alarm	0.01	29	0.4	0.3%	0.2%
AP296-VTP-XA-XX1	Failure Alarm	0.01	29	0.4	0.3%	0.2%
AP241-VTA-XA-263	Failure Alarm	0.01	29	0.4	0.3%	0.2%
AP241-VTA-XA-253	Failure Alarm	0.01	29	0.4	0.3%	0.2%
AP271-VTA-XA-910B	Failure Alarm	0.01	29	0.4	0.3%	0.2%
AP296-VTP-QS-(XX1)	General Alarm	0.01	29	0.4	0.3%	0.2%
AP271-WSTA-RXA-104	Radiation Failure Alarm	0.01	29	0.4	0.3%	0.2%
AP241-CHEMB-V-101	Ball Valve	0.01	83	0.4	0.1%	0.2%
AP241-CHEMB-V-102	Ball Valve	0.01	83	0.4	0.1%	0.2%
AP241-CHEMB-V-109	Automatic Recirc Valve	0.01	83	0.4	0.1%	0.2%
AP241-CHEMB-V-106	2-Way Ball Valve	0.01	83	0.4	0.1%	0.2%
AP241-CHEMB-V-104	Ball Valve	0.01	83	0.4	0.1%	0.2%
AP241-CHEMB-V-105	Ball Valve	0.01	83	0.4	0.1%	0.2%
2670	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2521	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2370	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2426	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2463	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2510	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2666	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2361	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2427	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2464	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2345	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2363	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2403	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2630	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2407	Surveillance Station	0.01	29	0.4	0.2%	0.2%
2421	Surveillance Station	0.01	29	0.4	0.2%	0.2%
1267	Surveillance Station	0.01	29	0.4	0.2%	0.2%
1270	Surveillance Station	0.01	29	0.4	0.2%	0.2%
1150	Surveillance Station	0.01	29	0.4	0.2%	0.2%
1266	Surveillance Station	0.01	29	0.4	0.2%	0.2%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
2626	Surveillance Station	0.01	29	0.4	0.2%	0.2%
AP102-WT-FAH-260	Flow Alarm High	0.01	25	0.4	0.3%	0.2%
AP296-VTP-FAL-(APXX1)	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-VTP-FAL-512B	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP296-VTP-FAL-(APXX2)	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-WSTA-TAHL-110	Temperature Alarm High Low	0.01	24	0.4	0.3%	0.1%
AP241-VTA-PDAH-265	High	0.01	24	0.4	0.3%	0.1%
AP241-VTA-PDAH-264	High	0.01	24	0.4	0.3%	0.1%
AP241-VTA-PDAH-255	High	0.01	24	0.4	0.3%	0.1%
AP241-VTA-PDAH-254	High	0.01	24	0.4	0.3%	0.1%
AP104-WSTA-LDA-124	Leak Detector Alarm	0.01	24	0.4	0.3%	0.1%
AN271-WSTA-LDA-155	Leak Detector Alarm	0.01	24	0.4	0.3%	0.1%
AN271-WST-LAH-135	Level Alarm High	0.01	24	0.4	0.3%	0.1%
AP271-VTA-FAL-908	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-VTA-FAL-912B	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-WSTA-FAL-104	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-VTA-TAHL-901B	Temperature Alarm High Low	0.01	24	0.4	0.3%	0.1%
AP271-VTP-FAL-509	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-VTA-FAL-922B	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-VTP-FAL-522B	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP296-VTP-FAL-(APXX3)	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP102-WSTA-LDA-122	Leak Detector Alarm	0.01	24	0.4	0.3%	0.1%
AP271-VTP-TAHL-501B	Temperature Alarm High Low	0.01	24	0.4	0.3%	0.1%
AP271-WSTA-FAL-102	Flow Alarm Low	0.01	24	0.4	0.3%	0.1%
AP271-VTP-FR-509	Flow Recorder	0.01	27	0.3	0.2%	0.1%
AP271-VTA-FR-908	Flow Recorder	0.01	27	0.3	0.2%	0.1%
AN05C-WT-LDS-ANPP	Leak Detector Alarm	0.01	29	0.3	0.2%	0.1%
APICE-CHEMB-YA-549	Event/State Alarm Low	0.01	29	0.3	0.2%	0.1%
APVP-WT-CASS-A-2405	Surveillance Station	0.01	29	0.3	0.2%	0.1%
APVP-WT-CASS-A-2347	Surveillance Station	0.01	29	0.3	0.2%	0.1%
APVP-WT-CASS-A-2465	Surveillance Station	0.01	29	0.3	0.2%	0.1%
APVP-WT-CASS-A-2321	Surveillance Station	0.01	29	0.3	0.2%	0.1%
--LDA-163	Leak Detector Alarm	0.01	25	0.3	0.2%	0.1%
AP02D-WT-ZE-262	Position Element	0.00	142	0.3	0.0%	0.1%
AP102-WT-PAL-280	Pressure Alarm Low	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDXA-225	Leak Detector Failure Alarm	0.01	24	0.3	0.2%	0.1%
AN242A-WT-LDS-ANSN2	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
AN242A-WT-LDS-ANPP	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
APICE-WT-LDA-282	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDA-225	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
AP102-WST-TAHL-273	Temperature Alarm High Low	0.01	24	0.3	0.2%	0.1%
AP102-WT-PAH-276	Pressure Alarm High	0.01	24	0.3	0.2%	0.1%
APICE-CHEMB-LAH-127	Level Alarm High	0.01	24	0.3	0.2%	0.1%
APICE-CHEMB-LAHH-126	Level Alarm High High	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDA-224	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDA-201	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDA-227	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDS-APVP	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDXA-201	Leak Detector Failure Alarm	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDXA-224	Leak Detector Failure Alarm	0.01	24	0.3	0.2%	0.1%
APVP-WT-LDS-APSL	Leak Detector Alarm	0.01	24	0.3	0.2%	0.1%
AP102-WT-ZC-244	Position Controller	0.01	27	0.3	0.2%	0.1%
AP102-WT-ZC-243	Position Controller	0.01	27	0.3	0.2%	0.1%
AP102-WT-ZC-242	Position Controller	0.01	27	0.3	0.2%	0.1%
AP102-WT-ZC-253	Position Controller	0.01	27	0.3	0.2%	0.1%
AP102-WT-ZC-261	Position Controller	0.01	27	0.3	0.2%	0.1%
AP102-WT-VFD-258	Variable Frequency Drive	0.01	27	0.3	0.2%	0.1%
AP102-WT-ZC-262	Position Controller	0.01	27	0.3	0.2%	0.1%
APICE-CHEMB-TIC-457	Controller	0.01	27	0.3	0.2%	0.1%
AP241-CHEMB-ZC-131	Position Controller	0.01	27	0.3	0.2%	0.1%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
APICE-CHEMB-FIC-XXX	Flow Indicating Controller	0.01	27	0.3	0.2%	0.1%
AP102-WT-ZC-245	Position Controller	0.01	27	0.3	0.2%	0.1%
AP102-WST-VFD-202	Variable Frequency Drive	0.01	27	0.3	0.2%	0.1%
AP102-WST-VFD-201	Variable Frequency Drive	0.01	27	0.3	0.2%	0.1%
APICE-CHEMB-ZC-132	Position Controller	0.01	27	0.3	0.2%	0.1%
APICE-CHEMB-FI-456	Flow Indicating Controller	0.01	27	0.3	0.2%	0.1%
APICE-CHEMB-FC-456	Flow Controller	0.01	25	0.2	0.2%	0.1%
AP104-WSTA-FIV-124C	Valve	0.01	44	0.2	0.1%	0.1%
AP104-WSTA-FIV-124B	Valve	0.01	44	0.2	0.1%	0.1%
AP104-WSTA-FIV-124A	Valve	0.01	44	0.2	0.1%	0.1%
AP102-WSTA-FIV-122A	Valve	0.01	44	0.2	0.1%	0.1%
AP102-WSTA-FIV-122B	Valve	0.01	44	0.2	0.1%	0.1%
AP102-WSTA-FIV-122C	Valve	0.01	44	0.2	0.1%	0.1%
AP02D-WT-FE-258	Flow Element	0.001	244	0.2	0.0%	0.1%
AP241-VTA-PI-921	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-TI-201	Temperature Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-PI-911	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-PDIS-255	Switch (High/Low)	0.005	44	0.2	0.1%	0.1%
AP241-VTA-PI-292	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-PI-294	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP901-WSTA-PI-104	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP901-WSTA-PI-102	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-FI-920	Flow Indicator	0.005	44	0.2	0.1%	0.1%
AP904-VTP-PI-106	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP901-VTP-PI-104	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-PDIS-265	Switch (High/Low)	0.005	44	0.2	0.1%	0.1%
AP296-VTP-PI-521	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP296-VTP-PI-511	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-FQI-920	Flow Totalizer Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-PDIS-254	Switch (High/Low)	0.005	44	0.2	0.1%	0.1%
AP296-VTP-HM-524	Hour Meter	0.005	44	0.2	0.1%	0.1%
AP901-VTA-PI-112	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP901-VTA-PI-114	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-TI-202	Temperature Indicator	0.005	44	0.2	0.1%	0.1%
AP901-VTP-PI-102	Pressure Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-TI-211	Temperature Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-TI-212	Temperature Indicator	0.005	44	0.2	0.1%	0.1%
(APXX1)	Hour Meter	0.005	44	0.2	0.1%	0.1%
AP296-VTP-FQI-520	Flow Totalizer Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-PDIS-264	Switch (High/Low)	0.005	44	0.2	0.1%	0.1%
AP296-VTP-FI-520	Flow Indicator	0.005	44	0.2	0.1%	0.1%
AP241-VTA-HM-924	Hour Meter	0.005	44	0.2	0.1%	0.1%
RW	Raw Water System	0.005	44	0.2	0.1%	0.1%
SW	Service Water System	0.005	44	0.2	0.1%	0.1%
AP102-WT-HA-8B001	Human Action	0.001	392	0.2	0.0%	0.1%
AP901-WSTA-PCV-102	Pressure Control Valve	0.005	43	0.2	0.1%	0.1%
AP241-VTA-FCV-913	Flow Control Valve	0.005	43	0.2	0.1%	0.1%
AP296-VTP-FCV-523	HVAC Flow Control Valve	0.005	43	0.2	0.1%	0.1%
AP901-WSTA-PCV-104	Pressure Control Valve	0.005	43	0.2	0.1%	0.1%
AP241-VTA-FCV-923	Flow Control Valve	0.005	43	0.2	0.1%	0.1%
AP296-VTP-FCV-513	HVAC Flow Control Valve	0.005	43	0.2	0.1%	0.1%
AP296-VTP-FLT-520	Record Sample Filter	0.003	46	0.1	0.1%	0.1%
AP241-VTA-FLT-212	HEPA Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-F-262	Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-F-252	Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-F-(APXX2)	Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-F-(APXX1)	Filter	0.003	43	0.1	0.1%	0.1%
XX1)	Filter	0.003	43	0.1	0.1%	0.1%
AP296-VTP-F-(APXX1)	Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-FLT-202	HEPA Filter	0.003	43	0.1	0.1%	0.1%

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XX1)	Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-FLT-920	Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-FLT-211	Pre-Filter	0.003	43	0.1	0.1%	0.1%
AP241-VTA-FLT-201	Pre-Filter	0.003	43	0.1	0.1%	0.1%
AP271-WSTA-RAH-104	Radiation Alarm High	0.01	10	0.1	0.2%	0.1%
AP296-VTP-RAH-(XX1)	Radiation Alarm High	0.01	10	0.1	0.2%	0.1%
AP271-VTP-RAH-510B	Radiation Alarm High	0.01	10	0.1	0.2%	0.1%
AP271-WSTA-RAH-102	Radiation Alarm High	0.01	10	0.1	0.2%	0.1%
AP271-VTA-RAH-910B	Radiation Alarm High	0.01	10	0.1	0.2%	0.1%
AP296-VTP-F-(APXX2)	Filter	0.003	42	0.1	0.1%	0.1%
AP271-VTP-RR-510	Radiation Recorder	0.01	11	0.1	0.2%	0.1%
AP271-WSTA-RR-102	Radiation Recorder	0.01	11	0.1	0.2%	0.1%
AP271-WSTA-RR-104	Radiation Recorder	0.01	11	0.1	0.2%	0.1%
APICE-CHEMB-RIAS-125A	Switch	0.01	10	0.1	0.2%	0.05%
AP102-WST-XA-101	Failure Alarm	0.01	10	0.1	0.2%	0.05%
AP271-VTA-FQI-908	Flow Totalizer Indicator	0.004	27	0.1	0.1%	0.05%
CP122-WT-FI-160	Flow Indicator	0.004	27	0.1	0.1%	0.05%
AP271-VTP-FQI-509	Flow Totalizer Indicator	0.004	27	0.1	0.1%	0.05%
Camera WST-TV-209	Instrument Air Supply	0.004	25	0.1	0.1%	0.04%
Camera WST-TV-230	Instrument Air Supply	0.004	25	0.1	0.1%	0.04%
APICE-CHEMB-YL-128	Event/State Light	0.003	32	0.1	0.1%	0.04%
APICE-CHEMB-YL-550	Event/State Light	0.003	32	0.1	0.1%	0.04%
APICE-CHEMB-YL-130	Event/State Light	0.003	32	0.1	0.1%	0.04%
AP02D-WT-PRV-112	Pressure Reducing Valve	0.001	196	0.1	0.0%	0.04%
CP122-WT-PCV-101	Pressure Control Valve	0.004	25	0.1	0.1%	0.04%
AP102-WT-FIC-258	Flow Indicating Controller	0.01	10	0.1	0.2%	0.04%
AP241-WT-102	Tank	0.000	2811	0.1	0.0%	0.04%
AP102-WT-ZI-262	Position Indicator	0.003	27	0.1	0.1%	0.04%
APICE-CHEMB-TI-124	Temperature Indicator	0.003	27	0.1	0.1%	0.04%
APICE-WST-PI-102-1	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP241-CHEMB-PI-105	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP241-CHEMB-PI-101	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP241-CHEMB-PI-102	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP241-CHEMB-PI-103	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP241-CHEMB-PI-104	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WST-TI-XX	Temperature Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WST-TI-205	Temperature Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WST-VI-206	Vibration Indicator	0.003	27	0.1	0.1%	0.04%
APICE-CHEMB-LI-126	Level Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WST-VI-207	Vibration Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WST-ZI-208	Position Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WST-TI-204	Temperature Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WT-PI-259	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
APICE-CHEMB-LI-548	Level Indicator	0.003	27	0.1	0.1%	0.04%
APICE-CHEMB-TI-120	Temperature Indicator	0.003	27	0.1	0.1%	0.04%
APICE-CHEMB-FI-123	Flow Indicator	0.003	27	0.1	0.1%	0.04%
APICE-CHEMB-PI-123	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
APICE-CHEMB-PI-546	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP106-WST-LI-106	106	0.003	27	0.1	0.1%	0.04%
AP102-WT-TI-277	Temperature Indicator	0.003	27	0.1	0.1%	0.04%
AP241-CHEMB-PI-106	Pressure Indicator	0.003	27	0.1	0.1%	0.04%
AP102-WST-TI-203	Temperature Indicator	0.003	27	0.1	0.1%	0.04%
AP241-VTA-DMPR-201	Damper	0.004	21	0.1	0.1%	0.04%
AP241-VTA-DMPR-211	Damper	0.004	21	0.1	0.1%	0.04%
APVP-WT-ZS-802A	Position Switch	0.002	42	0.1	0.04%	0.04%
AP102-WT-ZS-261	Position Switch	0.002	42	0.1	0.04%	0.04%
AP102-WT-ZS-253	Position Switch	0.002	42	0.1	0.04%	0.04%
AP102-WT-ZS-245	Position Switch	0.002	42	0.1	0.04%	0.04%
AP102-WT-ZS-244	Position Switch	0.002	42	0.1	0.04%	0.04%
AP102-WT-ZS-243	Position Switch	0.002	42	0.1	0.04%	0.04%

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APVP-WT-ZS-804B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-804A	Position Switch	0.002	42	0.1	0.04%	0.04%
AP102-WT-ZS-242	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-620A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-803A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-609A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-603C	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-620B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-616B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-616A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-612B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-612A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-610B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-610A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-609B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-803B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-603B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-601B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-601A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-602A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-602B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-602C	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-603A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-601C	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-606B	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-606A	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-606C	Position Switch	0.002	42	0.1	0.04%	0.04%
APVP-WT-ZS-802B	Position Switch	0.002	42	0.1	0.04%	0.04%
AP02D-WT-TE-277	Temperature Element	0.000	243	0.1	0.01%	0.03%
AP02D-WT-PE-259	Element	0.000	243	0.1	0.01%	0.03%
AP241-CHEMB-PCV-101	Pressure Control Valve	0.003	25	0.1	0.06%	0.03%
AP241-CHEMB-FCV-131	2-Way Flow Control Valve	0.003	25	0.1	0.06%	0.03%
AP241-RW-LCV-430	Flow Control Valve	0.003	25	0.1	0.06%	0.03%
APVP-WT-PS-616	Pressure Switch	0.0003	243	0.1	0.01%	0.03%
APVP-WT-PS-610	Pressure Switch	0.0003	243	0.1	0.01%	0.03%
APVP-WT-PS-609	Pressure Switch	0.0003	243	0.1	0.01%	0.03%
APVP-WT-PS-612	Pressure Switch	0.0003	243	0.1	0.01%	0.03%
CP122-WT-F-101	Filter	0.0028	27	0.1	0.05%	0.03%
AP02D-WT-A-(1,4,5&7)	Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-N-C	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-D-21	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
AP02D-WT-C-(F,5&8)	Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-P-N	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
AP02A-WT-A-E-(1)	Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-H-M	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
AP02D-WT-D-(2,4&6)	Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-C-D	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-A-J	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
AP02D-WT-(7&8)	Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-M-P	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
AP02D-WT-(3&6)	Assembly	0.0003	192	0.1	0.01%	0.03%
AP02A-WT-K-(1)	Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
APVP-WT-JMP-J-H	AP Valve Pit Jumper Assembly	0.0003	192	0.1	0.01%	0.03%
AP296-VTP-FT-509	Flow Transmitter	0.001	44	0.1	0.03%	0.03%
AP241-VTA-FE-908	Flow Element	0.001	44	0.1	0.03%	0.03%
AP241-VTA-FSL-912	Flow Switch Low	0.001	44	0.1	0.03%	0.03%
AP241-VTA-FT-908	Flow Transmitter	0.001	44	0.1	0.03%	0.03%
AP901-WSTA-FSL-102	Flow Switch Low	0.001	44	0.1	0.03%	0.03%
AP901-WSTA-FSL-104	Flow Switch Low	0.001	44	0.1	0.03%	0.03%
AP296-VTP-FSL-522	Flow Switch Low	0.001	44	0.1	0.03%	0.03%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP296-VTP-FE-509	Flow Element	0.001	44	0.1	0.03%	0.03%
AP241-VTA-FSL-922	Flow Switch Low	0.001	44	0.1	0.03%	0.03%
AN05C-WT-LDE-139	Leak Detection Element	0.003	19	0.1	0.06%	0.03%
AP102-WST-TE-48	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-53	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-52	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-40	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-41	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-42	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-43	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-44	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-45	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-50	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-47	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-49	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-39	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-51	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-36	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-37	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-38	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP102-WST-TE-46	Temperature Element	0.0003	166	0.1	0.01%	0.02%
AP241-CHEMB-AE-121	Analysis Element	0.002	27	0.04	0.03%	0.02%
AP102-WST-LIT-222	Level Indicating Transmitter	0.001	44	0.04	0.02%	0.02%
for Transfer Pump WT-P-019	Nitrogen System Supply	0.004	11	0.04	0.07%	0.02%
AP241-CHEMB-MT-101	Static Mixer	0.002	25	0.04	0.03%	0.02%
AP241-VTP-P-101	Pump	0.04	1	0.04	0.78%	0.02%
CP122-WT-PI-105B	Pressure Indicator	0.004	10	0.04	0.07%	0.02%
CP122-WT-PI-105A	Pressure Indicator	0.004	10	0.04	0.07%	0.02%
CP122-WT-PI-161	Pressure Indicator	0.004	10	0.04	0.07%	0.02%
AP241-VTA-HTR-211	Heater	0.001	52	0.04	0.01%	0.01%
AP241-VTA-HTR-251	Heater	0.001	52	0.04	0.01%	0.01%
AP241-VTA-HTR-261	Heater	0.001	52	0.04	0.01%	0.01%
AP901-WSTA-HTR-134	Heater	0.001	52	0.04	0.01%	0.01%
AP241-VTA-HTR-907	Heater	0.001	52	0.04	0.01%	0.01%
AP241-VTA-HTR-201	Heater	0.001	52	0.04	0.01%	0.01%
CP122-WT-FSH-160	Flow Switch High	0.001	27	0.03	0.02%	0.01%
AP296-VTP-FSL-APK11	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP242A-VTA-FSL-APK22	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP271-VTA-FSL-908	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP296-VTP-FSL-APK12	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP296-VTP-FSL-APK13	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP271-VTP-FSL-509	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP242A-VTA-FSL-APK23	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP242A-VTA-FSL-APK21	Flow Switch Low	0.001	27	0.03	0.02%	0.01%
AP241-VTA-V-104	Butterfly Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-102	Butterfly Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-216	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP904-VTP-V-116	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-212	2-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-201	2-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-202	2-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-203	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-204	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-205	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-206	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-211	2-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTP-V-102	Butterfly Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-213	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-215	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP901-VTA-V-114	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP241-VTA-V-242	Butterfly Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-244	Butterfly Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-292	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-294	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTP-V-104	Butterfly Damper Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTP-V-106	Butterfly Valve	0.001	43	0.03	0.01%	0.01%
AP901-VTA-V-112	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP901-VTP-V-114	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP901-VTP-V-112	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP241-VTA-V-214	3-Way Ball Valve	0.001	43	0.03	0.01%	0.01%
AP02D-WT-PSE-275	Rupture Disk	0.000	196	0.03	0.00%	0.01%
APICE-WST-YL-202D	Event/State Light	0.003	10	0.03	0.06%	0.01%
AP241-RW-ZS-430	Position Switch	0.002	15	0.03	0.04%	0.01%
AP241-CHEMB-ZS-132	Position Switch	0.002	15	0.03	0.04%	0.01%
AP241-CHEMB-ZS-131	Position Switch	0.002	15	0.03	0.04%	0.01%
AP241-CHEMB-ZT-131	Position Transmitter	0.001	27	0.03	0.02%	0.01%
AP271-WST-PIT-112	Pressure Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
AP102-WST-LI-222	Level Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-RW-FIT-456	Flow Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-RW-ZT-430	Position Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-RW-TIT-457	Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-RW-FE-456	Flow Element	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-PIT-123	Pressure Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-TIT-124	Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-LIT-126	Level Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-FIT-123	Flow Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-FIT-122	Flow Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-FE-123	Flow Element	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-FE-122	Flow Element	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-AIT-121	Analysis Indicating Transmitter	0.001	27	0.03	0.02%	0.01%
APICE-CHEMB-FQIC-122	Controller	0.001	27	0.03	0.02%	0.01%
AP241-CHEMB-TIT-120	Transmitter	0.001	27	0.03	0.02%	0.01%
ELEC	Electric Power System	0.004	7	0.02	0.06%	0.01%
AP104-WSTA-TE-90	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-55	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-93	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-89	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-92	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-97	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-94	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-95	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-96	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-99	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-98	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-91	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-82	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-70	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-71	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-72	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-73	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-74	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-75	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-76	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-77	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-78	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-79	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-57	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-81	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-67	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-83	Temperature Element	0.0005	44	0.02	0.01%	0.01%

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COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP102-WSTA-TE-84	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-85	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-86	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-87	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-88	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-89	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-90	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-91	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-92	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-80	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-906	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-100	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-101	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-27	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-28	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-29	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-30	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-31	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-32	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-33	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-34	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-69	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-54	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-68	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-56	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-58	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-59	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-60	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-61	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-62	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-63	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-64	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-65	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-66	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-95	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-35	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-76	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-93	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-65	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-66	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-67	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-68	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-69	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-70	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-71	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-72	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-73	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-63	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-75	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-62	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-77	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-78	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-79	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-80	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-81	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-82	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-83	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-84	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-85	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-86	Temperature Element	0.0005	44	0.02	0.01%	0.01%

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AP104-WSTA-TE-87	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-74	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-32	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-88	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-96	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-97	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-98	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-99	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-100	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-101	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-27	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-28	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-29	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-64	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-31	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP102-WSTA-TE-94	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-33	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-34	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-35	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-54	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-55	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-56	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-57	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-58	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-59	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-60	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-61	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP104-WSTA-TE-30	Temperature Element	0.0005	44	0.02	0.01%	0.01%
AP901-WSTA-TS-133	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-252	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TSH-901	Temperature Switch High	0.0005	44	0.02	0.01%	0.01%
AP296-VTP-TSH-501	Temperature Switch High	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-201	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP296-VTP-TSL-501	Temperature Switch Low	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-251	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP296-VTP-TS-507	HVAC Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-262	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP901-WSTA-TS-134	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP901-WSTA-TSH-110	Temperature Switch High	0.0005	44	0.02	0.01%	0.01%
AP901-WSTA-TSL-110	Temperature Switch Low	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TSL-253	Temperature Switch Low	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TSL-263	Temperature Switch Low	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TSL-901	Temperature Switch Low	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-907	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-261	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP241-VTA-TS-211	Temperature Switch	0.0005	44	0.02	0.01%	0.01%
AP296-VTP-TS-506	HVAC Temperature Switch	0.0005	44	0.02	0.01%	0.01%
102AP	Radiation switch High	0.002	11	0.02	0.03%	0.01%
AP296-VTP-RSH-APK11	Radiation Switch High	0.002	11	0.02	0.03%	0.01%
AP242A-VTA-RSH-APK21	Radiation Switch High	0.002	11	0.02	0.03%	0.01%
AP242A-VTA-RXS-APK21	Radiation Failure Switch	0.002	11	0.02	0.03%	0.01%
104AP	Radiation Switch High	0.002	11	0.02	0.03%	0.01%
AP296-VTP-RXS-APK11	Radiation Failure Switch	0.002	11	0.02	0.03%	0.01%
102AP	Radiation Failure Switch	0.002	11	0.02	0.03%	0.01%
104AP	Radiation Failure Switch	0.002	11	0.02	0.03%	0.01%
AP296-VTP-HTR-507	Heater	0.001	32	0.02	0.01%	0.01%
AP241-CHEMB-PD-101	Pulse Dampener	0.001	25	0.02	0.01%	0.01%
AP241-CHEMB-PD-102	Pulse Dampener	0.001	25	0.02	0.01%	0.01%
CP122-WT-PRV-101	Pressure Relief Valve	0.001	25	0.02	0.01%	0.01%
AP02D-WT-PSH-276	Pressure Switch High	0.0003	44	0.01	0.01%	0.01%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP102-WST-TSHL-273	Temperature Switch High Low	0.0003	44	0.01	0.01%	0.01%
AP102-WT-SN-622-M9	Segment	0.0001	215	0.01	0.00%	0.01%
AP102-WT-SN-612-M25	Tank Discharge Pipe Segment	0.0001	215	0.01	0.00%	0.01%
APVP-WT-SN-616-M25	Segment	0.0001	215	0.01	0.00%	0.01%
AP271-WSTA-EY-104	Voltage Equipment	0.0004	32	0.01	0.01%	0.01%
AP271-WSTA-EY-102	Voltage Equipment	0.0004	32	0.01	0.01%	0.01%
AP271-VTP-EY-510	Voltage Equipment	0.0004	32	0.01	0.01%	0.01%
AP271-VTA-EY-910	Voltage Equipment	0.0004	32	0.01	0.01%	0.01%
AP241-CHEMB-V-107	Globe Valve	0.001	25	0.01	0.01%	0.01%
AP241-CHEMB-V-108	Gate Valve	0.0005	25	0.01	0.01%	0.01%
AP241-CHEMB-V-110	2-Way Ball Valve	0.0005	25	0.01	0.01%	0.01%
AP271-WT-LDK-283	Leak Detector Relay	0.0003	44	0.01	0.01%	0.01%
APVP-WT-19	Connection	0.0001	193	0.01	0.001%	0.01%
APVP-WT-NOZ-J	Connection	0.0001	193	0.01	0.001%	0.01%
APVP-WT-NOZ-19	Connection	0.0001	193	0.01	0.001%	0.01%
APVP-WT-NOZ-21	Connection	0.0001	193	0.01	0.001%	0.01%
APVP-WT-NOZ-C	Connection	0.0001	193	0.01	0.001%	0.01%
APVP-WT-NOZ-D	Connection	0.0001	193	0.01	0.001%	0.01%
APVP-WT-NOZ-H	Connection	0.0001	193	0.01	0.001%	0.01%
AP02A-WT-1	Jumper Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-F	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-1	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-2	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-3	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-4	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-5	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-6	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-7	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-8	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-A	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-C	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-NOZ-1	Connection	0.0001	193	0.01	0.001%	0.01%
AP02D-WT-D	Connection	0.0001	193	0.01	0.001%	0.01%
AP02A-WT-A	Jumper Connection	0.0001	193	0.01	0.001%	0.01%
APVP-WT-NOZ-N	Connection	0.0001	193	0.01	0.001%	0.005%
AP02A-WT-K	Jumper Connection	0.0001	193	0.01	0.001%	0.005%
APVP-WT-NOZ-M	Connection	0.0001	193	0.01	0.001%	0.005%
AP02D-WT-NOZ-A	Connection	0.0001	193	0.01	0.001%	0.005%
APVP-WT-NOZ-P	Connection	0.0001	193	0.01	0.001%	0.005%
AP271-WT-LDK-216	Detector Relay	0.0003	40	0.01	0.005%	0.005%
AP271-WT-LDK-285	Leak Detector Relay	0.0003	40	0.01	0.005%	0.005%
AP241-CHEMB-HTR-101	Electric Heater	0.0004	27	0.01	0.008%	0.005%
AP271-VTA-FY-908	Flow Equipment	0.0004	27	0.01	0.008%	0.005%
AP271-VTP-FY-509	Flow Equipment	0.0004	27	0.01	0.008%	0.005%
AP241-CHEMB-RT-125A	Radiation Transmitter	0.001	11	0.01	0.02%	0.005%
AP102-WSTA-LIS-122B	Level Indicating Switch	0.0002	44	0.01	0.004%	0.005%
AP102-WSTA-LIS-122C	Level Indicating Switch	0.0002	44	0.01	0.004%	0.005%
AP104-WSTA-LIS-124A	Level Indicating Switch	0.0002	44	0.01	0.004%	0.005%
AP104-WSTA-LIS-124C	Level Indicating Switch	0.0002	44	0.01	0.004%	0.005%
AP102-WSTA-LIS-122A	Level Indicating Switch	0.0002	44	0.01	0.004%	0.005%
AP104-WSTA-LIS-124B	Level Indicating Switch	0.0002	44	0.01	0.004%	0.005%
AP241-VTA-(ISC-XX1)	Inlet Screen	0.0002	43	0.01	0.004%	0.004%
AP241-VTA-(ISC-XX2)	Inlet Screen	0.0002	43	0.01	0.004%	0.004%
AP02A-WST-NOZ-A	Jumper Connection	0.0001	193	0.01	0.001%	0.004%
AP02A-WST-NOZ-K	Jumper Connection	0.0001	193	0.01	0.001%	0.004%
AP02A-WST-NOZ-1	Jumper Connection	0.0001	193	0.01	0.001%	0.004%
AP241-VTP-EF-002	Exhaust Fan	0.01	1	0.01	0.2%	0.004%
AP241-VTA-F-101A	Fan	0.01	1	0.01	0.2%	0.004%
AP241-VTA-F-101B	Fan	0.01	1	0.01	0.2%	0.004%
AP241-VTA-EF-004	Exhaust Fan	0.01	1	0.01	0.2%	0.004%

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AP241-VTA-EF-003	Exhaust Fan	0.01	1	0.01	0.2%	0.004%
AP241-VTP-EF-001	Exhaust Fan	0.01	1	0.01	0.2%	0.004%
AP241-VTP-CP301	Control Panel	0.01	1	0.01	0.2%	0.004%
AP271-VTP-PDAH-145	High	0.01	1	0.01	0.2%	0.004%
AP271-VTP-LDXA-141	Leak Detector Failure Alarm	0.01	1	0.01	0.2%	0.004%
AP241-VTP-LDA-APK1	Leak Detector Alarm	0.01	1	0.01	0.2%	0.004%
AP271-VTP-PDAH-146	High	0.01	1	0.01	0.2%	0.004%
AP271-VTA-LAL-142	Level Alarm Low	0.01	1	0.01	0.2%	0.004%
AP271-VTP-PDAH-422	High	0.01	1	0.01	0.2%	0.004%
AP271-VTA-PDAH-761	High	0.01	1	0.01	0.2%	0.004%
AP271-VTP-LDA-141	Leak Detector Alarm	0.01	1	0.01	0.2%	0.004%
AP271-VTP-LAL-140	Level Alarm Low	0.01	1	0.01	0.2%	0.004%
AP271-VTA-PDAH-861	High	0.01	1	0.01	0.2%	0.004%
AP271-VTA-XA-759	Failure Alarm	0.01	1	0.01	0.2%	0.004%
AP271-VTP-LAH-140	Level Alarm High	0.01	1	0.01	0.2%	0.004%
AP271-VTA-LAH-142	Level Alarm High	0.01	1	0.01	0.2%	0.004%
AP241-VTP-VTP-CP401	Control Panel	0.01	1	0.01	0.2%	0.004%
AP271-VTP-PDAH-323	High	0.01	1	0.01	0.2%	0.004%
AP271-VTP-PDAH-423	High	0.01	1	0.01	0.2%	0.004%
AP271-VTP-XA-325	Failure Alarm	0.01	1	0.01	0.2%	0.004%
AP241-VTA-CP759	Control Panel	0.01	1	0.01	0.2%	0.004%
AP241-VTP-XA-510B	Failure Alarm	0.01	1	0.01	0.2%	0.004%
AP271-VTA-XA-760	Failure Alarm	0.01	1	0.01	0.2%	0.004%
AP241-VTP-QS-AP1	General Alarm	0.01	1	0.01	0.2%	0.004%
AP271-VTP-PDAH-322	High	0.01	1	0.01	0.2%	0.004%
AP241-VTA-CP859	Control Panel	0.01	1	0.01	0.2%	0.004%
AP241-CHEMB-TE-101	Temperature Sensing Bulb	0.0003	27	0.01	0.0%	0.004%
AP102-WT-IY-112	Current Equipment	0.0003	27	0.01	0.0%	0.004%
2330	Surveillance Station	0.01	1	0.01	0.2%	0.004%
2543	Surveillance Station	0.01	1	0.01	0.2%	0.004%
AP241-VTA-TDC-859	Controller	0.01	1	0.01	0.2%	0.004%
AP241-VTA-TDC-759	Controller	0.01	1	0.01	0.2%	0.004%
2344	Surveillance Station	0.01	1	0.01	0.2%	0.004%
CP122-WT-V-XXX	2-Way Ball Valve	0.0006	11	0.01	0.01%	0.003%
CP122-WT-V-107	2-Way Ball Valve	0.0006	11	0.01	0.01%	0.003%
CP122-WT-V-106	Check Valve	0.0006	11	0.01	0.01%	0.003%
CP122-WT-V-105	Automatic Switch-Over Valve	0.0006	11	0.01	0.01%	0.003%
CP122-WT-V-103	Angle Globe Valve	0.0006	11	0.01	0.01%	0.003%
CP122-WT-V-102	Angle Globe Valve	0.0006	11	0.01	0.01%	0.003%
CP122-WT-V-101	2-Way Ball Valve	0.0006	11	0.01	0.01%	0.003%
CP122-WT-V-104	Angle Globe Valve	0.0006	11	0.01	0.01%	0.003%
101B	Multiplexer	0.0001	44	0.01	0.003%	0.003%
AP102-WSTA-MUX-101B	Multiplexer	0.0001	44	0.01	0.003%	0.003%
AP102-WSTA-MUX-101A	Multiplexer	0.0001	44	0.01	0.003%	0.003%
APICE-CHEMB-SS-550	positions)	0.0006	10	0.01	0.011%	0.003%
AP241-CHEMB-MOV-132	3-Way Ball Valve	0.0004	14	0.01	0.007%	0.002%
AP241-CHEMB-LE-127	Level Element	0.0002	27	0.004	0.003%	0.002%
APVP-WT-LY-241	Level Equipment	0.0002	27	0.004	0.003%	0.002%
AP241-CHEMB-LE-126	Level Element	0.0002	27	0.004	0.003%	0.002%
AP241-CHEMB-LS-126	Level Switch	0.0002	27	0.004	0.003%	0.002%
CP122-WT-PS-161	Pressure Switch	0.0004	10	0.004	0.007%	0.002%
AZ156-WT-LDA-159	Leak Detector Alarm	0.0001	29	0.004	0.002%	0.002%
AP102-SW-SW-0302-M9	Segment	0.0001	43	0.003	0.001%	0.001%
AP104-WST-SW-304-M9	Segment	0.0001	43	0.003	0.001%	0.001%
APICE-CHEMB-HS-130	2-Position Hand Switch	0.0006	5	0.003	0.01%	0.001%
APICE-CHEMB-HS-128	Hand Switch	0.0006	5	0.003	0.01%	0.001%
AP102-WT-HS-202B	2-Position Hand Switch	0.0006	5	0.003	0.01%	0.001%
--LDA-162	Leak Detector Alarm	0.0001	25	0.003	0.002%	0.001%
AP02A-WT-NOZ-1	Jumper Connection	0.00001	193	0.003	0.0003%	0.001%
AP02A-WT-NOZ-K	Jumper Connection	0.00001	193	0.003	0.0003%	0.001%

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AP02A-WT-NOZ-A	Jumper Connection	0.00001	193	0.003	0.0003%	0.001%
AP241-VTP-YS-APK1	Event/State Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-TI-401	Temperature Indicator	0.003	1	0.003	0.1%	0.001%
AP242A-VTA-YS-APK2	Event/State Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-TI-301	Temperature Indicator	0.003	1	0.003	0.1%	0.001%
AP241-VTA-TI-701	Temperature Indicator	0.003	1	0.003	0.1%	0.001%
AP241-VTA-TI-801	Temperature Indicator	0.003	1	0.003	0.1%	0.001%
AP241-VTA-PDIS-862	Switch (High/Low)	0.003	1	0.003	0.1%	0.001%
AP241-VTA-PDIS-861	Switch (High/Low)	0.003	1	0.003	0.1%	0.001%
AP241-VTA-PDIS-762	Switch (High/Low)	0.003	1	0.003	0.1%	0.001%
AP241-VTA-PDIS-761	Switch (High/Low)	0.003	1	0.003	0.1%	0.001%
AP241-VTA-TI-702	Temperature Indicator	0.003	1	0.003	0.1%	0.001%
AP241-VTP-LDE-141	Leak Detector Element	0.003	1	0.003	0.1%	0.001%
AP241-VTA-TI-802	Temperature Indicator	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-423	Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-422	Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-324	Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-323	Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-322	Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-146	Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-145	Switch	0.003	1	0.003	0.1%	0.001%
AP241-VTP-PDIS-424	Switch	0.003	1	0.003	0.1%	0.001%
APICE-WT-LDK-203	Detector Relay	0.000	9	0.003	0.01%	0.001%
ANVPA-WT-LDK-331	Relay	0.000	9	0.003	0.01%	0.001%
ANA-WT-LDK-335	Relay	0.000	9	0.003	0.01%	0.001%
APICE-WT-LDK-205	Detector Relay	0.000	9	0.003	0.01%	0.001%
ANVPA-WT-LDK-162	Leak Detector Relay	0.000	9	0.003	0.01%	0.001%
ANVPA-WT-LDK-334	Leak Detector Relay	0.000	9	0.003	0.01%	0.001%
ANVPA-WT-LDK-163	Leak Detector Relay	0.000	9	0.003	0.01%	0.001%
AP241-VTA-DMPR-701	Damper	0.003	1	0.003	0.06%	0.001%
AP241-VTA-DMPR-801	Damper	0.003	1	0.003	0.06%	0.001%
AP241-VTP-DMPR-301	Damper	0.003	1	0.003	0.06%	0.001%
AP241-VTP-DMPR-401	Damper	0.003	1	0.003	0.06%	0.001%
AP241-RW-BOILER	BOILER	0.0001	25	0.002	0.00%	0.001%
AP241-VTP-FLT-302	HEPA Filter	0.002	1	0.002	0.04%	0.001%
AP241-VTP-FLT-403	HEPA Filter	0.002	1	0.002	0.04%	0.001%
AP241-VTA-FLT-701	HEPA Filter	0.002	1	0.002	0.04%	0.001%
AP241-VTA-FLT-702	HEPA Filter	0.002	1	0.002	0.04%	0.001%
AP241-VTA-FLT-801	HEPA Filter	0.002	1	0.002	0.04%	0.001%
AP241-VTP-FLT-402	HEPA Filter	0.002	1	0.002	0.04%	0.001%
AP241-VTP-FLT-303	HEPA Filter	0.002	1	0.002	0.04%	0.0008%
AP241-VTP-FLT-301	Pre-Filter	0.002	1	0.002	0.04%	0.0008%
AP241-VTP-DMST-002	Demister	0.002	1	0.002	0.04%	0.0008%
AP241-VTP-DMST-001	Demister	0.002	1	0.002	0.04%	0.0008%
AP241-VTA-FLT-802	HEPA Filter	0.002	1	0.002	0.04%	0.0008%
AP241-VTP-FLT-401	Pre-Filter	0.002	1	0.002	0.04%	0.0008%
AP241-VTP-MS-101	Manual Switch	0.002	1	0.002	0.04%	0.0007%
AP241-PW-102-M9	Pipe Segment	0.0001	25	0.002	0.00%	0.0007%
AP241-PW-104-M9	Pipe Segment	0.0001	25	0.002	0.00%	0.0007%
AP241-CHEMB-103-M9	Segment	0.0001	25	0.002	0.00%	0.0007%
AP271-WT-LDK-287B	Detector Relay	0.0003	4	0.001	0.01%	0.0005%
AP271-WT-LDK-287A	Detector Relay	0.0003	4	0.001	0.01%	0.0005%
AP271-WT-LDK-282	AP-102 Leak Detector Relay	0.0003	4	0.001	0.01%	0.0005%
AP271-WT-LDK-281	AP-102 Leak Detector Relay	0.0003	4	0.001	0.01%	0.0005%
APVP-WT-LDK-(225)	Leak Detector Relay	0.0003	4	0.001	0.01%	0.0005%
APICE-CHEMB-LEK-127	Level Element Relay	0.0003	4	0.001	0.01%	0.0005%
APVP-WT-LDK-(226)	Leak Detector Relay	0.0003	4	0.001	0.01%	0.0005%
APVP-WT-LDK-(227)	Leak Detector Relay	0.0003	4	0.001	0.01%	0.0005%
APICE-WT-LDK-MPS	Relay	0.0003	4	0.001	0.01%	0.0005%
AP296-VTP-FTP-504	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%

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AP241-VTA-FTP-205	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-206	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-207	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-212	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-214	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-215	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-216	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-217	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-242	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-204	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP296-VTP-FTP-503	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-211	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP296-VTP-FTP-505	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-244	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-901	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-902	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-903	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP102-IA-IA-M17	Pipe Segment	0.0001	18	0.001	0.001%	0.0005%
AP296-VTP-FTP-502	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTP-FTP-106	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-213	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTP-FTP-102	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTP-FTP-104	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP104-WST-IA-104-M31	Pipe Segment	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-102	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-104	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-201	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-202	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-VTA-FTP-203	Flow Test Port	0.0001	18	0.001	0.001%	0.0005%
AP241-CHEMB-TK-001	Diluent/Flush Tank	0.00003	25	0.001	0.001%	0.0004%
AP241-VTP-PDS-325	Pressure Differential Switch	0.001	1	0.001	0.018%	0.0004%
AP241-VTP-PDS-425	Pressure Differential Switch	0.001	1	0.001	0.018%	0.0004%
AP241-VTA-PDS-760	Pressure Differential Switch	0.001	1	0.001	0.018%	0.0004%
AP241-VTA-PDS-860	Pressure Differential Switch	0.001	1	0.001	0.018%	0.0004%
AP241-VTA-TDS-759	Temperature Differential Switch	0.001	1	0.001	0.018%	0.0004%
AP241-VTA-TDS-859	Temperature Differential Switch	0.001	1	0.001	0.018%	0.0004%
AP102-WST-ENCL-002	Transmitter Enclosure	0.00004	18	0.001	0.001%	0.0003%
AP241-VTA-ENCL-201	Instrument Enclosure	0.00004	18	0.001	0.001%	0.0003%
AP241-VTA-ENCL-211	Enclosure	0.00004	18	0.001	0.001%	0.0003%
AP104-WST-ENCL-004	Transmitter Enclosure	0.00004	18	0.001	0.001%	0.0003%
AP241-VTA-MOV-701	Butterfly Valve	0.001	1	0.001	0.01%	0.0003%
AP241-VTA-MOV-801	Butterfly Valve	0.001	1	0.001	0.01%	0.0003%
AP241-VTP-MOV-401	Motor Operated Butterfly Valve	0.001	1	0.001	0.01%	0.0003%
AP241-VTP-MOV-301	Butterfly Valve	0.001	1	0.001	0.01%	0.0003%
AP241-VTA-HS-(859)	Hand Switch	0.001	1	0.001	0.01%	0.0002%
AP241-VTA-HS-(759)	Hand Switch	0.001	1	0.001	0.01%	0.0002%
AP241-VTP-V-132	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-119	Butterfly Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-126	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-125	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-127	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-123	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-122	Butterfly Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-121	Butterfly Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-120	Butterfly Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-124	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-401	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-308	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-130	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-701	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AP241-VTA-V-702	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-703	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-704	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-801	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-802	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-128	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-804	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-120	2-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-402	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-403	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-404	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-405	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-406	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-407	Butterfly Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-408	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-409	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-803	3-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-135	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-129	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-121	2-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-131	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-309	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-134	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTA-V-119	2-Way Ball Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-136	Check Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-301	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-302	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-303	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-304	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-305	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-306	3-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-307	Butterfly Valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-V-133	2-Way Ball valve	0.001	1	0.0005	0.01%	0.0002%
AP241-VTP-HTR-101	Heater	0.0004	1	0.0004	0.01%	0.0002%
AP241-VTA-HTR-003	Heater	0.0004	1	0.0004	0.01%	0.0002%
AP241-VTA-HTR-004	Heater	0.0004	1	0.0004	0.01%	0.0002%
AP241-VTA-HTR-101	Heater	0.0004	1	0.0004	0.01%	0.0002%
AP241-VTP-HTR-001	Heater	0.0004	1	0.0004	0.01%	0.0002%
AP241-VTP-HTR-002	Heater	0.0004	1	0.0004	0.01%	0.0002%
AP241-VTA-TE-759C	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TE-859D	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TE-759A	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-TE-326A	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-TE-326B	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TSH-859B	Temperature Switch High	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TSH-859A	Temperature Switch High	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TSH-759B	Temperature Switch High	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TS-101	Temperature Switch	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TE-859C	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TE-859B	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-TS-142	Temperature Switch	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TSH-759A	Temperature Switch High	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-TSH-236A	Temperature Switch High	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TE-859A	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-TE-426B	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-TE-426A	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TE-759B	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTA-TE-759D	Temperature Element	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-TSH-426A	Temperature Switch High	0.0003	1	0.0003	0.01%	0.0001%
AP241-VTP-LSHL-140	Level Switch High Low	0.0002	1	0.0001	0.003%	0.0001%

Table F-2	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Unique Components to Expected Schedule Delay					
COMPLETE EQUIPMENT IDENTIFICATION NUMBER	COMPONENT DESCRIPTION	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
AZ156-WT-LDK-159	Detector Relay	0.0000	40	0.0001	0.0001%	0.0001%
AP241-VTP-FTP-402	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-110	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-405	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-404	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-403	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-109	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-305	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-304	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-303	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-301	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTA-FTP-701	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-401	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTA-FTP-756	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTP-FTP-302	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTA-FTP-856	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTA-FTP-801	Flow Test Port	0.0001	1	0.00004	0.001%	0.00002%
AP241-VTA-ENCL-101	Enclosure	0.00003	1	0.00003	0.001%	0.00001%
AP241-VTP-ENCL-110	Enclosure	0.00003	1	0.00003	0.001%	0.00001%
AP241-VTP-SP-101	Seal Pot	0.00003	1	0.00003	0.001%	0.00001%
AP241-VTA-SP-142	Seal Pot	0.00003	1	0.00003	0.001%	0.00001%
AP241-EDS-MCC-002	Motor Control Center	0.00003	1	0.00003	0.001%	0.00001%

Table F-3	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of Generic Components to Expected Schedule Delay				
Generic Component Type Description	EXPECTED NUMBER OF DELAY EVENTS	EXPECTED DELAY PER EVENT (HRS)	TOTAL EXPECTED DELAY TIME (HRS)	PERCENT CONTRIBUTION TO NUMBER OF EVENTS	PERCENT CONTRIBUTION TO TOTAL DELAY
Total	5.6	42	236	100%	100%
Valves	0.5	169	82	9%	35%
Instrumentation, other than leak and level	2.1	28	58	37%	24%
Waste Transfer Pump	0.2	115	22	3%	9%
Instrumentation, Leak detection	0.3	59	21	6%	9%
Pumps, other than mixer and transfer	0.5	39	20	9%	8%
Human actions	0.1	178	16	2%	7%
Fans	0.1	33	3	2%	1%
Control equipment	0.1	22	3	2%	1%
External events	1.3	3	3	24%	1%
Instrumentation, level	0.1	15	2	3%	1%
Other	0.2	29	6.1	4%	3%

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Table F-4	Critical Items List for the Low Activity Waste Transfer Activities Pinned to the WTD requested by BNFL, Ranked by the Contribution of System Type to Expected Schedule				
SYSTEM TYPE	**EXPECTED NUMBER OF DELAY EVENTS**	**EXPECTED DELAY PER EVENT (HR)**	**TOTAL EXPECTED DELAY TIME (HRS)**	**PERCENT CONTRIBUTION TO NUMBER OF EVENTS**	**PERCENT CONTRIBUTION TO TOTAL DELAY**
Total	**5.6**	**42**	**236**	**100%**	**100%**
Transfer	1.14	106	120	20.4%	50.9%
HVAC Annulus	1.57	32	49	28.2%	21.0%
HVAC	0.94	23	21	16.9%	9.1%
Service Water	0.03	618	16	0.5%	6.6%
Dilution/Flush	0.25	60	15	4.6%	6.5%
Dilution	0.18	33	6	3.2%	2.5%
External Events	1.31	3	3	23.4%	1.5%
INSTM	0.04	27	1	0.7%	0.5%
Monitoring	0.04	28	1	0.7%	0.4%
Nitrogen	0.05	19	1	0.8%	0.4%
Service Air	0.01	140	1	0.1%	0.3%
Annulus	0.01	24	0.4	0.3%	0.1%
Instrument Air	0.01	25	0.2	0.1%	0.1%
Raw Water	0.00	44	0.2	0.1%	0.1%
Electric Power	0.00	7	0.02	0.1%	0.01%

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Table F-5	Critical List for the Low Activity Waste Transfer Pinned to the WTD requested by BNFL, Ranked by Contribution of Mission Function to Expected Schedule Delay				
BRIEF DESCRIPTION	**EXPECTED NUMBER OF DELAY EVENTS**	**EXPECTED DELAY PER EVENT (HRS)**	**TOTAL EXPECTED DELAY TIME (HRS)**	**PERCENT CONTRIBUTION TO NUMBER OF EVENTS**	**PERCENT CONTRIBUTION TO TOTAL DELAY**
Total	**5.6**	**42**	**236**	**100%**	**100%**
Transfer LAW from AP-102 to BNFL	1.5	98	151	27.8%	64.0%
Safety	3.9	20	77	69.9%	32.5%
Flush	0.1	113	7	1.1%	2.8%
Support	0.1	23	2	1.2%	0.7%

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Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN296-VTA-FTP-901	AN Farm	296-A-30 Exhaust Stack	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	4	2	Not Avail
AN296-VTA-FTP-902	AN Farm	296-A-30 Exhaust Stack	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	4	2	Not Avail
AN296-VTA-PDI-901	AN Farm	296-A-30 Exhaust Stack	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	4	2	Not Avail
AN296-VTA-V-902	AN Farm	296-A-30 Exhaust Stack	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020201	4	2	Not Avail
AN296-VTA-V-903	AN Farm	296-A-30 Exhaust Stack	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020201	4	2	Not Avail
AN296-VTA-FQI-920	AN Farm	AN Farm	HVAC Annulus	VTA	FQI	Flow Totalizer Indicator	H-14-020201	4	2	Not Avail
AN241-VTA-EDS-MCC-002	AN Farm	AN Farm	HVAC Annulus	VTA	MCC	Motor Control Center	H-14-020201	3	1	Not Avail
AN241-VTA-SP-102	AN Farm	AN Farm	HVAC Annulus	VTA	SP	Seal Pot	H-14-020201	3	1	Not Avail
AN296-VTA-V-901	AN Farm	AN Farm	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020201	4	2	Not Avail
AN241-VTA-V-120	AN Farm	AN Farm	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020201	3	1	Not Avail
AN241-VTP-PDI-108	AN Farm	AN Farm	HVAC Primary	VTP	PDI	Pressure Differential Indicator	H-14-020101	3	2	Not Avail
AN241-VTP-PDI-109	AN Farm	AN Farm	HVAC Primary	VTP	PDI	Pressure Differential Indicator	H-14-020101	3	2	Not Avail
AN241-VTP-PNL-110	AN Farm	AN Farm	HVAC Primary	VTP	PNL	Panel	H-14-020101	3	2	Not Avail
AN271-VTP-RR-510	AN Farm	AN Farm	HVAC Primary	VTP	RR	Radiation Recorder	H-14-020101	4	1	Not Avail
AN241-VTP-V-116	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-117	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-118	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-119	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-124	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-125	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-126	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-127	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-128	AN Farm	AN Farm	HVAC Primary	VTP	V	2-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-129	AN Farm	AN Farm	HVAC Primary	VTP	V	Gate Valve	H-14-020101	3	2	Not Avail
AN04A-WT-SN-636	AN Farm	AN Farm	Transfer	WT	PIPE	Pipe Segment	ES-314E-M40	1	8	Not Avail
AN241-VTA-DMST-003	AN Farm	AN Farm A Train	HVAC Annulus	VTA	DMST	Demister	H-14-020201	3	1	Not Avail
AN241-VTA-EF-003	AN Farm	AN Farm A Train	HVAC Annulus	VTA	EF	Exhaust Fan	H-14-020201	3	1	Not Avail
AN241-VTA-FLT-701	AN Farm	AN Farm A Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020201	3	1	Not Avail
AN241-VTA-FLT-702	AN Farm	AN Farm A Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-101	AN Farm	AN Farm A Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-701	AN Farm	AN Farm A Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-702	AN Farm	AN Farm A Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-703	AN Farm	AN Farm A Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-704	AN Farm	AN Farm A Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-HTR-003	AN Farm	AN Farm A Train	HVAC Annulus	VTA	HTR	Heater	H-14-020201	3	1	Not Avail
AN241-VTA-PDI-701	AN Farm	AN Farm A Train	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-PDI-702	AN Farm	AN Farm A Train	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-PDI-703	AN Farm	AN Farm A Train	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-PDS-710	AN Farm	AN Farm A Train	HVAC Annulus	VTA	PDS	Pressure Differential Switch	H-14-020201	3	1	Not Avail
AN241-VTA-TDC-709	AN Farm	AN Farm A Train	HVAC Annulus	VTA	TDC	Temperature Differential Controller	H-14-020201	3	1	Not Avail
AN241-VTA-TE-709A	AN Farm	AN Farm A Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020201	3	1	Not Avail
AN241-VTA-TE-709B	AN Farm	AN Farm A Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020201	3	1	Not Avail
AN241-VTA-TI-701	AN Farm	AN Farm A Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-TI-702	AN Farm	AN Farm A Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-V-702	AN Farm	AN Farm A Train	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-703	AN Farm	AN Farm A Train	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-115	AN Farm	AN Farm A Train	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-701	AN Farm	AN Farm A Train	HVAC Annulus	VTA	V	Gate Valve	H-14-020201	3	1	Not Avail
AN241-VTP-DMST-001	AN Farm	AN Farm A Train	HVAC Primary	VTP	DMST	HVAC Demister	H-14-020101	3	2	Not Avail
AN241-VTP-EF-001	AN Farm	AN Farm A Train	HVAC Primary	VTP	EF	Exhaust Fan	H-14-020101	3	2	Not Avail
AN241-VTP-FLT-302	AN Farm	AN Farm A Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020101	3	2	Not Avail
AN241-VTP-FLT-303	AN Farm	AN Farm A Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020101	3	2	Not Avail
AN241-VTP-FLT-301	AN Farm	AN Farm A Train	HVAC Primary	VTP	FLT	Pre-Filter	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-301	AN Farm	AN Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN241-VTP-FTP-302	AN Farm	AN Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-303	AN Farm	AN Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-304	AN Farm	AN Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-305	AN Farm	AN Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-306	AN Farm	AN Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-307	AN Farm	AN Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-HTR-001	AN Farm	AN Farm A Train	HVAC Primary	VTP	HTR	Heater	H-14-020101	3	2	Not Avail
AN241-VTP-MOV-301	AN Farm	AN Farm A Train	HVAC Primary	VTP	MOV	Motor Operated Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTP-PDIS-307	AN Farm	AN Farm A Train	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020101	3	2	Not Avail
AN241-VTP-PDIS-308	AN Farm	AN Farm A Train	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020101	3	2	Not Avail
AN241-VTP-PDIS-309	AN Farm	AN Farm A Train	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020101	3	2	Not Avail
AN241-VTP-PDS-310	AN Farm	AN Farm A Train	HVAC Primary	VTP	PDS	Pressure Differential Switch	H-14-020101	3	2	Not Avail
AN241-VTP-TDC-306	AN Farm	AN Farm A Train	HVAC Primary	VTP	TDC	Temperature Differential Controller	H-14-020101	3	2	Not Avail
AN241-VTP-TDR-301	AN Farm	AN Farm A Train	HVAC Primary	VTP	TDR	Temperature Differential Recorder	H-14-020101	3	2	Not Avail
AN241-VTP-TDS-306	AN Farm	AN Farm A Train	HVAC Primary	VTP	TDS	Temperature Differential Switch	H-14-020101	3	2	Not Avail
AN241-VTP-TE-306A	AN Farm	AN Farm A Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TE-306B	AN Farm	AN Farm A Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TE-306C	AN Farm	AN Farm A Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TE-306D	AN Farm	AN Farm A Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TI-301	AN Farm	AN Farm A Train	HVAC Primary	VTP	TI	Temperature Indicator	H-14-020101	3	2	Not Avail
AN241-VTP-TI-302	AN Farm	AN Farm A Train	HVAC Primary	VTP	TI	Temperature Indicator	H-14-020101	3	2	Not Avail
AN241-VTP-TS-306	AN Farm	AN Farm A Train	HVAC Primary	VTP	TS	HVAC Temperature Switch	H-14-020101	3	2	Not Avail
AN241-VTP-V-302	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-303	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-304	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-305	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-306	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-307	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-108	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-109	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-301	AN Farm	AN Farm A Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTA-DMST-004	AN Farm	AN Farm B Train	HVAC Annulus	VTA	DMST	Demister	H-14-020201	3	1	Not Avail
AN241-VTA-EF-004	AN Farm	AN Farm B Train	HVAC Annulus	VTA	EF	Exhaust Fan	H-14-020201	3	1	Not Avail
AN241-VTA-FLT-801	AN Farm	AN Farm B Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020201	3	1	Not Avail
AN241-VTA-FLT-802	AN Farm	AN Farm B Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-102	AN Farm	AN Farm B Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-801	AN Farm	AN Farm B Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-802	AN Farm	AN Farm B Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-803	AN Farm	AN Farm B Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-FTP-804	AN Farm	AN Farm B Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	3	1	Not Avail
AN241-VTA-HTR-004	AN Farm	AN Farm B Train	HVAC Annulus	VTA	HTR	Heater	H-14-020201	3	1	Not Avail
AN241-VTA-PDI-801	AN Farm	AN Farm B Train	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-PDI-802	AN Farm	AN Farm B Train	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-PDI-803	AN Farm	AN Farm B Train	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-PDS-810	AN Farm	AN Farm B Train	HVAC Annulus	VTA	PDS	Pressure Differential Switch	H-14-020201	3	1	Not Avail
AN241-VTA-TDC-809	AN Farm	AN Farm B Train	HVAC Annulus	VTA	TDC	Temperature Differential Controller	H-14-020201	3	1	Not Avail
AN241-VTA-TE-809A	AN Farm	AN Farm B Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020201	3	1	Not Avail
AN241-VTA-TE-809B	AN Farm	AN Farm B Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020201	3	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN241-VTA-TI-801	AN Farm	AN Farm B Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-TI-802	AN Farm	AN Farm B Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020201	3	1	Not Avail
AN241-VTA-V-802	AN Farm	AN Farm B Train	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-803	AN Farm	AN Farm B Train	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-804	AN Farm	AN Farm B Train	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-805	AN Farm	AN Farm B Train	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-118	AN Farm	AN Farm B Train	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020201	3	1	Not Avail
AN241-VTA-V-801	AN Farm	AN Farm B Train	HVAC Annulus	VTA	V	Gate Valve	H-14-020201	3	1	Not Avail
AN241-VTP-DMST-002	AN Farm	AN Farm B Train	HVAC Primary	VTP	DMST	HVAC Demister	H-14-020101	3	2	Not Avail
AN241-VTP-EF-002	AN Farm	AN Farm B Train	HVAC Primary	VTP	EF	Exhaust Fan	H-14-020101	3	2	Not Avail
AN241-VTP-FLT-402	AN Farm	AN Farm B Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020101	3	2	Not Avail
AN241-VTP-FLT-403	AN Farm	AN Farm B Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020101	3	2	Not Avail
AN241-VTP-FLT-401	AN Farm	AN Farm B Train	HVAC Primary	VTP	FLT	Pre-Filter	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-401	AN Farm	AN Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-402	AN Farm	AN Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-403	AN Farm	AN Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-404	AN Farm	AN Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-405	AN Farm	AN Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-406	AN Farm	AN Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-FTP-407	AN Farm	AN Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	3	2	Not Avail
AN241-VTP-HTR-002	AN Farm	AN Farm B Train	HVAC Primary	VTP	HTR	Heater	H-14-020101	3	2	Not Avail
AN241-VTP-MOV-401	AN Farm	AN Farm B Train	HVAC Primary	VTP	MOV	HVAC Motor Operated Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTP-PDIS-407	AN Farm	AN Farm B Train	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020101	3	2	Not Avail
AN241-VTP-PDIS-408	AN Farm	AN Farm B Train	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020101	3	2	Not Avail
AN241-VTP-PDIS-409	AN Farm	AN Farm B Train	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020101	3	2	Not Avail
AN241-VTP-PDS-410	AN Farm	AN Farm B Train	HVAC Primary	VTP	PDS	Pressure Differential Switch	H-14-020101	3	2	Not Avail
AN241-VTP-TDC-406	AN Farm	AN Farm B Train	HVAC Primary	VTP	TDR	Temperature Differential Recorder	H-14-020101	3	2	Not Avail
AN241-VTP-TDR-401	AN Farm	AN Farm B Train	HVAC Primary	VTP	TDR	Temperature Differential Recorder	H-14-020101	3	2	Not Avail
AN241-VTP-TDS-406	AN Farm	AN Farm B Train	HVAC Primary	VTP	TDS	Temperature Differential Switch	H-14-020101	3	2	Not Avail
AN241-VTP-TE-406A	AN Farm	AN Farm B Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TE-406B	AN Farm	AN Farm B Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TE-406C	AN Farm	AN Farm B Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TE-406D	AN Farm	AN Farm B Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020101	3	2	Not Avail
AN241-VTP-TI-401	AN Farm	AN Farm B Train	HVAC Primary	VTP	TI	Temperature Indicator	H-14-020101	3	2	Not Avail
AN241-VTP-TI-402	AN Farm	AN Farm B Train	HVAC Primary	VTP	TI	Temperature Indicator	H-14-020101	3	2	Not Avail
AN241-VTP-TS-406	AN Farm	AN Farm B Train	HVAC Primary	VTP	TS	HVAC Temperature Switch	H-14-020101	3	2	Not Avail
AN241-VTP-V-402	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-403	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-404	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-405	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-406	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-407	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-110	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-111	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-401	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-130	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	Gate Valve	H-14-020101	3	2	Not Avail
AN241-VTP-V-131	AN Farm	AN Farm B Train	HVAC Primary	VTP	V	Gate Valve	H-14-020101	3	2	Not Avail
AN241-VTA-V-129	AN Farm	AN Farm Seal Pot SP-102	HVAC Annulus	VTA	V	Gate Valve	H-14-020201	3	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN241-VTA-V-130	AN Farm	AN Farm Seal Pot SP-102	HVAC Annulus	VTA	V	Gate Valve	H-14-020201	3	1	Not Avail
AN296-VTP-CAM-510	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	CAM	HVAC Continuous Air Monitor	H-14-020101	4	1	Not Avail
AN296-VTP-FCV-513	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FCV	Flow Control Valve	H-14-020101	4	1	Not Avail
AN296-VTP-FCV-523	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FCV	Flow Control Valve	H-14-020101	4	1	Not Avail
AN296-VTP-FI-520	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FI	HVAC Flow Indicator	H-14-020101	4	1	Not Avail
AN296-VTP-F-(ANXX3)	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FLT	Filter	H-14-020101	4	1	Not Avail
AN296-VTP-FLT-520	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FLT	Record Sample Filter	H-14-020101	4	1	Not Avail
AN296-VTP-FQI-520	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FQI	Flow Totalizer Indicator	H-14-020101	4	1	Not Avail
AN296-VTP-FSL-512	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FSL	Flow Switch Low	H-14-020101	4	1	Not Avail
AN296-VTP-FSL-522	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	FSL	Flow Switch Low	H-14-020101	4	1	Not Avail
AN296-VTP-P-514	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	P	HVAC Pump	H-14-020101	4	1	Not Avail
AN296-VTP-P-524	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	P	HVAC Pump	H-14-020101	4	1	Not Avail
AN296-VTP-PI-511	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	PI	Pressure Indicator	H-14-020101	4	1	Not Avail
AN296-VTP-PI-521	AN Farm	AN296-VTP-ENCL-500	HVAC Primary	VTP	PI	Pressure Indicator	H-14-020101	4	1	Not Avail
AN296-VTA-CAM-910	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	CAM	Continuous Air Monitor	H-14-020201	4	2	Not Avail
AN296-VTA-F-906A	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	F	Fan	H-14-020201	4	2	Not Avail
AN296-VTA-F-906B	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	F	Fan	H-14-020201	4	2	Not Avail
AN296-VTA-FCV-913	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FCV	Flow Control Valve	H-14-020201	4	2	Not Avail
AN296-VTA-FCV-923	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FCV	Flow Control Valve	H-14-020201	4	2	Not Avail
AN296-VTA-FI-920	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FI	Flow Indicator	H-14-020201	4	2	Not Avail
AN296-VTA-F-(ANXX1)	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FLT	Filter	H-14-020201	4	2	Not Avail
AN296-VTA-F-(ANXX2)	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FLT	Filter	H-14-020201	4	2	Not Avail
AN296-VTA-F-(ANXX3)	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FLT	Filter	H-14-020201	4	2	Not Avail
AN296-VTA-FLT-920	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FLT	Record Sample Filter	H-14-020201	4	2	Not Avail
AN296-VTA-FSL-912	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020201	4	2	Not Avail
AN296-VTA-FSL-922	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020201	4	2	Not Avail
AN296-VTA-HM-901	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	HM	Hour Meter	H-14-020201	4	2	Not Avail
AN296-VTA-HTR-907	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	HTR	Heater	H-14-020201	4	2	Not Avail
AN296-VTA-P-914	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	P	Pump	H-14-020201	4	2	Not Avail
AN296-VTA-P-924	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	P	Pump	H-14-020201	4	2	Not Avail
AN296-VTA-PI-911	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020201	4	2	Not Avail
AN296-VTA-PI-920	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020201	4	2	Not Avail
AN296-VTA-TS-906	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020201	4	2	Not Avail
AN296-VTA-TS-907	AN Farm	Annulus Exhaust Stack CAM Enclosure AN296-VTA-ENCL-900	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020201	4	2	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN241-VTA-CASS-C-1324	AN Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020201	3	1	Not Avail
AN241-VTA-CASS-C-1325	AN Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020201	3	1	Not Avail
AN242A-VTA-CASS-C-1364	AN Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020201	4	2	Not Avail
AN2750E-WSTA-CASS-C-1147	AN Farm	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020501	8	0	Not Avail
AN241-VTP-CASS-C-1323	AN Farm	Bldg 2750	HVAC Primary	VTP	CASS	Computer Automated Surveillance Station	H-14-020101	3	2	Not Avail
AN242A-VTA-PSH-ANK21	AN Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	PSH	Pressure Switch High	H-14-020201	4	2	Not Avail
AN242A-VTA-PSH-ANK22	AN Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	PSH	Pressure Switch High	H-14-020201	4	2	Not Avail
AN242A-VTA-QS-AN271	AN Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	QS	General Alarm	H-14-020201	4	2	Not Avail
AN242A-VTA-RSH-ANK2	AN Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	RSH	Radiation Switch High	H-14-020201	4	2	Not Avail
AN242A-VTA-RXS-ANK2	AN Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	RXS	Radiation Failure Switch	H-14-020201	4	2	Not Avail
AN241-VTA-PDAL-710	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	VTA	PDAL	Pressure Differential Alarm Low	H-14-020201	3	1	Not Avail
AN241-VTA-PDAL-810	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	VTA	PDAL	Pressure Differential Alarm Low	H-14-020201	3	1	Not Avail
AN271-VTA-RAH-910	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	VTA	RAH	Radiation Alarm High	H-14-020201	4	2	Not Avail
AN241-VTA-XA-709	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020201	3	1	Not Avail
AN241-VTA-XA-809	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020201	3	1	Not Avail
AN271-VTA-XA-910	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020201	4	2	Not Avail
AN271-VTP-RR-510	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	VTP	RR	Radiation Recorder	H-14-020201	4	2	Not Avail
AN271-WSTA-RR-102	AN Farm	Instr Bldg 241-AN-271	HVAC Annulus	WSTA	RR	Radiation Recorder	H-14-020501	8	0	Not Avail
AN241-VTP-PDAH-307	AN Farm	Instr Bldg 241-AN-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020101	3	2	Not Avail
AN241-VTP-PDAH-308	AN Farm	Instr Bldg 241-AN-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020101	3	2	Not Avail
AN241-VTP-PDAH-407	AN Farm	Instr Bldg 241-AN-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020101	3	2	Not Avail
AN241-VTP-PDAH-408	AN Farm	Instr Bldg 241-AN-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020101	3	2	Not Avail
AN241-VTP-XA-310	AN Farm	Instr Bldg 241-AN-271	HVAC Primary	VTP	PDAL	Pressure Differential Alarm Low	H-14-020101	3	2	Not Avail
AN241-VTP-XA-306	AN Farm	Instr Bldg 241-AN-271	HVAC Primary	VTP	TDAL	Temperature Differential Alarm Low	H-14-020101	3	2	Not Avail
AN241-VTP-HS	AN Farm	Primary Exhaust Fan Control Panel	HVAC Primary	VTP	HS	2-Position Hand Switch	H-14-020101	3	2	Not Avail
AN104-VTA-FTP-104	AN-101/AN-104	AN Farm Vent Instr Pit 2	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	2	1	Not Avail
AN241-SHM-N2 Carrier Canister	AN-104	AN Farm	Hydrogen Monitoring	SHM	CAN	Canister	H-14-020101	5	0	Not Avail
AN241-SHM-Span Gas Canister	AN-104	AN Farm	Hydrogen Monitoring	SHM	CAN	Canister	H-14-020101	5	0	Not Avail
AN241-SHM-HT-156D	AN-104	AN Farm	Hydrogen Monitoring	SHM	HT	Heat Trace	H-14-020101	5	0	Not Avail
AN241-SHM-NAH-155D	AN-104	AN Farm	Hydrogen Monitoring	SHM	NAH	Gas Alarm High	H-14-020101	5	0	Not Avail
AN241-SHM-P-150D	AN-104	AN Farm	Hydrogen Monitoring	SHM	P	Pump	H-14-020101	5	0	Not Avail
AN241-SHM-PCV-154D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PCV	Pressure Control Valve	H-14-020101	5	0	Not Avail
AN241-SHM-PCV-155D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PCV	Pressure Control Valve	H-14-020101	5	0	Not Avail
AN241-SHM-PCV-156D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PCV	Pressure Control Valve	H-14-020101	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN241-SHM-PI-154D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PI	Pressure Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-PI-155D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PI	Pressure Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-PI-156D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PI	Pressure Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-PI-157D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PI	Pressure Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-PI-158D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PI	Pressure Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-PI-159D	AN-104	AN Farm	Hydrogen Monitoring	SHM	PI	Pressure Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-SV-131D	AN-104	AN Farm	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-132D	AN-104	AN Farm	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-133D	AN-104	AN Farm	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-134D	AN-104	AN Farm	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-126D	AN-104	AN Farm	Hydrogen Monitoring	SHM	SV	Sample Check Valve	H-14-020101	5	0	Not Avail
AN241-SHM-TE-150D	AN-104	AN Farm	Hydrogen Monitoring	SHM	TE	Temperature Element	H-14-020101	5	0	Not Avail
AN241-SHM-TE-156D	AN-104	AN Farm	Hydrogen Monitoring	SHM	TE	Temperature Element	H-14-020101	5	0	Not Avail
AN241-SHM-XA-163D	AN-104	AN Farm	Hydrogen Monitoring	SHM	XA	Failure Alarm	H-14-020101	5	0	Not Avail
AN241-SHM-SV-103A	AN-104	Hydrogen Monitor Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Hyd Monitoring 2-Way Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-105A	AN-104	Hydrogen Monitor Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Hyd Monitoring 2-Way Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-116A	AN-104	Hydrogen Monitor Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Hyd Monitoring 2-Way Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-125A	AN-104	Hydrogen Monitor Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Hyd Monitoring 2-Way Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-104A	AN-104	Hydrogen Monitor Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Hyd Monitoring Check Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-124A	AN-104	Hydrogen Monitor Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Needle Valve	H-14-020101	5	0	Not Avail
AN241-SHM-HTR-160D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	HTR	Heater	H-14-020101	5	0	Not Avail
AN241-SHM-JY-150D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	JY	Power Equipment	H-14-020101	5	0	Not Avail
AN241-SHM-JY-156D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	JY	Power Equipment	H-14-020101	5	0	Not Avail
AN241-SHM-NAH-154D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	NAH	Gas Alarm High	H-14-020101	5	0	Not Avail
AN241-SHM-NE-154D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	NE	Gas Monitoring Element	H-14-020101	5	0	Not Avail
AN241-SHM-NE-155D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	NE	Gas Monitoring Element	H-14-020101	5	0	Not Avail
AN241-SHM-NIT-154D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	NIT	Gas Indicating Transmitter	H-14-020101	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN241-SHM-NIT-155D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	NIT	Gas Indicating Transmitter	H-14-020101	5	0	Not Avail
AN241-SHM-NR-154D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	NR	Gas Recorder	H-14-020101	5	0	Not Avail
AN241-SHM-PDI-151D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	PDI	Pressure Differential Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-PDIT-152D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	PDIT	Pressure Differential Indicating Transmitter	H-14-020101	5	0	Not Avail
AN241-SHM-PI-153D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	PI	Pressure Indicator	H-14-020101	5	0	Not Avail
AN241-SHM-SOV-150D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SOV	Solenoid Operated Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SOV-151D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SOV	Solenoid Operated Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SOV-152D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SOV	Solenoid Operated Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SOV-153D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SOV	Solenoid Operated Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SOV-154D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SOV	Solenoid Operated Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-103D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-105D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-106D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-107D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-108D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-111D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-112D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-115D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-116D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-117D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-118D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-119D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-120D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-121D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-122D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-123D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-125D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN241-SHM-SV-144D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-146D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-147D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-148D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-149D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-150D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-151D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	2-Way Sample Ball Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-104D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Check Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-140D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Gate Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-141D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Gate Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-142D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Gate Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-143D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Gate Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-124D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Needle Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-145D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Needle Valve	H-14-020101	5	0	Not Avail
AN241-SHM-SV-152D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	SV	Sample Needle Valve	H-14-020101	5	0	Not Avail
AN241-SHM-TAHL-162D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	TAHL	Temperature Alarm High Low	H-14-020101	5	0	Not Avail
AN241-SHM-TAL-150D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	TAL	Temperature Alarm Low	H-14-020101	5	0	Not Avail
AN241-SHM-TE-162D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	TE	Temperature Element	H-14-020101	5	0	Not Avail
AN241-SHM-TIS-162D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	TIS	Temperature Indicating Switch	H-14-020101	5	0	Not Avail
AN241-SHM-TSL-150D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	TSL	Temperature Switch Low	H-14-020101	5	0	Not Avail
AN241-SHM-TSL-156D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	TSL	Temperature Switch Low	H-14-020101	5	0	Not Avail
AN241-SHM-YYC-101D	AN-104	Hydrogen Monitoring Cabinet PNL-105D	Hydrogen Monitoring	SHM	YYC	Programmable Logic Controller	H-14-020101	5	0	Not Avail
AN105-VTP-F-AN105XX1	AN-104	Tank AN-104	HVAC Primary	VTP	FLT	Filter	H-14-020101	2	3	Not Avail
AN241-SHM-P-150A	AN-104	Tank AN-104	Hydrogen Monitoring	SHM	P	Hyd Monitoring Pump	H-14-102086		0	Not Avail
AN241-SHM-SV-126A	AN-104	Tank AN-104	Hydrogen Monitoring	SHM	SV	Hyd Monitoring Check Valve	H-14-020101	5	0	Not Avail
AN05C-WSTA-ENCL-005	AN-105	AN Farm	Monitoring	WSTA	ENCL	Transmitter Enclosure	H-14-020501	5	0	Not Avail
AZ156-WST-SS-103	AN-105	AN Farm Control Bldg	Transfer	WST	HS	2-Position Hand Switch	H-14-102451	2	0	Not Avail
AZ156-WST-II-101	AN-105	AN Farm Control Bldg	Transfer	WST	II	Current Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-II-102	AN-105	AN Farm Control Bldg	Transfer	WST	II	Current Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-II-103	AN-105	AN Farm Control Bldg	Transfer	WST	II	Current Indicator	H-14-102451	2	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AZ156-WST-II-104	AN-105	AN Farm Control Bldg	Transfer	WST	II	Current Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-II-122	AN-105	AN Farm Control Bldg	Transfer	WST	II	Current Indicator	H-14-102451	3	0	Not Avail
AZ156-WST-LI-222	AN-105	AN Farm Control Bldg	Transfer	WST	LI	Level Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-PI-102-1	AN-105	AN Farm Control Bldg	Transfer	WST	PI	Pressure Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-SC-101	AN-105	AN Farm Control Bldg	Transfer	WST	SC	Speed Controller	H-14-102451	2	0	Not Avail
AZ156-WST-SC-102	AN-105	AN Farm Control Bldg	Transfer	WST	SC	Speed Controller	H-14-102451	2	0	Not Avail
AZ156-WST-SC-103	AN-105	AN Farm Control Bldg	Transfer	WST	SC	Speed Controller	H-14-102451	2	0	Not Avail
AZ156-WST-SC-104	AN-105	AN Farm Control Bldg	Transfer	WST	SC	Speed Controller	H-14-102451	2	0	Not Avail
AZ156-WST-SI-101	AN-105	AN Farm Control Bldg	Transfer	WST	SI	Speed/Velocity Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-SI-102	AN-105	AN Farm Control Bldg	Transfer	WST	SI	Speed/Velocity Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-SI-103	AN-105	AN Farm Control Bldg	Transfer	WST	SI	Speed/Velocity Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-SI-104	AN-105	AN Farm Control Bldg	Transfer	WST	SI	Speed/Velocity Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-SS-101	AN-105	AN Farm Control Bldg	Transfer	WST	SS	2-Position Hand Switch	H-14-102451	2	0	Not Avail
AZ156-WST-SS-102	AN-105	AN Farm Control Bldg	Transfer	WST	SS	2-Position Hand Switch	H-14-102451	2	0	Not Avail
AZ156-WST-SS-104	AN-105	AN Farm Control Bldg	Transfer	WST	SS	2-Position Hand Switch	H-14-102451	2	0	Not Avail
AZ156-WST-SS-122	AN-105	AN Farm Control Bldg	Transfer	WST	SS	2-Position Hand Switch	H-14-102451	3	0	Not Avail
AZ156-WST-TAHL-273	AN-105	AN Farm Control Bldg	Transfer	WST	TAHL	Temperature Alarm High Low	H-14-102451	2	0	Not Avail
AZ156-WST-TI-157	AN-105	AN Farm Control Bldg	Transfer	WST	TI	Temperature Indicator	H-14-102451	3	0	Not Avail
AZ156-WST-TI-204	AN-105	AN Farm Control Bldg	Transfer	WST	TI	Temperature Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-TI-205	AN-105	AN Farm Control Bldg	Transfer	WST	TI	Temperature Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-TI-206	AN-105	AN Farm Control Bldg	Transfer	WST	TI	Temperature Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-TI-210	AN-105	AN Farm Control Bldg	Transfer	WST	TI	Temperature Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-TI-211	AN-105	AN Farm Control Bldg	Transfer	WST	TI	Temperature Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-TI-212	AN-105	AN Farm Control Bldg	Transfer	WST	TI	Temperature Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-VFD-101	AN-105	AN Farm Control Bldg	Transfer	WST	VDF	Variable Frequency Drive	H-14-102451	2	0	Not Avail
AZ156-WST-VFD-102	AN-105	AN Farm Control Bldg	Transfer	WST	VFD	Variable Frequency Drive	H-14-102451	2	0	Not Avail
AZ156-WST-VFD-103	AN-105	AN Farm Control Bldg	Transfer	WST	VFD	Variable Frequency Drive	H-14-102451	2	0	Not Avail
AZ156-WST-VFD-104	AN-105	AN Farm Control Bldg	Transfer	WST	VFD	Variable Frequency Drive	H-14-102451	2	0	Not Avail
AZ156-WST-VI-202	AN-105	AN Farm Control Bldg	Transfer	WST	VI	Vibration Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-VI-203	AN-105	AN Farm Control Bldg	Transfer	WST	VI	Vibration Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-VI-208	AN-105	AN Farm Control Bldg	Transfer	WST	VI	Vibration Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-VI-209	AN-105	AN Farm Control Bldg	Transfer	WST	VI	Vibration Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-YL-101A	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-101B	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-101C	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-102A	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-102B	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-102C	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-103A	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-103B	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-103C	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-103D	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-104A	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-104B	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-104C	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-YL-204D	AN-105	AN Farm Control Bldg	Transfer	WST	YL	Event/State Light	H-14-102451	2	0	Not Avail
AZ156-WST-ZI-201	AN-105	AN Farm Control Bldg	Transfer	WST	ZI	Position Indicator	H-14-102451	2	0	Not Avail
AZ156-WST-ZI-207	AN-105	AN Farm Control Bldg	Transfer	WST	ZI	Position Indicator	H-14-102451	2	0	Not Avail
AZ156-WT-FIC-155	AN-105	AN Farm Control Bldg	Transfer	WT	FIC	Flow Indicating Controller	H-14-102451	3	0	Not Avail
AZ156-WT-HS-122A	AN-105	AN Farm Control Bldg	Transfer	WT	HS	2-Position Hand Switch	H-14-102451	3	0	Not Avail
AZ156-WT-PAL-161	AN-105	AN Farm Control Bldg	Transfer	WT	PAL	Pressure Alarm Low	H-14-102451	3	0	Not Avail
AZ156-WT-PI-154	AN-105	AN Farm Control Bldg	Transfer	WT	PI	Pressure Indicator	H-14-102451	3	0	Not Avail
AZ156-WT-SC-122	AN-105	AN Farm Control Bldg	Transfer	WT	SC	Speed Controller	H-14-102451	3	0	Not Avail
AZ156-WT-SI-122	AN-105	AN Farm Control Bldg	Transfer	WT	SI	Speed/Velocity Indicator	H-14-102451	3	0	Not Avail
AZ156-WT-VFD-122	AN-105	AN Farm Control Bldg	Transfer	WT	VFD	Variable Frequency Drive	H-14-102451	2	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AZ156-WT-YL-122A	AN-105	AN Farm Control Bldg	Transfer	WT	YL	Event/State Light	H-14-102451	3	0	Not Avail
AZ156-WT-YL-122B	AN-105	AN Farm Control Bldg	Transfer	WT	YL	Event/State Light	H-14-102451	3	0	Not Avail
AZ156-WT-YL-122C	AN-105	AN Farm Control Bldg	Transfer	WT	YL	Event/State Light	H-14-102451	3	0	Not Avail
AZ156-WT-ZC-608	AN-105	AN Farm Control Bldg	Transfer	WT	ZC	Position Controller	H-14-102451	3	0	Not Avail
AZ156-WT-ZC-609	AN-105	AN Farm Control Bldg	Transfer	WT	ZC	Position Controller	H-14-102451	3	0	Not Avail
AZ156-WT-ZC-611	AN-105	AN Farm Control Bldg	Transfer	WT	ZC	Position Controller	H-14-102451	3	0	Not Avail
AZ156-WT-ZIC-610	AN-105	AN Farm Control Bldg	Transfer	WT	ZIC	Position Indicator Controller	H-14-102451	3	0	Not Avail
AN05C-WSTA-RE-115	AN-105	AN Farm Leak Detection Pit 05C	Monitoring	WSTA	RE	Radiation Sensing Element	H-14-020501	5	0	Not Avail
AN05C-WSTA-TE-102	AN-105	AN Farm Leak Detection Pit 05C	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-VTP-V-105	AN-105	AN Farm Vent Instrument Pit 103	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	2	3	Not Avail
AN105-WT-PIT-154	AN-105	AN Farm WT-PNL-AN12 Pump and Valve Pit Instr Enclosure	Transfer	WT	PIT	Pressure Indicating Transmitter	H-14-102451	3	0	Not Avail
AN05A-WT-CP113	AN-105	AN-05A Central Pump Pit	Transfer	WT	CP	Control Panel	H-14-020801	3	1	Not Avail
AN05A-WT-CP115	AN-105	AN-05A Central Pump Pit	Transfer	WT	CP	Control Panel	H-14-020801	3	1	Not Avail
AN05A-WT-LDE-137	AN-105	AN-05A Central Pump Pit	Transfer	WT	LDE	AN-05A Pump Pit Leak Detector Element	H-14-102451	3	0	Not Avail
AN05A-WT-LDSTA-137	AN-105	AN-05A Central Pump Pit	Transfer	WT	LDSTA	Leak Detector Station	H-14-020801	3	1	Not Avail
AN05A-WT-LDSTA-138	AN-105	AN-05A Central Pump Pit	Transfer	WT	LDSTA	Leak Detector Station	H-14-020801	3	1	Not Avail
AN05A-WT-(2,3&9)	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	JMP	AN-05A Pump Pit Jumper Assembly	H-14-102451	3	0	Not Avail
AN05A-WT-B(9&10)	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	JMP	AN-05A Pump Pit Jumper Assembly	H-14-102451	3	0	Not Avail
AN05A-WT-MOV-609	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	MOV	3-Way Ball Valve	H-14-102451	3	0	Not Avail
AN05A-WT-MOV-611	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	MOV	3-Way Ball Valve	H-14-102451	3	0	Not Avail
AN05A-WT-10	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-2	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-8	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN105-WT-ZS-609	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	ZS	Position Switch	H-14-102451	3	0	Not Avail
AN105-WT-ZS-610	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	ZS	Position Switch	H-14-102451	3	0	Not Avail
AN105-WT-ZS-611	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	ZS	Position Switch	H-14-102451	3	0	Not Avail
AN105-WT-ZT-610	AN-105	AN-05A Pump Pit	Dilution/Flush	WT	ZT	Position Transmitter	H-14-102451	3	0	Not Avail
AZ156-WT-LDK-159	AN-105	AN-05A Pump Pit	Monitoring	WT	LDK	AN-05A Pump Pit Leak Detector Relay	H-14-102451	3	0	Not Avail
AN05A-WT-V-106	AN-105	AN-05A Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102451	3	0	Not Avail
AN05A-WT-V-XXX	AN-105	AN-05A Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102451	3	0	Not Avail
AN105-WST-VT-208	AN-105	AN-05A Pump Pit	Transfer	WST	VT	Vibration Transmitter	H-14-102451	2	0	Not Avail
AN105-WST-VT-209	AN-105	AN-05A Pump Pit	Transfer	WST	VT	Vibration Transmitter	H-14-102451	2	0	Not Avail
AN05A-WST-ZT-207	AN-105	AN-05A Pump Pit	Transfer	WST	ZT	Position Transmitter	H-14-102451	2	0	Not Avail
AN05A-WT-FE-155	AN-105	AN-05A Pump Pit	Transfer	WT	FE	Flow Element	H-14-102451	3	0	Not Avail
AN05A-WT-A(8)	AN-105	AN-05A Pump Pit	Transfer	WT	JMP	AN-05A Pump Pit Jumper Assembly	H-14-102451	3	0	Not Avail
AN05A-WT-(1,4&5)	AN-105	AN-05A Pump Pit	Transfer	WT	JMP	AN-05A Valve Pit Jumper Assembly	H-14-102451	3	0	Not Avail
AN05A-WT-(5&6)	AN-105	AN-05A Pump Pit	Transfer	WT	JMP	AN-05A Valve Pit Jumper Assembly	H-14-102451	3	0	Not Avail
AN05A-WT-(6,7&8)	AN-105	AN-05A Pump Pit	Transfer	WT	JMP	AN-05A Valve Pit Jumper Assembly	H-14-102451	3	0	Not Avail
AN05A-WT-G(4)	AN-105	AN-05A Pump Pit	Transfer	WT	JMP	AN-05A Valve Pit Jumper Assembly	H-14-102451	3	0	Not Avail
AN05A-WT-MOV-608	AN-105	AN-05A Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102451	3	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN05A-WT-1	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-3	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-4	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-5	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-6	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-7	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-9	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-A	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-G	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-8	AN-105	AN-05A Pump Pit	Transfer	WT	NOZ	AN-05A Pump Pit Jumper Connection	H-14-102451	3	0	Not Avail
AN05A-WT-PE-154	AN-105	AN-05A Pump Pit	Transfer	WT	PE	WT Pump Discharge Pressure Element	H-14-102451	3	0	Not Avail
AN05A-WT-TE-157	AN-105	AN-05A Pump Pit	Transfer	WT	TE	Temperature Element	H-14-102451	3	0	Not Avail
AN105-WT-ZS-608	AN-105	AN-05A Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102451	3	0	Not Avail
ANVPA-WT-SN-265-M25	AN-105	AN-05A Pump Pit to AN-A Valve Pit	Transfer	WT	PIPE	Tank Discharge Pipe Segment	H-14-102451	4	0	Not Avail
AN05B-WT-LDE-138	AN-105	AN-05B Annulus Pump Pit	Transfer	WT	LDE	Leak Detection Element	H-14-020801	3	1	Not Avail
AN05C-WST-ENCL-005	AN-105	AN-05C Leak Detection Pit	Monitoring	WST	ENCL	Transmitter Enclosure	H-14-020601	5	0	Not Avail
AN05C-WT-LDE-139	AN-105	AN-05C Leak Detection Pit	Monitoring	WT	LDE	Leak Detection Element	H-14-020801	3	1	Not Avail
AN05C-WST-V-218	AN-105	AN-105	Instrument Air	WST	V	2-Way Ball Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-220	AN-105	AN-105	Instrument Air	WST	V	Gate Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-216	AN-105	AN-105	Instrument Air	WST	V	Globe valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-217	AN-105	AN-105	Instrument Air	WST	V	Globe valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-219	AN-105	AN-105	Instrument Air	WST	V	Globe valve	H-14-020301	3	0	Not Avail
AN903-WSTA-CAM-105	AN-105	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	CAM	Continuous Air Monitor	H-14-020501	8	0	Not Avail
AN903-WSTA-FCV-105	AN-105	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	FCV	Flow Control Valve	H-14-020501	8	0	Not Avail
AN903-WSTA-F-(AN105-XX1)	AN-105	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	FLT	Filter	H-14-020501	8	0	Not Avail
AN903-WSTA-P-005	AN-105	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	P	Pump	H-14-020501	8	0	Not Avail
AN2750E-WST-CASS-C-1267	AN-105	Bldg 2750	Monitoring	WST	CASS	Computer Automated Surveillance Station	H-14-020601	5	0	Not Avail
AN2750E-WST-CASS-C-1270	AN-105	Bldg 2750	Monitoring	WST	CASS	Computer Automated Surveillance Station	H-14-020601	5	0	Not Avail
AN241-WT-CASS-A-1507	AN-105	Bldg 2750	Transfer	WT	CASS	Computer Automated Surveillance Station	H-14-020801	3	1	Not Avail
AN2750E-WSTA-CASS-C-1161	AN-105	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020501	8	0	Not Avail
AN2750E-WSTA-CASS-C-1150	AN-105	Bldg 2750	Monitoring	WSTA	CASS	Computer Automated Surveillance Station	H-14-020501	5	0	Not Avail
AN2750E-WSTA-CASS-C-1266	AN-105	Bldg 2750	Monitoring	WSTA	CASS	Computer Automated Surveillance Station	H-14-020501	5	0	Not Avail
AN05C-WT-LDS-ANPP	AN-105	Evap Bldg 242-A	Monitoring	WT	LDS	Leak Detector Alarm	H-14-020801	3	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN05C-WT-II-AN1051	AN-105	Evap Bldg 242-A	Transfer	WT	II	Current Indicator	H-14-020801	3	1	Not Avail
AN05C-WT-YS-AN105	AN-105	Evap Bldg 242-A	Transfer	WT	YS	Event/State Switch	H-14-020801	3	1	Not Avail
AN271-WSTA-RAH-105	AN-105	Evaporator Bldg 242-A	HVAC Annulus	WSTA	RAH	Radiation Alarm High	H-14-020501	8	0	Not Avail
AN242A-WSTA-RSH-AN105	AN-105	Evaporator Bldg 242-A	HVAC Annulus	WSTA	RSH	Radiation switch High	H-14-020501	8	0	Not Avail
AN271-WSTA-RAH-115A	AN-105	Evaporator Bldg 242-A	Monitoring	WSTA	RAH	Radiation Alarm High	H-14-020501	5	0	Not Avail
AN271-WSTA-SS-105C	AN-105	Instr Bldg 241-AN-271	Annulus - Other	WSTA	SS	Selector Switch (3 or more positions)	H-14-020501	5	0	Not Avail
AN271-WSTA-SS-105D	AN-105	Instr Bldg 241-AN-271	Annulus - Other	WSTA	SS	Selector Switch (3 or more positions)	H-14-020501	5	0	Not Avail
AN271-WST-LAH-135	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	LAH	Level Alarm High	H-14-020601	5	0	Not Avail
AN271-WST-PAH-115	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	PAH	Pressure Alarm High	H-14-020601	5	0	Not Avail
AN271-WST-PAL-115	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	PAL	Pressure Alarm Low	H-14-020601	5	0	Not Avail
AN271-WST-PR-115	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	PR	Pressure Recorder	H-14-020601	5	0	Not Avail
AN271-WST-PSH-115	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	PSH	Pressure Switch High	H-14-020601	5	0	Not Avail
AN271-WST-PSL-115	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	PSL	Pressure Switch Low	H-14-020601	5	0	Not Avail
AN271-WST-SS-105A	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	SS	Selector Switch (3 or more positions)	H-14-020601	5	0	Not Avail
AN271-WST-SS-105B	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	SS	Selector Switch (3 or more positions)	H-14-020601	5	0	Not Avail
AN271-WST-V-117	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	V	Angle Globe Valve	H-14-020601	5	0	Not Avail
AN271-WST-V-118	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	V	Angle Globe Valve	H-14-020601	5	0	Not Avail
AN271-WST-V-119	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	V	Globe Valve	H-14-020601	5	0	Not Avail
AN271-WST-V-120	AN-105	Instr Bldg 241-AN-271	Monitoring	WST	V	Globe Valve	H-14-020601	5	0	Not Avail
AN271-WSTA-LDA-155	AN-105	Instr Bldg 241-AN-271	Monitoring	WSTA	LDA	Leak Detector Alarm	H-14-020501	5	0	Not Avail
AN271-WT-LY-120	AN-105	Instr Bldg 241-AN-271	Transfer	WT	LY	Alarm Relay (Disconnected)	H-14-020801	3	1	Not Avail
AN271-WSTA-CRM-111	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	CRM	Count Rate Monitor	H-14-020501	5	0	Not Avail
AN271-WSTA-PRM-115	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	PRM	Process Radiation High	H-14-020501	5	0	Not Avail
AN271-WSTA-RIS-115	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	RIS	Radiation Indicating Switch	H-14-020501	5	0	Not Avail
AN242A-WSTA-RSH-AN04C	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	RSH	Radiation Switch High	H-14-020501	5	0	Not Avail
AN271-WSTA-SGI-145	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	SGI	Specific Gravity Indicator	H-14-020501	5	0	Not Avail
AN271-WSTA-V-125	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	V	Angle Globe Valve	H-14-020501	5	0	Not Avail
AN271-WSTA-V-145	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	V	Angle Globe Valve	H-14-020501	5	0	Not Avail
AN271-WSTA-V-135	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	V	Globe Valve	H-14-020501	5	0	Not Avail
AN271-WSTA-WFA-135	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	WFA	Weight Factor Alarm	H-14-020501	5	0	Not Avail
AN271-WSTA-WFAS-135	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	WFAS	Weight Factor Alarm Switch	H-14-020501	5	0	Not Avail
AN271-WSTA-WFI-125	AN-105	Instrument Bldg 241-AN-271	Monitoring	WSTA	WFI	Weight Factor Indicator	H-14-020501	5	0	Not Avail
AN105-VTA-FLT-210	AN-105	Tank AN-105	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020201	2	1	Not Avail
AN105-VTA-FLT-209	AN-105	Tank AN-105	HVAC Annulus	VTA	FLT	Pre-Filter	H-14-020201	2	1	Not Avail
AN105-VTA-FTP-209	AN-105	Tank AN-105	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	2	1	Not Avail
AN105-VTA-FTP-210	AN-105	Tank AN-105	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	2	1	Not Avail
AN105-VTA-PDI-209	AN-105	Tank AN-105	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	2	1	Not Avail
AN105-VTA-PDI-210	AN-105	Tank AN-105	HVAC Annulus	VTA	PDI	Pressure Differential Indicator	H-14-020201	2	1	Not Avail
AN105-VTA-PI-225	AN-105	Tank AN-105	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020201	2	1	Not Avail
AN105-VTA-V-125	AN-105	Tank AN-105	HVAC Annulus	VTA	V	2-Way Ball valve	H-14-020201	2	1	Not Avail
AN105-VTA-V-212	AN-105	Tank AN-105	HVAC Annulus	VTA	V	2-Way Ball valve	H-14-020201	2	1	Not Avail
AN105-VTA-V-227	AN-105	Tank AN-105	HVAC Annulus	VTA	V	2-Way Ball valve	H-14-020201	2	1	Not Avail
AN105-VTA-V-228	AN-105	Tank AN-105	HVAC Annulus	VTA	V	2-Way Ball valve	H-14-020201	2	1	Not Avail
AN105-VTA-V-229	AN-105	Tank AN-105	HVAC Annulus	VTA	V	2-Way Ball valve	H-14-020201	2	1	Not Avail
AN105-VTA-V-205	AN-105	Tank AN-105	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020201	2	1	Not Avail
AN105-VTP-FC-205	AN-105	Tank AN-105	HVAC Primary	VTP	FC	HVAC Flow Controller	H-14-020101	2	3	Not Avail
AN105-VTP-FCV-205	AN-105	Tank AN-105	HVAC Primary	VTP	FCV	Flow Control Valve	H-14-020101	2	3	Not Avail
AN296-VTP-F-(ANXX2)	AN-105	Tank AN-105	HVAC Primary	VTP	FLT	Filter	H-14-020101	4	1	Not Avail
AN105-VTP-FLT-210	AN-105	Tank AN-105	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020101	2	3	Not Avail
AN105-VTP-FLT-209	AN-105	Tank AN-105	HVAC Primary	VTP	FLT	Pre-Filter	H-14-020101	2	3	Not Avail
AN105-VTP-FTP-105	AN-105	Tank AN-105	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	2	3	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN105-VTP-FTP-225	AN-105	Tank AN-105	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	2	3	Not Avail
AN105-VTP-FTP-226	AN-105	Tank AN-105	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	2	3	Not Avail
AN105-VTP-FTP-227	AN-105	Tank AN-105	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	2	3	Not Avail
AN105-VTP-FTP-228	AN-105	Tank AN-105	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	2	3	Not Avail
AN105-VTP-FTP-229	AN-105	Tank AN-105	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	2	3	Not Avail
AN105-VTP-FTP-230	AN-105	Tank AN-105	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020101	2	3	Not Avail
AN105-VTP-PDI-217	AN-105	Tank AN-105	HVAC Primary	VTP	PDI	Pressure Differential Indicator	H-14-020101	2	3	Not Avail
AN105-VTP-PDI-218	AN-105	Tank AN-105	HVAC Primary	VTP	PDI	Pressure Differential Indicator	H-14-020101	2	3	Not Avail
AN105-VTP-PDI-219	AN-105	Tank AN-105	HVAC Primary	VTP	PDI	Pressure Differential Indicator	H-14-020101	2	3	Not Avail
AN105-VTP-PDI-220	AN-105	Tank AN-105	HVAC Primary	VTP	PDI	Pressure Differential Indicator	H-14-020101	2	3	Not Avail
AN105-VTP-SG-205	AN-105	Tank AN-105	HVAC Primary	VTP	SG	Sight Glass	H-14-020101	2	3	Not Avail
AN105-VTP-V-237	AN-105	Tank AN-105	HVAC Primary	VTP	V	2-Gate Valve Assembly	H-14-020101	2	3	Not Avail
AN105-VTP-V-238	AN-105	Tank AN-105	HVAC Primary	VTP	V	2-Gate Valve Assembly	H-14-020101	2	3	Not Avail
AN105-VTP-V-239	AN-105	Tank AN-105	HVAC Primary	VTP	V	2-Gate Valve Assembly	H-14-020101	2	3	Not Avail
AN105-VTP-V-240	AN-105	Tank AN-105	HVAC Primary	VTP	V	2-Gate Valve Assembly	H-14-020101	2	3	Not Avail
AN105-VTP-V-241	AN-105	Tank AN-105	HVAC Primary	VTP	V	2-Gate Valve Assembly	H-14-020101	2	3	Not Avail
AN105-VTP-V-242	AN-105	Tank AN-105	HVAC Primary	VTP	V	2-Gate Valve Assembly	H-14-020101	2	3	Not Avail
AN105-VTP-V-205	AN-105	Tank AN-105	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	2	3	Not Avail
AN105-VTP-V-265	AN-105	Tank AN-105	HVAC Primary	VTP	V	Butterfly Valve	H-14-020101	2	3	Not Avail
AN105-WST-FIV-103	AN-105	Tank AN-105	Monitoring	WST	FIV	Flow Indicating Valve	H-14-020601	5	0	Not Avail
AN105-WST-LE-134	AN-105	Tank AN-105	Monitoring	WST	LE	Level Element	H-14-020601	5	0	Not Avail
AN105-WST-LI-103	AN-105	Tank AN-105	Monitoring	WST	LIT	Level Indicating Transmitter	H-14-020601	5	0	Not Avail
AN105-WST-LIT-104	AN-105	Tank AN-105	Monitoring	WST	LIT	Level Indicating Transmitter	H-14-020601	5	0	Not Avail
AN105-WST-PI-102	AN-105	Tank AN-105	Monitoring	WST	PI	Pressure Indicator	H-14-020601	5	0	Not Avail
AN105-WST-SG-103	AN-105	Tank AN-105	Monitoring	WST	SG	Specific Gravity Indicator	H-14-020601	5	0	Not Avail
AN105-WST-SG-104	AN-105	Tank AN-105	Monitoring	WST	SG	Specific Gravity Indicator	H-14-020601	5	0	Not Avail
AN105-WST-SS-107	AN-105	Tank AN-105	Monitoring	WST	SS	Selector Switch (3 or more positions)	H-14-020601	5	0	Not Avail
AN105-WST-SV-101	AN-105	Tank AN-105	Monitoring	WST	SV	Sample 2-Way Ball Valve	H-14-020601	5	0	Not Avail
AN105-WST-SV-102	AN-105	Tank AN-105	Monitoring	WST	SV	Sample 2-Way Ball Valve	H-14-020601	5	0	Not Avail
AN105-WST-SV-103	AN-105	Tank AN-105	Monitoring	WST	SV	Sample 2-Way Ball Valve	H-14-020601	5	0	Not Avail
AN105-WST-SV-104	AN-105	Tank AN-105	Monitoring	WST	SV	Sample 2-Way Ball Valve	H-14-020601	5	0	Not Avail
AN105-WST-TE-001	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-002	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-003	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-004	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-005	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-006	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-007	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-008	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-009	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-010	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-011	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-012	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-013	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-014	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-015	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-016	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-017	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-018	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-019	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-020	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-021	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-TE-022	AN-105	Tank AN-105	Monitoring	WST	TE	Temperature Element	H-14-020601	5	0	Not Avail
AN105-WST-V-108	AN-105	Tank AN-105	Monitoring	WST	V	2-Way Ball Valve	H-14-020601	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN105-WST-V-109	AN-105	Tank AN-105	Monitoring	WST	V	2-Way Ball Valve	H-14-020601	5	0	Not Avail
AN105-WST-V-130	AN-105	Tank AN-105	Monitoring	WST	V	2-Way Ball Valve	H-14-020601	5	0	Not Avail
AN105-WST-V-135	AN-105	Tank AN-105	Monitoring	WST	V	2-Way Ball Valve	H-14-020601	5	0	Not Avail
AN105-WST-V-131	AN-105	Tank AN-105	Monitoring	WST	V	Angle Globe Valve	H-14-020601	5	0	Not Avail
AN105-WST-V-110	AN-105	Tank AN-105	Monitoring	WST	V	Check Valve	H-14-020601	5	0	Not Avail
AN105-WST-V-132	AN-105	Tank AN-105	Monitoring	WST	V	Globe valve	H-14-020601	5	0	Not Avail
AN105-WSTA-FIV-104	AN-105	Tank AN-105	Monitoring	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020501	5	0	Not Avail
AN105-WSTA-FIV-105	AN-105	Tank AN-105	Monitoring	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020501	5	0	Not Avail
AN105-WSTA-FIV-106	AN-105	Tank AN-105	Monitoring	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020501	5	0	Not Avail
AN105-WSTA-LIS-104	AN-105	Tank AN-105	Monitoring	WSTA	LIS	Level Indicating Switch	H-14-020501	5	0	Not Avail
AN105-WSTA-LIS-105	AN-105	Tank AN-105	Monitoring	WSTA	LIS	Level Indicating Switch	H-14-020501	5	0	Not Avail
AN105-WSTA-LIS-106	AN-105	Tank AN-105	Monitoring	WSTA	LIS	Level Indicating Switch	H-14-020501	5	0	Not Avail
AZ156-WT-LDA-159	AN-105	Tank AN-105	Monitoring	WT	LDA	Leak Detector Alarm	H-14-102451	3	0	Not Avail
AN05C-WT-LDSTA-139	AN-105	Tank AN-105	Monitoring	WT	LDSTA	Leak Detector Station	H-14-020801	3	1	Not Avail
CP122-WT-FI-160	AN-105	Tank AN-105	Nitrogen	WT	FI	Flow Indicator	H-14-102451	3	0	Not Avail
CP122-WT-F-101	AN-105	Tank AN-105	Nitrogen	WT	FLT	Filter	H-14-102451	3	0	Not Avail
CP122-WT-FSH-160	AN-105	Tank AN-105	Nitrogen	WT	FSH	Flow Switch High	H-14-102451	3	0	Not Avail
CP122-WT-PCV-101	AN-105	Tank AN-105	Nitrogen	WT	PCV	Pressure Control Valve	H-14-102451	3	0	Not Avail
CP122-WT-PI-105A	AN-105	Tank AN-105	Nitrogen	WT	PI	Pressure Indicator	H-14-102451	3	0	Not Avail
CP122-WT-PI-105B	AN-105	Tank AN-105	Nitrogen	WT	PI	Pressure Indicator	H-14-102451	3	0	Not Avail
CP122-WT-PI-161	AN-105	Tank AN-105	Nitrogen	WT	PI	Pressure Indicator	H-14-102451	3	0	Not Avail
CP122-WT-PRV-101	AN-105	Tank AN-105	Nitrogen	WT	PRV	Pressure Relief Valve	H-14-102451	3	0	Not Avail
CP122-WT-PS-161	AN-105	Tank AN-105	Nitrogen	WT	PS	Pressure Switch	H-14-102451	3	0	Not Avail
CP122-WT-V-101	AN-105	Tank AN-105	Nitrogen	WT	V	2-Way Ball Valve	H-14-102451	3	0	Not Avail
CP122-WT-V-107	AN-105	Tank AN-105	Nitrogen	WT	V	2-Way Ball Valve	H-14-102451	3	0	Not Avail
CP122-WT-V-XXX	AN-105	Tank AN-105	Nitrogen	WT	V	2-Way Ball Valve	H-14-102451	3	0	Not Avail
CP122-WT-V-102	AN-105	Tank AN-105	Nitrogen	WT	V	Angle Globe Valve	H-14-102451	3	0	Not Avail
CP122-WT-V-103	AN-105	Tank AN-105	Nitrogen	WT	V	Angle Globe Valve	H-14-102451	3	0	Not Avail
CP122-WT-V-104	AN-105	Tank AN-105	Nitrogen	WT	V	Angle Globe Valve	H-14-102451	3	0	Not Avail
CP122-WT-V-105	AN-105	Tank AN-105	Nitrogen	WT	V	Automatic Switch-Over Valve	H-14-102451	3	0	Not Avail
CP122-WT-V-106	AN-105	Tank AN-105	Nitrogen	WT	V	Check Valve	H-14-102451	3	0	Not Avail
AN105-WST-SW-3051-M9	AN-105	Tank AN-105	Service Water	WST	PIPE	Valve Pit Discharge Pipe Segment	H-14-102451	2	0	Not Avail
AN105-WST-V-142	AN-105	Tank AN-105	Service Water	WST	V	Service Water Check Valve	H-14-102451	2	0	Not Avail
AN105-WST-LIT-104	AN-105	Tank AN-105	Transfer	WST	LIT	Level Indicating Transmitter	H-14-102451	2	0	Not Avail
AN105-WST-MTS-101	AN-105	Tank AN-105	Transfer	WST	MTS	Manual Transfer Switch	H-14-102451	2	0	Not Avail
AN105-WST-MTS-102	AN-105	Tank AN-105	Transfer	WST	MTS	Manual Transfer Switch	H-14-102451	2	0	Not Avail
AN105-WST-MTS-103	AN-105	Tank AN-105	Transfer	WST	MTS	Manual Transfer Switch	H-14-102451	2	0	Not Avail
AN105-WST-MTS-104	AN-105	Tank AN-105	Transfer	WST	MTS	Manual Transfer Switch	H-14-102451	2	0	Not Avail
AZ156-WST-IA-XXX-131	AN-105	Tank AN-105	Transfer	WST	PIPE	Pipe Segment	H-14-102451	2	0	Not Avail
AN105-WST-TBX-101	AN-105	Tank AN-105	Transfer	WST	TBX	Terminal Box	H-14-102451	2	0	Not Avail
AN105-WST-TBX-102	AN-105	Tank AN-105	Transfer	WST	TBX	Terminal Box	H-14-102451	2	0	Not Avail
AN105-WST-TBX-103	AN-105	Tank AN-105	Transfer	WST	TBX	Terminal Box	H-14-102451	2	0	Not Avail
AN105-WST-TE-204	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-205	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-206	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-210	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-211	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-212	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-36	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-37	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-38	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN105-WST-TE-39	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-40	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-41	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-42	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-43	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-44	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-45	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-46	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-47	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-48	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-49	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-50	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-51	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-52	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AN105-WST-TE-53	AN-105	Tank AN-105	Transfer	WST	TE	Temperature Element	H-14-102451	2	0	Not Avail
AZ156-WST-TI-XX	AN-105	Tank AN-105	Transfer	WST	TI	Temperature Indicator	H-14-102451	2	0	Not Avail
ENCL-005-WST-V-101	AN-105	Tank AN-105	Transfer	WST	V	Globe Valve	H-14-102451	2	0	Not Avail
AN105-WST-VT-202	AN-105	Tank AN-105	Transfer	WST	VT	Vibration Transmitter	H-14-102451	2	0	Not Avail
AN105-WST-VT-203	AN-105	Tank AN-105	Transfer	WST	VT	Vibration Transmitter	H-14-102451	2	0	Not Avail
AN105-WST-P-001	AN-105	Tank AN-105	Transfer	WST	WMP	Mixer Pump	H-14-102451	2	0	Not Avail
AN105-WST-P-002	AN-105	Tank AN-105	Transfer	WST	WMP	Mixer Pump	H-14-102451	2	0	Not Avail
AN105-WST-ZS-201	AN-105	Tank AN-105	Transfer	WST	ZS	Position Switch	H-14-102451	2	0	Not Avail
AN105-WST-ZS-207	AN-105	Tank AN-105	Transfer	WST	ZS	Position Switch	H-14-102451	2	0	Not Avail
AN105-WST-ZT-201	AN-105	Tank AN-105	Transfer	WST	ZT	Position Transmitter	H-14-102451	2	0	Not Avail
AN05C-WT-CP114	AN-105	Tank AN-105	Transfer	WT	CP	Control Panel	H-14-020801	3	1	Not Avail
AZ156-WT-DI-153	AN-105	Tank AN-105	Transfer	WT	DI	Density Indicator	H-14-102451	3	0	Not Avail
AN05A-WT-241-AN105	AN-105	Tank AN-105	Transfer	WT	DST	AN Tank Farm Double-Shelled Tank	H-14-102451	3	0	Not Avail
AN105-WT-ENCL-110	AN-105	Tank AN-105	Transfer	WT	ENCL	Camera Purge Panel Enclosure	H-14-102451	2	0	Not Avail
AZ156-WT-FAH-160	AN-105	Tank AN-105	Transfer	WT	FAH	Flow Alarm High	H-14-102451	3	0	Not Avail
AZ156-WT-FI-153	AN-105	Tank AN-105	Transfer	WT	FI	Flow Indicator	H-14-102451	3	0	Not Avail
AN105-WT-FIT-155	AN-105	Tank AN-105	Transfer	WT	FIT	Flow Indicating Transmitter	H-14-102451	3	0	Not Avail
AN105-WT-MTS-106	AN-105	Tank AN-105	Transfer	WT	MTS	Manual Transfer Switch	H-14-102451	3	0	Not Avail
AN105-WT-MTS-158	AN-105	Tank AN-105	Transfer	WT	MTS	Manual Transfer Switch	H-14-102451	2	0	Not Avail
AZ156-WT-PAH-156	AN-105	Tank AN-105	Transfer	WT	PAH	Pressure Alarm High	H-14-102451	3	0	Not Avail
AN05A-WT-PRV-102	AN-105	Tank AN-105	Transfer	WT	PRV	Pressure Relief Valve	H-14-102451	3	0	Not Avail
AN05A-WT-PSH-156	AN-105	Tank AN-105	Transfer	WT	PSH	Pressure Switch High	H-14-102451	3	0	Not Avail
AN05A-WT-SL-165-M25	AN-105	Tank AN-105	Transfer	WT	SL	Slurry Pipe Segment	H-14-102451	3	0	Not Avail
AZ156-WT-TI-153	AN-105	Tank AN-105	Transfer	WT	TI	Temperature Indicator	H-14-102451	3	0	Not Avail
AN05A-WT-UE-153	AN-105	Tank AN-105	Transfer	WT	UE	Multivariable Element	H-14-102451	3	0	Not Avail
AZ156-WT-UT-153	AN-105	Tank AN-105	Transfer	WT	UT	Multivariable Transmitter	H-14-102451	3	0	Not Avail
AN105-WT-V-124	AN-105	Tank AN-105	Transfer	WT	V	2-Way Ball Valve	H-14-102451	3	0	Not Avail
AN05A-WT-V-108	AN-105	Tank AN-105	Transfer	WT	V	3-Way Ball Valve	H-14-102451	3	0	Not Avail
AN05A-WT-V-806	AN-105	Tank AN-105	Transfer	WT	V	Check Valve	H-14-102451	3	0	Not Avail
AN05A-WT-P-022	AN-105	Tank AN-105	Transfer	WT	WTP	Transfer Pump	H-14-102451	3	0	Not Avail
AZ156-WT-ZC-158	AN-105	Tank AN-105	Transfer	WT	ZC	Position Controller	H-14-102451	3	0	Not Avail
AN05A-WT-ZE-158	AN-105	Tank AN-105	Transfer	WT	ZE	Position Element	H-14-102451	3	0	Not Avail
AZ156-WT-ZI-158	AN-105	Tank AN-105	Transfer	WT	ZI	Position Indicator	H-14-102451	3	0	Not Avail
AN05A-WT-ZS-158	AN-105	Tank AN-105	Transfer	WT	ZS	Position Switch	H-14-102451	3	0	Not Avail
AN105-WSTA-TE-027	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-028	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-029	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-030	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-031	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-032	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN105-WSTA-TE-033	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-034	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-035	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-054	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-055	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-056	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-057	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-058	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-059	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-060	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-061	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-062	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-063	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-064	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-065	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-066	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-067	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-068	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-069	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-070	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-071	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-072	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-073	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-074	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-075	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-076	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-077	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-078	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-079	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-080	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-081	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-082	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-083	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-084	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-085	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-086	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-087	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-088	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-089	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-090	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-091	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-092	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-093	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-094	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-095	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-096	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-097	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-098	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-099	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-100	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN105-WSTA-TE-101	AN-105	Tank AN-105 Annulus	Monitoring	WSTA	TE	Temperature Element	H-14-020501	5	0	Not Avail
AN05C-WST-PCV-115	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	PCV	Pressure Control Valve	H-14-020301	3	0	Not Avail
AN05C-WST-PI-115	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	PI	Pressure Indicator	H-14-020301	3	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN05C-WST-PRV-115	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	PRV	Pressure Relief Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-222	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-223	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-224	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-225	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-226	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-227	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-228	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-229	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-230	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-234	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve	H-14-020301	3	0	Not Avail
AN05C-WST-V-231	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve (Spare)	H-14-020301	3	0	Not Avail
AN05C-WST-V-232	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve (Spare)	H-14-020301	3	0	Not Avail
AN05C-WST-V-233	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Angle Globe Valve (Spare)	H-14-020301	3	0	Not Avail
AN05C-WST-V-221	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Instrument Air	WST	V	Gate Valve	H-14-020301	3	0	Not Avail
AN05C-WST-FIV-102	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	FIV	Flow Indicating Valve	H-14-020601	5	0	Not Avail
AN05C-WST-PI-115	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	PI	Pressure Indicator	H-14-020601	5	0	Not Avail
AN05C-WST-PI-125	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	PI	Pressure Indicator	H-14-020601	5	0	Not Avail
AN05C-WST-PT-115	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	PT	Pressure Transmitter	H-14-020601	5	0	Not Avail
AN05C-WST-PT-125	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	PT	Pressure Transmitter	H-14-020601	5	0	Not Avail
AN05C-WST-PY-115	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	PY	Pressure Equipment	H-14-020601	5	0	Not Avail
AN05C-WST-PY-125	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	PY	Pressure Equipment	H-14-020601	5	0	Not Avail
AN05C-WST-V-101	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	V	Globe Valve	H-14-020601	5	0	Not Avail
AN05C-WST-V-102	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	V	Globe Valve	H-14-020601	5	0	Not Avail
AN05C-WST-V-106	AN-105	Transmitter Encl AN-05C-WSTA-ENCL-005	Monitoring	WST	V	Globe Valve	H-14-020601	5	0	Not Avail
AN05C-WSTA-FIV-101	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	FIV	Flow Indicating Valve	H-14-020501	5	0	Not Avail
AN05C-WSTA-FIV-102	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	FIV	Flow Indicating Valve	H-14-020501	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AN05C-WSTA-FIV-103	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	FIV	Flow Indicating Valve	H-14-020501	5	0	Not Avail
AN05C-WSTA-HTR-101	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	HTR	Heater	H-14-020501	5	0	Not Avail
AN05C-WSTA-PI-125	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	PI	Pressure Indicator	H-14-020501	5	0	Not Avail
AN05C-WSTA-PI-135	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	PI	Pressure Indicator	H-14-020501	5	0	Not Avail
AN05C-WSTA-PI-145	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	PI	Pressure Indicator	H-14-020501	5	0	Not Avail
AN05C-WSTA-SGT-145	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	SGT	Specific Gravity Transmitter	H-14-020501	5	0	Not Avail
AN05C-WSTA-V-101	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	V	2-Way Globe Valve	H-14-020501	5	0	Not Avail
AN05C-WSTA-V-102	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	V	2-Way Globe Valve	H-14-020501	5	0	Not Avail
AN05C-WSTA-V-103	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	V	2-Way Globe Valve	H-14-020501	5	0	Not Avail
AN05C-WSTA-V-107	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	V	3-Gate Valve Assembly	H-14-020501	5	0	Not Avail
AN05C-WSTA-V-108	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	V	3-Gate Valve Assembly	H-14-020501	5	0	Not Avail
AN05C-WSTA-V-109	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	V	3-Gate Valve Assembly	H-14-020501	5	0	Not Avail
AN271-WSTA-WFT-125	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	WFT	Weight Factor Transmitter	H-14-020501	5	0	Not Avail
AN271-WSTA-WFT-135	AN-105	Transmitter Enclosure AN05C-WSTA-ENCL-005	Monitoring	WSTA	WFT	Weight Factor Transmitter	H-14-020501	5	0	Not Avail
AN105/106-WSTA-241-AN903	AN-105/AN-106	AN Farm Vent Instr Pit 3	HVAC Annulus	WSTA	ENCL	Enclosure	H-14-020501	8	0	Not Avail
AN105-VTA-PI-105	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020201	3	1	Not Avail
AN903-VTA-PS-105	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	VTA	PS	Pressure Switch	H-14-020201	2	1	Not Avail
AN105-VTA-V-112	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020201	2	1	Not Avail
AN903-WSTA-F-103A	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	F	Fan	H-14-020501	8	0	Not Avail
AN903-WSTA-F-103B	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	F	Fan	H-14-020501	8	0	Not Avail
AN903-WSTA-HTR-113	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	HTR	Heater	H-14-020501	8	0	Not Avail
AN903-WSTA-TI-113	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	TI	Temperature Indicator	H-14-020501	8	0	Not Avail
AN903-WSTA-TS-103	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	TS	Temperature Switch	H-14-020501	8	0	Not Avail
AN903-WSTA-TS-113	AN-105/AN-106	Annulus Tanks AN 105/106 CAM Instr Encl 241-AN-903	HVAC Annulus	WSTA	TS	Temperature Switch	H-14-020501	8	0	Not Avail
AN105-VTA-FTP-105	AN-105/AN--106	AN Farm Vent Instr Pit 3	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020201	2	1	Not Avail
AN105-VTA-V-105	AN-105/AN--106	AN Farm Vent Instr Pit 3	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020201	2	1	Not Avail
ANVPA-WT-LDA-162	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDA	Leak Detected Alarm	H-14-102451	4	0	Not Avail
ANVPA-WT-LDA-163	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDA	Leak Detected Alarm	H-14-102451	4	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
ANA-WT-LDE-335	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDE	AN-A Valve Pit Leak Detector Element	H-14-100941	1	0	Not Avail
ANVPA-WT-LDE-331	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDE	AN-A Valve Pit Leak Detector Element	H-14-102451	4	0	Not Avail
ANVPA-WT-LDE-162	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDE	Leak Detector Element	H-14-102451	4	0	Not Avail
ANVPA-WT-LDE-163	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDE	Leak Detector Element	H-14-102451	4	0	Not Avail
ANA-WT-LDK-335	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDK	AN-A Valve Pit Leak Detector Relay	H-14-020802	4	1	Not Avail
ANVPA-WT-LDK-331	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDK	AN-A Valve Pit Leak Detector Relay	H-14-102451	4	0	Not Avail
ANVPA-WT-LDK-162	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDK	Leak Detector Relay	H-14-102451	4	0	Not Avail
ANVPA-WT-LDK-163	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDK	Leak Detector Relay	H-14-102451	4	0	Not Avail
ANVPA-WT-LDK-334	AN-A Valve Pit	AN-A Valve Pit	Monitoring	WT	LDK	Leak Detector Relay	H-14-102451	4	0	Not Avail
ANVPA-WT-L14-L15-L16-(D&E)	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	JMP	AN-A Valve Pit Jumper Assembly	H-14-102451	4	0	Not Avail
ANVPA-WT-L19-(E,F,G&H)	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	JMP	AN-A Valve Pit Jumper Assembly	H-14-102451	4	0	Not Avail
ANVPA-WT-D	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-E	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-F	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-G	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-H	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-L14	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-L15	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-L16	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-L19	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	NOZ	AN-A Valve Pit Jumper Connection	H-14-102451	4	0	Not Avail
ANVPA-WT-V-311	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	2-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-313	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	2-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-315	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	2-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-317	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	2-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-320	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	2-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-802	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	2-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-312	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	3-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-314	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	3-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-316	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	3-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-318	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	3-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-319	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	3-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-V-321	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	V	3-Way Ball Valve	H-14-102451	4	0	Not Avail
ANVPA-WT-ZC-802	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZC	Position Controller	H-14-102451	4	0	Not Avail
AZ156-WT-ZC-318	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZC	Position Controller	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-312	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-314	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-315	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-316	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-317	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
ANVPA-WT-ZS-318	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-319	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-320	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-321	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
ANVPA-WT-ZS-802	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
AZ156-WT-ZS-311	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
AZ156-WT-ZS-313	AN-A Valve Pit	AN-A Valve Pit	Transfer	WT	ZS	Position Switch	H-14-102451	4	0	Not Avail
AN2750E-WT-CASS-A-1503	AN-A Valve Pit	Bldg 2750	Transfer	WT	CASS	Computer Automated Surveillance Station	H-14-020801	5	0	Not Avail
AN2750E-WT-CASS-A-1507	AN-A Valve Pit	Bldg 2750	Transfer	WT	CASS	Computer Automated Surveillance Station	H-14-020801	5	0	Not Avail
AN242A-WT-LDS-ANPP	AN-A Valve Pit	Evaporator Bldg 242-A	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020801	5	0	Not Avail
AN242A-WT-LDS-ANSN2	AN-A Valve Pit	Evaporator Bldg 242-A	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020801	5	0	Not Avail
AN241-WT-LDSTA-146	AN-A Valve Pit	Leak Detector Station 146	Monitoring	WT	LDSTA	Leak Detector Station	H-14-020801	5	0	Not Avail
AN241-WT-LDSTA-148	AN-A Valve Pit	Leak Detector Station 148	Monitoring	WT	LDSTA	Leak Detector Station	H-14-020801	5	0	Not Avail
AN241-WT-LDSTA-149	AN-B Valve Pit	Leak Detector Station 149	Monitoring	WT	LDSTA	Leak Detector Station	H-14-020801	6	0	Not Avail
AP296-VTP-FTP-502	AP Farm	296-A-40 Primary Exhaust Stack	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	3	1	Not Avail
AP296-VTP-FTP-503	AP Farm	296-A-40 Primary Exhaust Stack	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	3	1	Not Avail
AP296-VTP-FTP-504	AP Farm	296-A-40 Primary Exhaust Stack	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	3	1	Not Avail
AP296-VTP-FTP-505	AP Farm	296-A-40 Primary Exhaust Stack	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	3	1	Not Avail
AP241-VTA-FE-908	AP Farm	296-A-41 Annulus Exhaust Stack	HVAC Annulus	VTA	FE	Flow Element	H-14-020203	4	1	Not Avail
AP241-VTA-FTP-901	AP Farm	296-A-41 Annulus Exhaust Stack	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	4	1	Not Avail
AP241-VTA-FTP-902	AP Farm	296-A-41 Annulus Exhaust Stack	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	4	1	Not Avail
AP241-VTA-FTP-903	AP Farm	296-A-41 Annulus Exhaust Stack	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	4	1	Not Avail
AP241-VTP-HTR-101	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	HTR	Heater	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-145	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-146	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-322	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-323	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-324	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-422	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-423	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDIS-424	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDIS	Pressure Differential Indicating Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDS-325	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDS	Pressure Differential Switch	H-14-020103	2	1	Not Avail
AP241-VTP-PDS-425	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	PDS	Pressure Differential Switch	H-14-020103	2	1	Not Avail
AP241-VTP-TS-142	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	TS	Temperature Switch	H-14-020103	2	1	Not Avail
AP241-VTP-V-126	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-128	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-129	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-VTP-V-124	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-125	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-301	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-302	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-303	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-304	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-305	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-306	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-401	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-402	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-403	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-404	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-405	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-406	AP Farm	A & B Trains Instr Enclosure AP241-VTP-ENCL-110	HVAC Primary	VTP	V	3-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTA-HS-(759)	AP Farm	ANN Exh 'A' Train Heater Power Control Panel AP241-VIA-CP-759	HVAC Annulus	VTA	HS	Hand Switch	H-14-020203	3	1	Not Avail
AP241-VTA-TDC-759	AP Farm	ANN Exh 'A' Train Heater Power Control Panel AP241-VIA-CP-759	HVAC Annulus	VTA	TDC	Temperature Differential Controller	H-14-020203	3	1	Not Avail
AP241-VTA-TDS-759	AP Farm	ANN Exh 'A' Train Heater Power Control Panel AP241-VIA-CP-759	HVAC Annulus	VTA	TDS	Temperature Differential Switch	H-14-020203	3	1	Not Avail
AP241-VTA-HS-(859)	AP Farm	ANN Exh 'B' Train Heater Power Control Panel AP241-VIA-CP-859	HVAC Annulus	VTA	HS	Hand Switch	H-14-020203	3	1	Not Avail
AP241-VTA-TDC-859	AP Farm	ANN Exh 'B' Train Heater Power Control Panel AP241-VIA-CP-859	HVAC Annulus	VTA	TDC	Temperature Differential Controller	H-14-020203	3	1	Not Avail
AP241-VTA-TDS-859	AP Farm	ANN Exh 'B' Train Heater Power Control Panel AP241-VIA-CP-859	HVAC Annulus	VTA	TDS	Temperature Differential Switch	H-14-020203	3	1	Not Avail
AP241-VTA-CAM-910	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	CAM	Continuous Air Monitor	H-14-020203	4	1	Not Avail
AP241-VTA-F-906A	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	F	Fan	H-14-020203	4	1	Not Avail
AP241-VTA-F-906B	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	F	Fan	H-14-020203	4	1	Not Avail
AP241-VTA-FCV-913	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FCV	Flow Control Valve	H-14-020203	4	1	Not Avail
AP241-VTA-F-(APXX1)	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FLT	Filter	H-14-020203	4	1	Not Avail
AP241-VTA-F-(APXX2)	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FLT	Filter	H-14-020203	4	1	Not Avail
AP241-VTA-FLT-920	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FLT	Filter	H-14-020203	4	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-VTA-FQI-920	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FQI	Flow Totalizer Indicator	H-14-020203	4	1	Not Avail
AP241-VTA-FSL-912	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020203	4	1	Not Avail
AP241-VTA-FSL-922	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020203	4	1	Not Avail
AP241-VTA-FT-908	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FT	Flow Transmitter	H-14-020203	4	1	Not Avail
AP241-VTA-HTR-907	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	HTR	Heater	H-14-020203	4	1	Not Avail
AP241-VTA-P-914	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	P	Pump	H-14-020203	4	1	Not Avail
AP241-VTA-P-924	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	P	Pump	H-14-020203	4	1	Not Avail
AP241-VTA-PI-911	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020203	4	1	Not Avail
AP241-VTA-PI-921	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020203	4	1	Not Avail
AP241-VTA-TS-906	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	4	1	Not Avail
AP241-VTA-TS-907	AP Farm	ANN Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	4	1	Not Avail
AP241-VTA-FCV-923	AP Farm	Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FCV	Flow Control Valve	H-14-020203	4	1	Not Avail
AP241-VTA-FI-920	AP Farm	Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FI	Flow Indicator	H-14-020203	4	1	Not Avail
AP241-EDS-MCC-002	AP Farm	AP Farm	HVAC Annulus	EDS	MCC	Motor Control Center	H-14-020203	3	1	Not Avail
AP241-VTA-SP-142	AP Farm	AP Farm	HVAC Annulus	VTA	SP	Seal Pot	H-14-020203	3	1	Not Avail
AP104-WST-ENCL-004	AP Farm	AP Farm	HVAC Annulus	WST	ENCL	Transmitter Enclosure	H-14-020503	4	0	Not Avail
AP241-VTP-ENCL-110	AP Farm	AP Farm	HVAC Primary	VTP	ENCL	Enclosure	H-14-020103	2	1	Not Avail
AP241-VTP-SP-101	AP Farm	AP Farm	HVAC Primary	VTP	SP	Seal Pot	H-14-020103	2	1	Not Avail
AP241-VTP-V-123	AP Farm	AP Farm	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-131	AP Farm	AP Farm	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-132	AP Farm	AP Farm	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-135	AP Farm	AP Farm	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-408	AP Farm	AP Farm	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-409	AP Farm	AP Farm	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTA-ENCL-101	AP Farm	AP Farm A & B Train	HVAC Annulus	VTA	ENCL	Enclosure	H-14-020203	3	1	Not Avail
AP241-VTA-CP759	AP Farm	AP Farm A Train	HVAC Annulus	VTA	CP	Control Panel	H-14-020203	3	1	Not Avail
AP241-VTA-DMPR-701	AP Farm	AP Farm A Train	HVAC Annulus	VTA	DMPR	Damper	H-14-020203	3	1	Not Avail
AP241-VTA-EF-003	AP Farm	AP Farm A Train	HVAC Annulus	VTA	EF	Exhaust Fan	H-14-020203	3	1	Not Avail
AP241-VTA-FLT-701	AP Farm	AP Farm A Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020203	3	1	Not Avail
AP241-VTA-FLT-702	AP Farm	AP Farm A Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020203	3	1	Not Avail
AP241-VTA-FTP-701	AP Farm	AP Farm A Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	3	1	Not Avail
AP241-VTA-FTP-756	AP Farm	AP Farm A Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	3	1	Not Avail
AP241-VTA-HTR-003	AP Farm	AP Farm A Train	HVAC Annulus	VTA	HTR	Heater	H-14-020203	3	1	Not Avail
AP241-VTA-MOV-701	AP Farm	AP Farm A Train	HVAC Annulus	VTA	MOV	Butterfly Valve	H-14-020203	3	1	Not Avail
AP241-VTA-TE-759A	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TE-759B	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TE-759C	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TE-759D	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TI-701	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	3	1	Not Avail
AP241-VTA-TI-702	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	3	1	Not Avail
AP241-VTA-TSH-759A	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TSH	Temperature Switch High	H-14-020203	3	1	Not Avail
AP241-VTA-TSH-759B	AP Farm	AP Farm A Train	HVAC Annulus	VTA	TSH	Temperature Switch High	H-14-020203	3	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-VTA-V-119	AP Farm	AP Farm A Train	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTP-CP301	AP Farm	AP Farm A Train	HVAC Primary	VTP	CP	Control Panel	H-14-020103	2	1	Not Avail
AP241-VTP-DMPR-301	AP Farm	AP Farm A Train	HVAC Primary	VTP	DMPR	Damper	H-14-020103	2	1	Not Avail
AP241-VTP-DMST-001	AP Farm	AP Farm A Train	HVAC Primary	VTP	DMST	Demister	H-14-020103	2	1	Not Avail
AP241-VTP-EF-001	AP Farm	AP Farm A Train	HVAC Primary	VTP	EF	Exhaust Fan	H-14-020103	2	1	Not Avail
AP241-VTP-FLT-302	AP Farm	AP Farm A Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020103	2	1	Not Avail
AP241-VTP-FLT-303	AP Farm	AP Farm A Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020103	2	1	Not Avail
AP241-VTP-FLT-301	AP Farm	AP Farm A Train	HVAC Primary	VTP	FLT	Pre-Filter	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-109	AP Farm	AP Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-301	AP Farm	AP Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-302	AP Farm	AP Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-303	AP Farm	AP Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-304	AP Farm	AP Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-305	AP Farm	AP Farm A Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-HTR-001	AP Farm	AP Farm A Train	HVAC Primary	VTP	HTR	Heater	H-14-020103	2	1	Not Avail
AP241-VTP-MOV-301	AP Farm	AP Farm A Train	HVAC Primary	VTP	MOV	HVAC Motor Operated Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTP-TE-326A	AP Farm	AP Farm A Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020103	2	1	Not Avail
AP241-VTP-TE-326B	AP Farm	AP Farm A Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020103	2	1	Not Avail
AP241-VTP-TI-301	AP Farm	AP Farm A Train	HVAC Primary	VTP	TI	Temperature Indicator	H-14-020103	2	1	Not Avail
AP241-VTP-TSH-236A	AP Farm	AP Farm A Train	HVAC Primary	VTP	TSH	Temperature Switch High	H-14-020103	2	1	Not Avail
AP241-VTP-V-308	AP Farm	AP Farm A Train	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-309	AP Farm	AP Farm A Train	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-119	AP Farm	AP Farm A Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-120	AP Farm	AP Farm A Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-307	AP Farm	AP Farm A Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTA-CP859	AP Farm	AP Farm B Train	HVAC Annulus	VTA	CP	Control Panel	H-14-020203	3	1	Not Avail
AP241-VTA-DMPR-801	AP Farm	AP Farm B Train	HVAC Annulus	VTA	DMPR	Damper	H-14-020203	3	1	Not Avail
AP241-VTA-EF-004	AP Farm	AP Farm B Train	HVAC Annulus	VTA	EF	Exhaust Fan	H-14-020203	3	1	Not Avail
AP241-VTA-FLT-801	AP Farm	AP Farm B Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020203	3	1	Not Avail
AP241-VTA-FLT-802	AP Farm	AP Farm B Train	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020203	3	1	Not Avail
AP241-VTA-FTP-801	AP Farm	AP Farm B Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	3	1	Not Avail
AP241-VTA-FTP-856	AP Farm	AP Farm B Train	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	3	1	Not Avail
AP241-VTA-HTR-004	AP Farm	AP Farm B Train	HVAC Annulus	VTA	HTR	Heater	H-14-020203	3	1	Not Avail
AP241-VTA-MOV-801	AP Farm	AP Farm B Train	HVAC Annulus	VTA	MOV	Butterfly Valve	H-14-020203	3	1	Not Avail
AP241-VTA-TE-859A	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TE-859B	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TE-859C	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TE-859D	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TE	Temperature Element	H-14-020203	3	1	Not Avail
AP241-VTA-TI-801	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	3	1	Not Avail
AP241-VTA-TI-802	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	3	1	Not Avail
AP241-VTA-TSH-859A	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TSH	Temperature Switch High	H-14-020203	3	1	Not Avail
AP241-VTA-TSH-859B	AP Farm	AP Farm B Train	HVAC Annulus	VTA	TSH	Temperature Switch High	H-14-020203	3	1	Not Avail
AP241-VTA-V-120	AP Farm	AP Farm B Train	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTP-VTP-CP401	AP Farm	AP Farm B Train	HVAC Primary	VTP	CP	Control Panel	H-14-020103	2	1	Not Avail
AP241-VTP-DMPR-401	AP Farm	AP Farm B Train	HVAC Primary	VTP	DMPR	Damper	H-14-020103	2	1	Not Avail
AP241-VTP-DMST-002	AP Farm	AP Farm B Train	HVAC Primary	VTP	DMST	Demister	H-14-020103	2	1	Not Avail
AP241-VTP-EF-002	AP Farm	AP Farm B Train	HVAC Primary	VTP	EF	Exhaust Fan	H-14-020103	2	1	Not Avail
AP241-VTP-FLT-402	AP Farm	AP Farm B Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020103	2	1	Not Avail
AP241-VTP-FLT-403	AP Farm	AP Farm B Train	HVAC Primary	VTP	FLT	HEPA Filter	H-14-020103	2	1	Not Avail
AP241-VTP-FLT-401	AP Farm	AP Farm B Train	HVAC Primary	VTP	FLT	Pre-Filter	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-110	AP Farm	AP Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-401	AP Farm	AP Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-402	AP Farm	AP Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-403	AP Farm	AP Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-VTP-FTP-404	AP Farm	AP Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-405	AP Farm	AP Farm B Train	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	2	1	Not Avail
AP241-VTP-HTR-002	AP Farm	AP Farm B Train	HVAC Primary	VTP	HTR	Heater	H-14-020103	2	1	Not Avail
AP241-VTP-MOV-401	AP Farm	AP Farm B Train	HVAC Primary	VTP	MOV	Motor Operated Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTP-TE-426A	AP Farm	AP Farm B Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020103	2	1	Not Avail
AP241-VTP-TE-426B	AP Farm	AP Farm B Train	HVAC Primary	VTP	TE	Temperature Element	H-14-020103	2	1	Not Avail
AP241-VTP-TI-401	AP Farm	AP Farm B Train	HVAC Primary	VTP	TI	Temperature Indicator	H-14-020103	2	1	Not Avail
AP241-VTP-TSH-426A	AP Farm	AP Farm B Train	HVAC Primary	VTP	TSH	Temperature Switch High	H-14-020103	2	1	Not Avail
AP241-VTP-V-127	AP Farm	AP Farm B Train	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-130	AP Farm	AP Farm B Train	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-133	AP Farm	AP Farm B Train	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-134	AP Farm	AP Farm B Train	HVAC Primary	VTP	V	2-Way Ball valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-121	AP Farm	AP Farm B Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-122	AP Farm	AP Farm B Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTP-V-407	AP Farm	AP Farm B Train	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	2	1	Not Avail
AP241-VTP-LSHL-140	AP Farm	AP Farm Seal Pot SP-101	HVAC Primary	VTP	LSHL	Level Switch High Low	H-14-020103	2	1	Not Avail
AP241-VTP-MS-101	AP Farm	AP Farm Seal Pot SP-101	HVAC Primary	VTP	MS	Manual Switch	H-14-020103	2	1	Not Avail
AP241-VTP-P-101	AP Farm	AP Farm Seal Pot SP-101	HVAC Primary	VTP	P	Pump	H-14-020103	2	1	Not Avail
AP241-VTP-V-136	AP Farm	AP Farm Seal Pot SP-101	HVAC Primary	VTP	V	Check Valve	H-14-020103	2	1	Not Avail
AP241-VTP-LDE-141	AP Farm	AP Farm Seal Pot SP-101	Monitoring	VTP	LDE	Leak Detector Element	H-14-020103	2	1	Not Avail
AP241-VTP-FTP-102	AP Farm	AP Farm Vent Instrument Pit 1	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	1	1	Not Avail
AP241-VTP-FTP-104	AP Farm	AP Farm Vent Instrument Pit 1	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	1	1	Not Avail
AP241-VTP-V-104	AP Farm	AP Farm Vent Instrument Pit 1	HVAC Primary	VTP	V	Butterfly Damper Valve	H-14-020103	1	1	Not Avail
AP241-VTP-V-102	AP Farm	AP Farm Vent Instrument Pit 1	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	1	1	Not Avail
AP241-VTP-FTP-106	AP Farm	AP Farm Vent Instrument Pit 2	HVAC Primary	VTP	FTP	Flow Test Port	H-14-020103	1	1	Not Avail
AP241-VTP-V-106	AP Farm	AP Farm Vent Instrument Pit 2	HVAC Primary	VTP	V	Butterfly Valve	H-14-020103	1	1	Not Avail
AP241-VTA-F-101A	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	F	Fan	H-14-020203	3	1	Not Avail
AP241-VTA-F-101B	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	F	Fan	H-14-020203	3	1	Not Avail
AP241-VTA-HTR-101	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	HTR	Heater	H-14-020203	3	1	Not Avail
AP241-VTA-PDIS-761	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	3	1	Not Avail
AP241-VTA-PDIS-762	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	3	1	Not Avail
AP241-VTA-PDIS-861	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	3	1	Not Avail
AP241-VTA-PDIS-862	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	3	1	Not Avail
AP241-VTA-PDS-760	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	PDS	Pressure Differential Switch	H-14-020203	3	1	Not Avail
AP241-VTA-PDS-860	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	PDS	Pressure Differential Switch	H-14-020203	3	1	Not Avail
AP241-VTA-TS-101	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	3	1	Not Avail
AP241-VTA-V-701	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTA-V-702	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTA-V-703	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTA-V-704	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTA-V-801	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTA-V-802	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTA-V-803	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP241-VTA-V-804	AP Farm	AP241-VTA-ENCL-101	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	3	1	Not Avail
AP2750E-VTA-CASS-A-2330	AP Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020203	3	1	Not Avail
AP2750E-VTA-CASS-A-2344	AP Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020203	3	1	Not Avail
AP2750E-VTA-CASS-A-2345	AP Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020203	4	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP2750E-VTA-CASS-A-2403	AP Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020203	4	1	Not Avail
AP2750E-VTA-CASS-A-2427	AP Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020203	4	1	Not Avail
AP2750E-VTA-CASS-A-2464	AP Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020203	4	1	Not Avail
AP2750E-VTA-CASS-A-2521	AP Farm	Bldg 2750	HVAC Annulus	VTA	CASS	Computer Automated Surveillance Station	H-14-020203	4	1	Not Avail
AP2750E-VTP-CASS-A-2370	AP Farm	Bldg 2750	HVAC Primary	VTP	CASS	Computer Automated Surveillance Station	H-14-020103	3	1	Not Avail
AP2750E-VTP-CASS-A-2426	AP Farm	Bldg 2750	HVAC Primary	VTP	CASS	Computer Automated Surveillance Station	H-14-020103	3	1	Not Avail
AP2750E-VTP-CASS-A-2463	AP Farm	Bldg 2750	HVAC Primary	VTP	CASS	Computer Automated Surveillance Station	H-14-020103	3	1	Not Avail
AP2750E-VTP-CASS-A-2510	AP Farm	Bldg 2750	HVAC Primary	VTP	CASS	Computer Automated Surveillance Station	H-14-020103	3	1	Not Avail
AP2750E-VTP-CASS-A-2543	AP Farm	Bldg 2750	HVAC Primary	VTP	CASS	Computer Automated Surveillance Station	H-14-020103	2	1	Not Avail
APICE-CHEMB-FIC-XXX	AP Farm	Bldg AP-271 Annex (Bldg AP-271 Annex (ICE Bldg))	Dilution/Flush	CHEMB	FIC	Flow Indicating Controller	H-14-102086	8	0	Not Avail
APICE-CHEMB-FI-123	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	CHEMB	FI	Flow Indicator	H-14-102086	8	0	Not Avail
APICE-CHEMB-LAH-127	AP Farm	Bldg AP-271 Annex (ICE Bldg)	Dilution/Flush	CHEMB	LAH	Level Alarm High	H-14-102086	8	0	Not Avail
AP241-CHEMB-AE-121	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	AE	Analysis Element	H-14-102086	8	0	Not Avail
AP241-CHEMB-AIT-121	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	AIT	Analysis Indicating Transmitter	H-14-102086	8	0	Not Avail
AP241-CHEMB-PD-101	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	DAMP	Pulse Dampener	H-14-102086	8	0	Not Avail
AP241-CHEMB-PD-102	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	DAMP	Pulse Dampener	H-14-102086	8	0	Not Avail
APICE-CHEMB-FC-456	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FC	Flow Controller	H-14-102086	8	0	Not Avail
AP241-CHEMB-FCV-131	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FCV	2-Way Flow Control Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-FE-122	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FE	Flow Element	H-14-102086	8	0	Not Avail
AP241-CHEMB-FE-123	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FE	Flow Element	H-14-102086	8	0	Not Avail
APICE-CHEMB-FI-456	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FIC	Flow Indicating Controller	H-14-102086	8	0	Not Avail
APICE-CHEMB-FIC-XXX	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FIC	Flow Indicating Controller	H-14-102086	8	0	Not Avail
AP241-CHEMB-FIT-122	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FIT	Flow Indicating Transmitter	H-14-102086	8	0	Not Avail
AP241-CHEMB-FIT-123	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FIT	Flow Indicating Transmitter	H-14-102086	8	0	Not Avail
APICE-CHEMB-FQIC-122	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	FQIC	Flow Totalizer Indicator Controller	H-14-102086	8	0	Not Avail
APICE-CHEMB-HS-130	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	HS	2-Position Hand Switch	H-14-102086	8	0	Not Avail
APICE-CHEMB-HS-128	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	HS	Hand Switch	H-14-102086	8	0	Not Avail
AP241-CHEMB-HTR-101	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	HTR	Electric Heater	H-14-102086	8	0	Not Avail
APICE-CHEMB-LAHH-126	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	LAHH	Level Alarm High High	H-14-102086	8	0	Not Avail
AP241-CHEMB-LE-126	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	LE	Level Element	H-14-102086	8	0	Not Avail
APICE-CHEMB-LEK-127	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	LEK	Level Element Relay	H-14-102086	8	0	Not Avail
APICE-CHEMB-LI-126	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	LI	Level Indicator	H-14-102086	8	0	Not Avail
APICE-CHEMB-LI-548	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	LI	Level Indicator	H-14-102086	8	0	Not Avail
AP241-CHEMB-LIT-126	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	LIT	Level Indicating Transmitter	H-14-102086	8	0	Not Avail
AP241-CHEMB-LS-126	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	LS	Level Switch	H-14-102086	8	0	Not Avail
AP241-CHEMB-MOV-132	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	MOV	3-Way Ball Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-MT-101	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	MT	Static Mixer	H-14-102086	8	0	Not Avail
AP241-CHEMB-P-002	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	P	Diluent/Flush Pump	H-14-102086	8	0	Not Avail
AP241-CHEMB-(P-1)	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	P	Pump	H-14-102086	8	0	Not Avail
AP241-CHEMB-(P-2)	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	P	Pump	H-14-102086	8	0	Not Avail
AP241-CHEMB-(P-3)	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	P	Pump	H-14-102086	8	0	Not Avail
AP241-CHEMB-(P-4)	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	P	Pump	H-14-102086	8	0	Not Avail
AP241-CHEMB-PCV-101	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PCV	Pressure Control Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-PI-101	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-CHEMB-PI-102	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail
AP241-CHEMB-PI-103	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail
AP241-CHEMB-PI-104	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail
AP241-CHEMB-PI-105	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail
AP241-CHEMB-PI-106	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail
APICE-CHEMB-PI-123	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail
APICE-CHEMB-PI-546	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PI	Pressure Indicator	H-14-102086	8	0	Not Avail
AP241-CHEMB-103-M9	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PIPE	Dilution/Flush Discharge Pipe Segment	H-14-102086	8	0	Not Avail
AP241-CHEMB-PIT-123	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	PIT	Pressure Indicating Transmitter	H-14-102086	8	0	Not Avail
APICE-CHEMB-RIAS-125A	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	RAIS	Radiation Alarm Indicating Switch	H-14-102086	8	0	Not Avail
AP241-CHEMB-RT-125A	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	RT	Radiation Transmitter	H-14-102086	8	0	Not Avail
APICE-CHEMB-SS-550	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	SS	Selector Switch (3 or more positions)	H-14-102086	8	0	Not Avail
AP241-CHEMB-TE-101	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	TE	Temperature Sensing Bulb	H-14-102086	8	0	Not Avail
APICE-CHEMB-TI-120	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	TI	Temperature Indicator	H-14-102086	8	0	Not Avail
APICE-CHEMB-TI-124	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	TI	Temperature Indicator	H-14-102086	8	0	Not Avail
APICE-CHEMB-TIC-457	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	TIC	Temperature Indicating Controller	H-14-102086	8	0	Not Avail
AP241-CHEMB-TIT-120	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	TIT	Temperature Indicating Transmitter	H-14-102086	8	0	Not Avail
AP241-CHEMB-TIT-124	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	TIT	Temperature Indicating Transmitter	H-14-102086	8	0	Not Avail
AP241-CHEMB-TK-001	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	TK	Diluent/Flush Tank	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-106	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	2-Way Ball Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-110	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	2-Way Ball Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-109	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	Automatic Recirc Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-101	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	Ball Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-102	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	Ball Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-104	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	Ball Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-105	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	Ball Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-108	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	Gate Valve	H-14-102086	8	0	Not Avail
AP241-CHEMB-V-107	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	V	Globe Valve	H-14-102086	8	0	Not Avail
APICE-CHEMB-YA-549	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	YAL	Event/State Alarm Low	H-14-102086	8	0	Not Avail
APICE-CHEMB-YL-128	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	YL	Event/State Light	H-14-102086	8	0	Not Avail
APICE-CHEMB-YL-130	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	YL	Event/State Light	H-14-102086	8	0	Not Avail
APICE-CHEMB-YL-550	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	YL	Event/State Light	H-14-102086	8	0	Not Avail
AP241-CHEMB-ZC-131	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	ZC	Position Controller	H-14-102086	8	0	Not Avail
APICE-CHEMB-ZC-132	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	ZC	Position Controller	H-14-102086	8	0	Not Avail
AP241-CHEMB-ZS-131	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	ZS	Position Switch	H-14-102086	8	0	Not Avail
AP241-CHEMB-ZS-132	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	ZS	Position Switch	H-14-102086	8	0	Not Avail
AP241-CHEMB-ZT-131	AP Farm	Dilution Pad	Dilution/Flush	CHEMB	ZT	Position Transmitter	H-14-102086	8	0	Not Avail
AP241-PW-102-M9	AP Farm	Dilution Pad	Dilution/Flush	PW	PIPE	Pipe Segment	H-14-102086	8	0	Not Avail
AP241-PW-104-M9	AP Farm	Dilution Pad	Dilution/Flush	PW	PIPE	Pipe Segment	H-14-102086	8	0	Not Avail
AP241-RW-BOILER	AP Farm	Dilution Pad	Dilution/Flush	RW	BOILER	BOILER	H-14-102086	8	0	Not Avail
AP241-RW-LCV-430	AP Farm	Dilution Pad	Dilution/Flush	RW	FCV	Flow Control Valve	H-14-102086	8	0	Not Avail
AP241-RW-FE-456	AP Farm	Dilution Pad	Dilution/Flush	RW	FE	Flow Element	H-14-102086	8	0	Not Avail
AP241-RW-FIT-456	AP Farm	Dilution Pad	Dilution/Flush	RW	FIT	Flow Indicating Transmitter	H-14-102086	8	0	Not Avail
AP241-RW-TIT-457	AP Farm	Dilution Pad	Dilution/Flush	RW	TIT	Temperature Indicating Transmitter	H-14-102086	8	0	Not Avail
AP241-RW-ZS-430	AP Farm	Dilution Pad	Dilution/Flush	RW	ZS	Position Switch	H-14-102086	8	0	Not Avail
AP241-RW-ZT-430	AP Farm	Dilution Pad	Dilution/Flush	RW	ZT	Position Transmitter	H-14-102086	8	0	Not Avail
AP241-CHEMB-LE-127	AP Farm	Dilution Pad Sump	Dilution/Flush	CHEMB	LE	Level Element	H-14-102086	8	0	Not Avail
AP242A-VTA-FSL-APK21	AP Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020203	4	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP242A-VTA-FSL-APK22	AP Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020203	4	1	Not Avail
AP242A-VTA-FSL-APK23	AP Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020203	4	1	Not Avail
AP242A-VTA-RSH-APK21	AP Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	RSH	Radiation Switch High	H-14-020203	4	1	Not Avail
AP242A-VTA-RXS-APK21	AP Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	RXS	Radiation Failure Switch	H-14-020203	4	1	Not Avail
AP242A-VTA-YS-APK2	AP Farm	Evaporator Bldg 242-A	HVAC Annulus	VTA	YS	Event/State Switch	H-14-020203	3	1	Not Avail
AP296-VTP-FAL-(APXX1)	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP296-VTP-FAL-(APXX2)	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP296-VTP-FAL-(APXX3)	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP296-VTP-FSL-APK11	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	FSL	Flow Switch Low	H-14-020103	3	1	Not Avail
AP296-VTP-FSL-APK12	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	FSL	Flow Switch Low	H-14-020103	3	1	Not Avail
AP296-VTP-FSL-APK13	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	FSL	Flow Switch Low	H-14-020103	3	1	Not Avail
AP241-VTP-QS-AP1	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	QS	General Alarm	H-14-020103	2	1	Not Avail
AP296-VTP-QS-(XX1)	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	QS	General Alarm	H-14-020103	3	1	Not Avail
AP296-VTP-RAH-(XX1)	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	RAH	Radiation Alarm High	H-14-020103	3	1	Not Avail
AP296-VTP-RSH-APK11	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	RSH	Radiation Switch High	H-14-020103	3	1	Not Avail
AP296-VTP-RXS-APK11	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	RXS	Radiation Failure Switch	H-14-020103	3	1	Not Avail
AP296-VTP-XA-XX1	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	XA	Failure Alarm	H-14-020103	3	1	Not Avail
AP241-VTP-YS-APK1	AP Farm	Evaporator Bldg 242-A	HVAC Primary	VTP	YS	Event/State Switch	H-14-020103	2	1	Not Avail
AP241-VTP-LDA-APK1	AP Farm	Evaporator Bldg 242-A	Monitoring	VTP	LDA	Leak Detector Alarm	H-14-020103	2	1	Not Avail
AP271-VTA-EY-910	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	EY	Voltage Equipment	H-14-020203	4	1	Not Avail
AP271-VTA-FAL-908	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	FAL	Flow Alarm Low	H-14-020203	4	1	Not Avail
AP271-VTA-FAL-912B	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	FAL	Flow Alarm Low	H-14-020203	4	1	Not Avail
AP271-VTA-FAL-922B	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	FAL	Flow Alarm Low	H-14-020203	4	1	Not Avail
AP271-VTA-FQI-908	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	FQI	Flow Totalizer Indicator	H-14-020203	4	1	Not Avail
AP271-VTA-FR-908	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	FR	Flow Recorder	H-14-020203	4	1	Not Avail
AP271-VTA-FSL-908	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	FSL	Flow Switch Low	H-14-020203	4	1	Not Avail
AP271-VTA-FY-908	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	FY	Flow Equipment	H-14-020203	4	1	Not Avail
AP271-VTA-LAH-142	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	LAH	Level Alarm High	H-14-020203	3	1	Not Avail
AP271-VTA-LAL-142	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	LAL	Level Alarm Low	H-14-020203	3	1	Not Avail
AP271-VTA-PDAH-761	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	PDAH	Pressure Differential Alarm High	H-14-020203	3	1	Not Avail
AP271-VTA-PDAH-861	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	PDAH	Pressure Differential Alarm High	H-14-020203	3	1	Not Avail
AP271-VTA-RAH-910B	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	RAH	Radiation Alarm High	H-14-020203	4	1	Not Avail
AP271-VTA-TAHL-901B	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	TAHL	Temperature Alarm High Low	H-14-020203	4	1	Not Avail
AP271-VTA-XA-759	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020203	3	1	Not Avail
AP271-VTA-XA-760	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020203	3	1	Not Avail
AP271-VTA-XA-910B	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020203	4	1	Not Avail
AP271-VTP-RR-510	AP Farm	Instr Bldg 241-AP-271	HVAC Annulus	VTP	RR	Radiation Recorder	H-14-020203	4	1	Not Avail
AP271-VTP-LAH-140	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	LAH	Level Alarm High	H-14-020103	2	1	Not Avail
AP271-VTP-LAL-140	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	LAL	Level Alarm Low	H-14-020103	2	1	Not Avail
AP271-VTP-PDAH-145	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020103	2	1	Not Avail
AP271-VTP-PDAH-146	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020103	2	1	Not Avail
AP271-VTP-PDAH-322	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020103	2	1	Not Avail
AP271-VTP-PDAH-323	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020103	2	1	Not Avail
AP271-VTP-PDAH-422	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020103	2	1	Not Avail
AP271-VTP-PDAH-423	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	PDAH	Pressure Differential Alarm High	H-14-020103	2	1	Not Avail
AP271-VTP-XA-325	AP Farm	Instr Bldg 241-AP-271	HVAC Primary	VTP	XA	Failure Alarm	H-14-020103	2	1	Not Avail
AP271-VTP-LDA-141	AP Farm	Instr Bldg 241-AP-271	Monitoring	VTP	LDA	Leak Detector Alarm	H-14-020103	2	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP271-VTP-LDXA-141	AP Farm	Instr Bldg 241-AP-271	Monitoring	VTP	LDXA	Leak Detector Failure Alarm	H-14-020103	2	1	Not Avail
AP271-VTP-EY-510	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	EY	Voltage Equipment	H-14-020103	3	1	Not Avail
AP271-VTP-FAL-509	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP271-VTP-FAL-512B	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP271-VTP-FAL-522B	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP271-VTP-FQI-509	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	FQI	Flow Totalizer Indicator	H-14-020103	3	1	Not Avail
AP271-VTP-FR-509	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	FR	Flow Recorder	H-14-020103	3	1	Not Avail
AP271-VTP-FSL-509	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	FSL	Flow Switch Low	H-14-020103	3	1	Not Avail
AP271-VTP-FY-509	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	FY	Flow Equipment	H-14-020103	3	1	Not Avail
AP271-VTP-RAH-510B	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	RAH	Radiation Alarm High	H-14-020103	3	1	Not Avail
AP271-VTP-RR-510	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	RR	Radiation Recorder	H-14-020103	3	1	Not Avail
AP271-VTP-TAHL-501B	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	TAHL	Temperature Alarm High Low	H-14-020103	3	1	Not Avail
AP241-VTP-XA-510B	AP Farm	Instrument Bldg 241-AP-271	HVAC Primary	VTP	XA	Failure Alarm	H-14-020103	2	1	Not Avail
AP241-VTA-FAL-912A	AP Farm	Local Alarm Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FAL	Flow Alarm Low	H-14-020203	4	1	Not Avail
AP241-VTA-FAL-922A	AP Farm	Local Alarm Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	FAL	Flow Alarm Low	H-14-020203	4	1	Not Avail
AP241-VTA-RAH-910A	AP Farm	Local Alarm Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	RAH	Radiation Alarm High	H-14-020203	4	1	Not Avail
AP241-VTA-TAHL-901A	AP Farm	Local Alarm Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	TAHL	Temperature Alarm High Low	H-14-020203	4	1	Not Avail
AP241-VTA-XA-910A	AP Farm	Local Alarm Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020203	4	1	Not Avail
AP296-VTP-FAL-512A	AP Farm	Local Alarm Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP296-VTP-FAL-522A	AP Farm	Local Alarm Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FAL	Flow Alarm Low	H-14-020103	3	1	Not Avail
AP296-VTP-RAH-510A	AP Farm	Local Alarm Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	RAH	Radiation Alarm High	H-14-020103	3	1	Not Avail
AP102-VTP-TAHL-501A	AP Farm	Local Alarm Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	TAHL	Temperature Alarm High Low	H-14-020103	3	1	Not Avail
AP271-VTP-XA-510A	AP Farm	Local Alarm Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	XA	Failure Alarm	H-14-020103	3	1	Not Avail
AP241-VTA-HM-924	AP Farm	Monitor Connection Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	HM	Hour Meter	H-14-020203	4	1	Not Avail
AP241-VTA-TSL-901	AP Farm	Monitor Connection Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	TSL	Temperature Switch Low	H-14-020203	4	1	Not Avail
AP241-VTA-TSH-901	AP Farm	Monitor Connection Box inside Annulus Exhaust Stack CAM Enclosure AP296-VTA-ENCL-900	HVAC Annulus	VTA	TSH	Temperature Switch High	H-14-020203	4	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP296-VTP-HM-524	AP Farm	Monitor Connection Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	HM	Hour Meter	H-14-020103	3	1	Not Avail
AP296-VTP-TSH-501	AP Farm	Monitor Connection Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	TSH	Temperature Switch High	H-14-020103	3	1	Not Avail
AP296-VTP-TSL-501	AP Farm	Monitor Connection Box Inside Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	TSL	Temperature Switch Low	H-14-020103	3	1	Not Avail
AP296-VTP-FE-509	AP Farm	Primary Exhaust Stack 296-A-40	HVAC Primary	VTP	FE	Flow Element	H-14-020103	3	1	Not Avail
AP296-VTP-CAM-510	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	CAM	HVAC Continuous Air Monitor	H-14-020103	3	1	Not Avail
AP296-VTP-F-506A	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	F	Cabinet Cooling Fan	H-14-020103	3	1	Not Avail
AP296-VTP-F-506B	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	F	Cabinet Cooling Fan	H-14-020103	3	1	Not Avail
AP296-VTP-FCV-513	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FCV	HVAC Flow Control Valve	H-14-020103	3	1	Not Avail
AP296-VTP-FCV-523	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FCV	HVAC Flow Control Valve	H-14-020103	3	1	Not Avail
AP296-VTP-FI-520	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FI	HVAC Flow Indicator	H-14-020103	3	1	Not Avail
AP296-VTP-F-(APXX1)	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FLT	Filter	H-14-020103	3	1	Not Avail
AP296-VTP-F-(APXX2)	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FLT	Filter	H-14-020103	3	1	Not Avail
AP296-VTP-FLT-520	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FLT	Record Sample Filter	H-14-020103	3	1	Not Avail
AP296-VTP-FQI-520	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FQI	Flow Totalizer Indicator	H-14-020103	3	1	Not Avail
AP296-VTP-FSL-522	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FSL	Flow Switch Low	H-14-020103	3	1	Not Avail
AP296-VTP-FT-509	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	FT	Flow Transmitter	H-14-020103	3	1	Not Avail
AP296-VTP-HTR-507	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	HTR	Heater	H-14-020103	3	1	Not Avail
AP296-VTP-P-514	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	P	Pump	H-14-020103	3	1	Not Avail
AP296-VTP-P-524	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	P	Pump	H-14-020103	3	1	Not Avail
AP296-VTP-PI-511	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	PI	Pressure Indicator	H-14-020103	3	1	Not Avail
AP296-VTP-PI-521	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	PI	Pressure Indicator	H-14-020103	3	1	Not Avail
AP296-VTP-TS-506	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	TS	HVAC Temperature Switch	H-14-020103	3	1	Not Avail
AP296-VTP-TS-507	AP Farm	Primary Exhaust Stack Instr AP-296-VTP-ENCL-500	HVAC Primary	VTP	TS	HVAC Temperature Switch	H-14-020103	3	1	Not Avail
AP241-VTA-V-121	AP Farm	Seal Pot SP-142	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020203	3	1	Not Avail
APVP-WT-JMP-A-J	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail
APVP-WT-JMP-C-D	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail
APVP-WT-JMP-D-21	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail
APVP-WT-JMP-H-M	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail
APVP-WT-JMP-J-H	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
APVP-WT-JMP-M-P	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail
APVP-WT-JMP-N-C	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail
APVP-WT-JMP-P-N	AP Valve Pit	AP Valve Pit	Transfer	WT	JMP	AP Valve Pit Jumper Assembly	H-14-020803	5	1	Not Avail
APVP-WT-19	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-19	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-21	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-C	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-D	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-H	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-J	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-M	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-N	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-NOZ-P	AP Valve Pit	AP Valve Pit	Transfer	WT	NOZ	AP Valve Pit Jumper Connection	H-14-020803	5	1	Not Avail
APVP-WT-PS-609	AP Valve Pit	AP Valve Pit	Transfer	WT	PS	Pressure Switch	H-14-020803	5	1	Not Avail
APVP-WT-PS-610	AP Valve Pit	AP Valve Pit	Transfer	WT	PS	Pressure Switch	H-14-020803	5	1	Not Avail
APVP-WT-PS-612	AP Valve Pit	AP Valve Pit	Transfer	WT	PS	Pressure Switch	H-14-020803	5	1	Not Avail
APVP-WT-PS-616	AP Valve Pit	AP Valve Pit	Transfer	WT	PS	Pressure Switch	H-14-020803	5	1	Not Avail
APVP-WT-V-601	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-602	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-603	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-606	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-609	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-610	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-612	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-616	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-619	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-620	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-802	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-803	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-V-804	AP Valve Pit	AP Valve Pit	Transfer	WT	V	Ball Valve	H-14-020803	5	1	Not Avail
APVP-WT-ZS-601A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-601B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-601C	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-602A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-602B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-602C	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-603A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-603B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-603C	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-606A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-606B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-606C	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-609A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-609B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-610A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
APVP-WT-ZS-610B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-612A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-612B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-616A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-616B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-620A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-620B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-802A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-802B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-803A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-803B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-804A	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-ZS-804B	AP Valve Pit	AP Valve Pit	Transfer	WT	ZS	Position Switch	H-14-020803	5	1	Not Avail
APVP-WT-SN-616-M25	AP Valve Pit	AP Valve Pit to Tank AP-106	Transfer	WT	PIPE	Valve Pit Discharge Pipe Segment	H-14-020803	5	1	Not Avail
APVP-WT-CASS-A-2321	AP Valve Pit	Bldg 2750	Transfer	WT	CASS	Computer Automated Surveillance Station	H-14-020803	5	1	Not Avail
APVP-WT-CASS-A-2347	AP Valve Pit	Bldg 2750	Transfer	WT	CASS	Computer Automated Surveillance Station	H-14-020803	5	1	Not Avail
APVP-WT-CASS-A-2405	AP Valve Pit	Bldg 2750	Transfer	WT	CASS	Computer Automated Surveillance Station	H-14-020803	5	1	Not Avail
APVP-WT-CASS-A-2465	AP Valve Pit	Bldg 2750	Transfer	WT	CASS	Computer Automated Surveillance Station	H-14-020803	5	1	Not Avail
APVP-WT-LDS-APSL	AP Valve Pit	Evaporator Bldg 242-A	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDS-APVP	AP Valve Pit	Evaporator Bldg 242-A	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDA-201	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDA-224	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDA-225	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDA-227	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDA	Leak Detector Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDK-(225)	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDK	Leak Detector Relay	H-14-020803	5	1	Not Avail
APVP-WT-LDK-(226)	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDK	Leak Detector Relay	H-14-020803	5	1	Not Avail
APVP-WT-LDK-(227)	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDK	Leak Detector Relay	H-14-020803	5	1	Not Avail
APVP-WT-LDXA-201	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDXA	Leak Detector Failure Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDXA-224	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDXA	Leak Detector Failure Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LDXA-225	AP Valve Pit	Instr Bldg 241-AN-271	Monitoring	WT	LDXA	Leak Detector Failure Alarm	H-14-020803	5	1	Not Avail
APVP-WT-LY-241	AP Valve Pit	Instr Bldg 241-AN-271	Transfer	WT	LY	Level Equipment	H-14-020803	5	1	Not Avail
AP241-VTA-FTP-244	AP-101/AP-102	ANN Exhaust Instr Stack Instr Enclosure AP241-VIA-ENCL-201	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-PI-294	AP-101/AP-102	ANN Exhaust Instr Stack Instr Enclosure AP241-VIA-ENCL-201	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020203	1	1	Not Avail
AP241-VTA-V-294	AP-101/AP-102	ANN Exhaust Instr Stack Instr Enclosure AP241-VIA-ENCL-201	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-244	AP-101/AP-102	ANN Exhaust Instr Stack Instr Enclosure AP241-VIA-ENCL-201	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020203	1	1	Not Avail
AP241-VTA-DMPR-201	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	DMPR	Damper	H-14-020203	1	1	Not Avail
AP241-VTA-FLT-202	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020203	1	1	Not Avail
AP241-VTA-FLT-201	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FLT	Pre-Filter	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-201	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-202	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-VTA-FTP-203	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-204	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-205	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-206	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-207	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-HTR-251	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	HTR	Heater	H-14-020203	1	1	Not Avail
AP241-VTA-ISC-XX1)	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	ISC	Inlet Screen	H-14-020203	1	1	Not Avail
AP241-VTA-TC-251	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	TC	Temperature Controller	H-14-020203	1	1	Not Avail
AP241-VTA-TI-201	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	1	1	Not Avail
AP241-VTA-TI-202	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	1	1	Not Avail
AP241-VTA-TS-201	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	1	1	Not Avail
AP241-VTA-TS-251	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	1	1	Not Avail
AP241-VTA-TSL-253	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	TSL	Temperature Switch Low	H-14-020203	1	1	Not Avail
AP241-VTA-V-201	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-202	AP-101/AP-102	AP Farm Annulus Air Intake Station A	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-PDAH-254	AP-101/AP-102	Instr Bldg 241-AP-271	HVAC Annulus	VTA	PDAH	Pressure Differential Alarm High	H-14-020203	1	1	Not Avail
AP241-VTA-PDAH-255	AP-101/AP-102	Instr Bldg 241-AP-271	HVAC Annulus	VTA	PDAH	Pressure Differential Alarm High	H-14-020203	1	1	Not Avail
AP241-VTA-XA-253	AP-101/AP-102	Instr Bldg 241-AP-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020203	1	1	Not Avail
AP241-VTA-PI-292	AP-102	ANN Exhaust Instr Stack Instr Enclosure AP 241-VIA-ENCL-201	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020203	1	1	Not Avail
AP241-VTA-V-292	AP-102	ANN Exhaust Instr Stack Instr Enclosure AP 241-VIA-ENCL-201	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP102-WST-ENCL-002	AP-102	AP Farm	HVAC Annulus	WST	ENCL	Transmitter Enclosure	H-14-020503	2	1	Not Avail
APICE-WT-LDK-203	AP-102	AP-02A Central Pump Pit	Monitoring	WT	LDK	AP-02A Central Pump Pit Leak Detector Relay	H-14-102086	3	0	Not Avail
AP02A-WST-NOZ-1	AP-102	AP-02A Central Pump Pit	Transfer	WST	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP02A-WST-NOZ-A	AP-102	AP-02A Central Pump Pit	Transfer	WST	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP02A-WST-NOZ-K	AP-102	AP-02A Central Pump Pit	Transfer	WST	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP02A-WT-NOZ-1	AP-102	AP-02A Central Pump Pit	Transfer	WST	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP02A-WT-NOZ-A	AP-102	AP-02A Central Pump Pit	Transfer	WST	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP02A-WT-NOZ-K	AP-102	AP-02A Central Pump Pit	Transfer	WST	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP02A-WT-A-E-(1)	AP-102	AP-02A Central Pump Pit	Transfer	WT	JMP	AP-02A Central Pump Pit Jumper Assembly	H-14-102086	3	0	Not Avail
AP02A-WT-K-(1)	AP-102	AP-02A Central Pump Pit	Transfer	WT	JMP	AP-02A Central Pump Pit Jumper Assembly	H-14-102086	3	0	Not Avail
AP02A-WT-LDE-203	AP-102	AP-02A Central Pump Pit	Transfer	WT	LDE	AP-02A Central Pump Pit Leak Detector Element	H-14-102086	3	0	Not Avail
AP02D-WT-MOV-253	AP-102	AP-02A Central Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	3	0	Not Avail
AP02A-WT-1	AP-102	AP-02A Central Pump Pit	Transfer	WT	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02A-WT-A	AP-102	AP-02A Central Pump Pit	Transfer	WT	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02A-WT-K	AP-102	AP-02A Central Pump Pit	Transfer	WT	NOZ	AP-02A Central Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP102-WT-ZS-253	AP-102	AP-02A Central Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	3	0	Not Avail
AP102-WT-SN-612-M25	AP-102	AP-02A Central Pump Pit to AP Valve Pit	Transfer	WT	PIPE	Tank Discharge Pipe Segment	H-14-102086	3	0	Not Avail
AP02D-WT-D-(2,4&6)	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	JMP	AP-02D Pump Pit Jumper Assembly	H-14-102086	3	0	Not Avail
AP02D-WT-MOV-245	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	MOV	3-Way Ball Valve	H-14-102086	3	0	Not Avail
AP02D-WT-MOV-261	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	MOV	3-Way Ball Valve	H-14-102086	3	0	Not Avail
AP02D-WT-2	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-3	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-6	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-D	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-V-806	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	V	Check Valve	H-14-102086	3	0	Not Avail
AP102-WT-ZS-245	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	ZS	Position Switch	H-14-102086	3	0	Not Avail
AP102-WT-ZS-261	AP-102	AP-02D Pump Pit	Dilution/Flush	WT	ZS	Position Switch	H-14-102086	3	0	Not Avail
AP02D-WT-LDE-205	AP-102	AP-02D Pump Pit	Monitoring	WT	LDE	AP-02D Pump Pit Leak Detector Element	H-14-102086	3	0	Not Avail
AP102-WT-LDE-281	AP-102	AP-02D Pump Pit	Monitoring	WT	LDE	AP-02D Pump Pit Leak Detector Element	H-14-102086	3	0	Not Avail
AP102-WT-LDE-282	AP-102	AP-02D Pump Pit	Monitoring	WT	LDE	AP-02D Pump Pit Leak Detector Element	H-14-102086	3	0	Not Avail
APICE-WT-LDK-205	AP-102	AP-02D Pump Pit	Monitoring	WT	LDK	AP-02D Pump Pit Leak Detector Relay	H-14-102086	3	0	Not Avail
AP02D-WT-V-209	AP-102	AP-02D Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102086	3	0	Not Avail
AP02D-WT-V-210	AP-102	AP-02D Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102086	3	0	Not Avail
AP02D-WT-V-211	AP-102	AP-02D Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102086	3	0	Not Avail
AP02D-WT-FE-258	AP-102	AP-02D Pump Pit	Transfer	WT	FE	Flow Element	H-14-102086	3	0	Not Avail
AP02D-WT-(3&6)	AP-102	AP-02D Pump Pit	Transfer	WT	JMP	AP-02D Pump Pit Jumper Assembly	H-14-102086	3	0	Not Avail
AP02D-WT-(7&8)	AP-102	AP-02D Pump Pit	Transfer	WT	JMP	AP-02D Pump Pit Jumper Assembly	H-14-102086	3	0	Not Avail
AP02D-WT-A-(1,4,5&7)	AP-102	AP-02D Pump Pit	Transfer	WT	JMP	AP-02D Pump Pit Jumper Assembly	H-14-102086	3	0	Not Avail
AP02D-WT-C-(F,5&8)	AP-102	AP-02D Pump Pit	Transfer	WT	JMP	AP-02D Pump Pit Jumper Assembly	H-14-102086	3	0	Not Avail
AP02D-WT-MOV-242	AP-102	AP-02D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	3	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP02D-WT-MOV-243	AP-102	AP-02D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	3	0	Not Avail
AP02D-WT-MOV-244	AP-102	AP-02D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	3	0	Not Avail
AP02D-WT-1	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-4	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-5	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-7	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-8	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-A	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-C	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-F	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	3	0	Not Avail
AP02D-WT-NOZ-1	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP02D-WT-NOZ-A	AP-102	AP-02D Pump Pit	Transfer	WT	NOZ	AP-02D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP02D-WT-PE-259	AP-102	AP-02D Pump Pit	Transfer	WT	PE	WT Pump Discharge Pressure Element	H-14-102086	3	0	Not Avail
AP02D-WT-TE-277	AP-102	AP-02D Pump Pit	Transfer	WT	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WT-ZS-242	AP-102	AP-02D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	3	0	Not Avail
AP102-WT-ZS-243	AP-102	AP-02D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	3	0	Not Avail
AP102-WT-ZS-244	AP-102	AP-02D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	3	0	Not Avail
APICE-WT-LDK-MPS	AP-102	AP-271 Annex	Monitoring	WT	LDK	AP-02D MPS Leak Detector Relay	H-14-102086	3	0	Not Avail
AP102-WT-FAH-260	AP-102	AP-271 Annex	Nitrogen	WT	FAH	Flow Alarm High	H-14-102086	3	0	Not Avail
AP106-WST-LI-106	AP-102	AP-271 Annex	Transfer	WST	LI	Level Indicator for Tank AP-106	H-14-102086	2	0	Not Avail
AP102-WST-LI-222	AP-102	AP-271 Annex	Transfer	WST	LIT	Level Indicating Transmitter	H-14-102086	2	0	Not Avail
APICE-WST-PI-102-1	AP-102	AP-271 Annex	Transfer	WST	PI	Pressure Indicator	H-14-102086	2	0	Not Avail
AP102-WST-TAHL-273	AP-102	AP-271 Annex	Transfer	WST	TAHL	Temperature Alarm High Low	H-14-102086	2	0	Not Avail
AP102-WST-TI-203	AP-102	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	2	0	Not Avail
AP102-WST-TI-204	AP-102	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	2	0	Not Avail
AP102-WST-TI-205	AP-102	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	2	0	Not Avail
AP102-WST-TI-XX	AP-102	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	2	0	Not Avail
AP102-WST-VFD-201	AP-102	AP-271 Annex	Transfer	WST	VFD	Variable Frequency Drive	H-14-102086	2	0	Not Avail
AP102-WST-VFD-202	AP-102	AP-271 Annex	Transfer	WST	VFD	Variable Frequency Drive	H-14-102086	2	0	Not Avail
AP102-WST-VI-206	AP-102	AP-271 Annex	Transfer	WST	VI	Vibration Indicator	H-14-102086	2	0	Not Avail
AP102-WST-VI-207	AP-102	AP-271 Annex	Transfer	WST	VI	Vibration Indicator	H-14-102086	2	0	Not Avail
AP102-WST-XA-101	AP-102	AP-271 Annex	Transfer	WST	XA	Failure Alarm	H-14-102086	2	0	Not Avail
APICE-WST-YL-202D	AP-102	AP-271 Annex	Transfer	WST	YL	Event/State Light	H-14-102086	2	0	Not Avail
AP102-WST-ZI-208	AP-102	AP-271 Annex	Transfer	WST	ZI	Position Indicator	H-14-102086	2	0	Not Avail
AP102-WT-FIC-258	AP-102	AP-271 Annex	Transfer	WT	FIC	Flow Indicating Controller	H-14-102086	3	0	Not Avail
AP102-WT-HS-202B	AP-102	AP-271 Annex	Transfer	WT	HS	2-Position Hand Switch	H-14-102086	2	0	Not Avail
AP102-WT-PAH-276	AP-102	AP-271 Annex	Transfer	WT	PAH	Pressure Alarm High	H-14-102086	3	0	Not Avail
AP102-WT-PAL-280	AP-102	AP-271 Annex	Transfer	WT	PAL	Pressure Alarm Low	H-14-102086	3	0	Not Avail
AP102-WT-PI-259	AP-102	AP-271 Annex	Transfer	WT	PI	Pressure Indicator	H-14-102086	3	0	Not Avail
AP102-WT-TI-277	AP-102	AP-271 Annex	Transfer	WT	TI	Temperature Indicator	H-14-102086	3	0	Not Avail
AP102-WT-VFD-258	AP-102	AP-271 Annex	Transfer	WT	VFD	Variable Frequency Drive	H-14-102086	3	0	Not Avail
AP102-WT-ZC-242	AP-102	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	3	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP102-WT-ZC-243	AP-102	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	3	0	Not Avail
AP102-WT-ZC-244	AP-102	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	3	0	Not Avail
AP102-WT-ZC-245	AP-102	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	3	0	Not Avail
AP102-WT-ZC-253	AP-102	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	3	0	Not Avail
AP102-WT-ZC-261	AP-102	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	3	0	Not Avail
AP102-WT-ZC-262	AP-102	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	3	0	Not Avail
AP102-WT-ZI-262	AP-102	AP-271 Annex	Transfer	WT	ZI	Position Indicator	H-14-102086	3	0	Not Avail
AP271-WT-LDK-281	AP-102	AP-271 Leak Detector Relay Cabinet	Monitoring	WT	LDK	AP-102 Leak Detector Relay	H-14-102086	3	0	Not Avail
AP271-WT-LDK-282	AP-102	AP-271 Leak Detector Relay Cabinet	Monitoring	WT	LDK	AP-102 Leak Detector Relay	H-14-102086	3	0	Not Avail
AP241-IA-Instrument Air for Camera WST-TV-209	AP-102	Bldg 241-AP-273	Instrument Air	IA	IA	Instrument Air Supply	H-14-102086	2	0	Not Avail
AP2750E-WSTA-CASS-A-2361	AP-102	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	9	0	Not Avail
AP2750E-WSTA-CASS-A-2407	AP-102	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	9	0	Not Avail
AP2750E-WSTA-CASS-A-2626	AP-102	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	2	1	Not Avail
AP2750E-WSTA-CASS-A-2630	AP-102	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	9	0	Not Avail
APICE-WT-LDA-282	AP-102	Bldg AP-271 Annex (ICE Bldg)	Monitoring	WT	LDA	Leak Detector Alarm	H-14-102086	3	0	Not Avail
AP242A-WSTA-RSH-102AP	AP-102	Evaporator Bldg 242-A	HVAC Annulus	WSTA	RSH	Radiation switch High	H-14-020503	9	0	Not Avail
AP242A-WSTA-RXS-102AP	AP-102	Evaporator Bldg 242-A	HVAC Annulus	WSTA	RXS	Radiation Failure Switch	H-14-020503	9	0	Not Avail
AP271-WSTA-EY-102	AP-102	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	EY	Voltage Equipment	H-14-020503	9	0	Not Avail
AP271-WSTA-FAL-102	AP-102	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	FAL	Flow Alarm Low	H-14-020503	9	0	Not Avail
AP271-WSTA-RAH-102	AP-102	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	RAH	Radiation Alarm High	H-14-020503	9	0	Not Avail
AP271-WSTA-RR-102	AP-102	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	RR	Radiation Recorder	H-14-020503	9	0	Not Avail
AP271-WSTA-RXA-102	AP-102	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	RXA	Radiation Failure Alarm	H-14-020503	9	0	Not Avail
AP271-WSTA-TAHL-110	AP-102	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	TAHL	Temperature Alarm High Low	H-14-020503	9	0	Not Avail
AP102-WSTA-LDA-122	AP-102	Instr Bldg 241-AP-271	Monitoring	WSTA	LDA	Leak Detector Alarm	H-14-020503	2	1	Not Avail
AP271-WST-PIT-112	AP-102	Instrument Bldg 241-AP-271	Transfer	WST	PIT	Pressure Indicating Transmitter	H-14-102086	2	0	Not Avail
AP102-WT-IY-112	AP-102	Instrument Bldg 241-AP-271	Transfer	WT	IY	Current Equipment	H-14-102086	2		Not Avail
AP102-WST-V-145	AP-102	Mixer Pump WST-P-001	Transfer	WST	V	3-Way Ball Valve	H-14-102086	2	0	Not Avail
AP102-WST-TSHL-273	AP-102	PLC Instrument Enclosure WT-ENCL-101	Transfer	WST	TSHL	Temperature Switch High Low	H-14-102086	2	0	Not Avail
AP-Service Water for Transfer Pump WT-P-002	AP-102	Service Water Enclosure	Service Water		SWS	Service Water System	H-14-102086			Not Avail
AP241-VTA-ENCL-201	AP-102	Tank AP-102	HVAC Annulus	VTA	ENCL	Instrument Enclosure	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-242	AP-102	Tank AP-102	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-V-242	AP-102	Tank AP-102	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020203	1	1	Not Avail
AP271-WT-LDK-283	AP-102	Tank AP-102	Monitoring	WT	LDK	Leak Detector Relay	H-14-102086	3	0	Not Avail
AP102-IA-IA-M17	AP-102	Tank AP-102	Service Air	IA	PIPE	Pipe Segment	H-14-102086	2	0	Not Avail
AP102-WST-V-141	AP-102	Tank AP-102	Service Air	WST	V	Gate Valve	H-14-102086	2	0	Not Avail
AP102-SW-SW-0302-M9	AP-102	Tank AP-102	Service Water	SW	PIPE	Valve Pit Discharge Pipe Segment	H-14-102086	2	0	Not Avail
AP102-WST-V-142	AP-102	Tank AP-102	Service Water	WST	V	Service Water Check Valve	H-14-102086	2	0	Not Avail
--Service Water System	AP-102	Tank AP-102	Service Water		SWS	Service Water System	H-14-102086	7	0	Not Avail
AP102-WST-LIT-222	AP-102	Tank AP-102	Transfer	WST	LIT	Level Indicating Transmitter	H-14-102086	2	0	Not Avail
AP102-WST-TE-36	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-37	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-38	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-39	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-40	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-41	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP102-WST-TE-42	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-43	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-44	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-45	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-46	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-47	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-48	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-49	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-50	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-51	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-52	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-TE-53	AP-102	Tank AP-102	Transfer	WST	TE	Temperature Element	H-14-102086	3	0	Not Avail
AP102-WST-P-001	AP-102	Tank AP-102	Transfer	WST	WMP	Mixer Pump	H-14-102086	2	0	Not Avail
AP241-WT-102	AP-102	Tank AP-102	Transfer	WT	DST	AP Tank Farm Double-Shelled Tank	H-14-102086	3	0	Not Avail
AP02D-WT- LDE-283	AP-102	Tank AP-102	Transfer	WT	LDE	Leak Detector Element	H-14-102086	3	0	Not Avail
AP102-WT-SN-622-M9	AP-102	Tank AP-102	Transfer	WT	PIPE	Valve Pit Discharge Pipe Segment	H-14-102086	3	0	Not Avail
AP02D-WT-PRV-112	AP-102	Tank AP-102	Transfer	WT	PRV	Pressure Reducing Valve	H-14-102086	3	0	Not Avail
AP02D-WT-PSE-275	AP-102	Tank AP-102	Transfer	WT	PSE	Rupture Disk	H-14-102086	3	0	Not Avail
AP02D-WT-PSH-276	AP-102	Tank AP-102	Transfer	WT	PSH	Pressure Switch High	H-14-102086	3	0	Not Avail
AP02D-WT-P-002	AP-102	Tank AP-102	Transfer	WT	WTP	Transfer Pump	H-14-102086	3	0	Not Avail
AP02D-WT-ZE-262	AP-102	Tank AP-102	Transfer	WT	ZE	Position Element	H-14-102086	3	0	Not Avail
AP102-WSTA-FIV-122A	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020503	2	1	Not Avail
AP102-WSTA-FIV-122B	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020503	2	1	Not Avail
AP102-WSTA-FIV-122C	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020503	2	1	Not Avail
AP102-WSTA-LIS-122A	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	LIS	Level Indicating Switch	H-14-020503	2	1	Not Avail
AP102-WSTA-LIS-122B	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	LIS	Level Indicating Switch	H-14-020503	2	1	Not Avail
AP102-WSTA-LIS-122C	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	LIS	Level Indicating Switch	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-100	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-101	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-27	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-28	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-29	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-30	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-31	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-32	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-33	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-34	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-35	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-54	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-55	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-56	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-57	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-58	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-59	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-60	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-61	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-62	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-63	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-64	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-65	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP102-WSTA-TE-66	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-67	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-68	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-69	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-70	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-71	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-72	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-73	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-74	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-75	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-76	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-77	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-78	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-79	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-80	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-81	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-82	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-83	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-84	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-85	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-86	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-87	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-88	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-89	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-90	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-91	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-92	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-93	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-94	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-95	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-96	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-97	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-98	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP102-WSTA-TE-99	AP-102	Tank AP-102 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	2	1	Not Avail
AP241-VTA-F-252	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	FLT	Filter	H-14-020203	1	1	Not Avail
AP241-VTA-HTR-201	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	HTR	Heater	H-14-020203	1	1	Not Avail
AP241-VTA-PDIS-254	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	1	1	Not Avail
AP241-VTA-PDIS-255	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	1	1	Not Avail
AP241-VTA-TS-252	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	1	1	Not Avail
AP241-VTA-V-203	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-204	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-205	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-206	AP-102	Tank AP-102 Enclosure 201	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP102-WSTA-MUX-101A	AP-102	Transmitter Enclosure AP102-WST-ENCL-002	HVAC Annulus	WSTA	MUX	Multiplexer	H-14-020503	2	1	Not Avail
AP102-WSTA-MUX-101B	AP-102	Transmitter Enclosure AP102-WST-ENCL-002	HVAC Annulus	WSTA	MUX	Multiplexer	H-14-020503	2	1	Not Avail
AP901-VTA-PI-112	AP-102/AP-104	Annulus Tanks 102/104 CAM Instr ENCL 241-AP-901	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020203	2	1	Not Avail
AP901-VTA-PI-114	AP-102/AP-104	Annulus Tanks 102/104 CAM Instr ENCL 241-AP-901	HVAC Annulus	VTA	PI	Pressure Indicator	H-14-020203	2	1	Not Avail
AP901-VTA-V-112	AP-102/AP-104	Annulus Tanks 102/104 CAM Instr ENCL 241-AP-901	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	2	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP901-VTA-V-114	AP-102/AP-104	Annulus Tanks 102/104 CAM Instr ENCL 241-AP-901	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	2	1	Not Avail
AP901-WSTA-CAM-102	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	CAM	Continuous Air Monitor	H-14-020503	9	0	Not Avail
AP901-WSTA-CAM-104	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	CAM	Continuous Air Monitor	H-14-020503	9	0	Not Avail
AP901-WSTA-F-133A	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	F	Fan	H-14-020503	9	0	Not Avail
AP901-WSTA-F-133B	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	F	Fan	H-14-020503	9	0	Not Avail
AP901-WSTA-F-(AP102-XX1)	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	FLT	Filter	H-14-020503	9	0	Not Avail
AP901-WSTA-F-(AP104-XX1)	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	FLT	Filter	H-14-020503	9	0	Not Avail
AP901-WSTA-FSL-102	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	FSL	Flow Switch Low	H-14-020503	9	0	Not Avail
AP901-WSTA-FSL-104	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	FSL	Flow Switch Low	H-14-020503	9	0	Not Avail
AP901-WSTA-HM-(APXX1)	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	HM	Hour Meter	H-14-020503	9	0	Not Avail
AP901-WSTA-HTR-134	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	HTR	Heater	H-14-020503	9	0	Not Avail
AP901-WSTA-P-102	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	P	Pump	H-14-020503	9	0	Not Avail
AP901-WSTA-P-104	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	P	Pump	H-14-020503	9	0	Not Avail
AP901-WSTA-PCV-102	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	PCV	Pressure Control Valve	H-14-020503	9	0	Not Avail
AP901-WSTA-PCV-104	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	PCV	Pressure Control Valve	H-14-020503	9	0	Not Avail
AP901-WSTA-PI-102	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	PI	Pressure Indicator	H-14-020503	9	0	Not Avail
AP901-WSTA-PI-104	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	PI	Pressure Indicator	H-14-020503	9	0	Not Avail
AP901-WSTA-TS-133	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	TS	Temperature Switch	H-14-020503	9	0	Not Avail
AP901-WSTA-TS-134	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	TS	Temperature Switch	H-14-020503	9	0	Not Avail
AP901-WSTA-TSH-110	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	TSH	Temperature Switch High	H-14-020503	9	0	Not Avail
AP901-WSTA-TSL-110	AP-102/AP-104	Annulus Tanks AP 102/104 CAN Instr ENCL 241-AP-901	HVAC Annulus	WSTA	TSL	Temperature Switch Low	H-14-020503	9	0	Not Avail
AP901-VTP-PI-102	AP-102/AP-104	Annulus TK 102/104 CAM Instr Encl 241-AP-901	HVAC Primary	VTP	PI	Pressure Indicator	H-14-020103	1	1	Not Avail
AP901-VTP-PI-104	AP-102/AP-104	Annulus TK 102/104 CAM Instr Encl 241-AP-901	HVAC Primary	VTP	PI	Pressure Indicator	H-14-020103	1	1	Not Avail
AP901-VTP-V-112	AP-102/AP-104	Annulus TK 102/104 CAM Instr Encl 241-AP-901	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020103	1	1	Not Avail
AP901-VTP-V-114	AP-102/AP-104	Annulus TK 102/104 CAM Instr Encl 241-AP-901	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020103	1	1	Not Avail
AP241-VTA-FTP-102	AP-102/AP-104	AP Farm Vent Pit 1	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	2	1	Not Avail
AP241-VTA-FTP-104	AP-102/AP-104	AP Farm Vent Pit 1	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	2	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-VTA-V-102	AP-102/AP-104	AP Farm Vent Pit 1	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020203	2	1	Not Avail
AP241-VTA-V-104	AP-102/AP-104	AP Farm Vent Pit 1	HVAC Annulus	VTA	V	Butterfly Valve	H-14-020203	2	1	Not Avail
AP241-VTA-DMPR-211	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	DMPR	Damper	H-14-020203	1	1	Not Avail
AP241-VTA-FLT-212	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FLT	HEPA Filter	H-14-020203	1	1	Not Avail
AP241-VTA-FLT-211	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FLT	Pre-Filter	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-211	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-212	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-213	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-214	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-215	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-216	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-FTP-217	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	FTP	Flow Test Port	H-14-020203	1	1	Not Avail
AP241-VTA-HTR-261	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	HTR	Heater	H-14-020203	1	1	Not Avail
AP241-VTA-ISC-XX2)	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	ISC	Inlet Screen	H-14-020203	1	1	Not Avail
AP241-VTA-TC-261	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	TC	Temperature Controller	H-14-020203	1	1	Not Avail
AP241-VTA-TI-211	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	1	1	Not Avail
AP241-VTA-TI-212	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	TI	Temperature Indicator	H-14-020203	1	1	Not Avail
AP241-VTA-TS-211	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	1	1	Not Avail
AP241-VTA-TS-261	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	1	1	Not Avail
AP241-VTA-TSL-263	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	TSL	Temperature Switch Low	H-14-020203	1	1	Not Avail
AP241-VTA-V-211	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-212	AP-103/AP-104	AP Farm Annulus Air Intake Station B	HVAC Annulus	VTA	V	2-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-PDAH-264	AP-103/AP-104	Instr Bldg 241-AP-271	HVAC Annulus	VTA	PDAH	Pressure Differential Alarm High	H-14-020203	1	1	Not Avail
AP241-VTA-PDAH-265	AP-103/AP-104	Instr Bldg 241-AP-271	HVAC Annulus	VTA	PDAH	Pressure Differential Alarm High	H-14-020203	1	1	Not Avail
AP241-VTA-XA-263	AP-103/AP-104	Instr Bldg 241-AP-271	HVAC Annulus	VTA	XA	Failure Alarm	H-14-020203	1	1	Not Avail
AP241-WT-Nitrogen System for Transfer Pump WT-P-019	AP-104	AP Farm Nitrogen Station	Nitrogen	WT	N2	Nitrogen System Supply	H-14-102086	3	0	Not Avail
AP04A-WST-211	AP-104	AP-04A Central Pump Pit	Monitoring	WST	LDE	AP-04A Central Pump Pit Leak Detector Element	H-14-102086	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP04A-WST-A-E-(1)	AP-104	AP-04A Central Pump Pit	Transfer	WST	JMP	AP-04A Central Pump Pit Jumper Assembly	H-14-102086	5	0	Not Avail
AP04A-WST-K-(1)	AP-104	AP-04A Central Pump Pit	Transfer	WST	JMP	AP-04A Central Pump Pit Jumper Assembly	H-14-102086	5	0	Not Avail
AP04A-WST-1	AP-104	AP-04A Central Pump Pit	Transfer	WST	NOZ	AP-04A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04A-WST-A	AP-104	AP-04A Central Pump Pit	Transfer	WST	NOZ	AP-04A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04A-WST-E	AP-104	AP-04A Central Pump Pit	Transfer	WST	NOZ	AP-04A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04A-WST-K	AP-104	AP-04A Central Pump Pit	Transfer	WST	NOZ	AP-04A Central Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP104-WST-TE-215	AP-104	AP-04A Central Pump Pit	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-216	AP-104	AP-04A Central Pump Pit	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-217	AP-104	AP-04A Central Pump Pit	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-VT-218	AP-104	AP-04A Central Pump Pit	Transfer	WST	VT	Vibration Transmitter	H-14-102086	4	0	Not Avail
AP104-WST-VT-219	AP-104	AP-04A Central Pump Pit	Transfer	WST	VT	Vibration Transmitter	H-14-102086	4	0	Not Avail
AP04A-WT-MOV-254	AP-104	AP-04A Central Pump Pit	Transfer	WT	MOV	AP-04A Central Pump Pit Valve	H-14-102086	5	0	Not Avail
AP104-WT-ZS-254	AP-104	AP-04A Central Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	5	0	Not Avail
AP104-WT-SN-614-M25	AP-104	AP-04A Central Pump Pit to AP Valve Pit	Transfer	WT	PIPE	Tank Discharge Pipe Segment	H-14-102086	5	0	Not Avail
AP04D-WT-C-(9&10)	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	JMP	AP-04D Pump Pit Jumper Assembly	H-14-102086	6	0	Not Avail
AP04D-WT-D-(2,4&6)	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	JMP	AP-04D Pump Pit Jumper Assembly	H-14-102086	5	0	Not Avail
AP04D-WT-MOV-249	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	MOV	3-Way Ball Valve	H-14-102086	5	0	Not Avail
AP04D-WT-MOV-263	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	MOV	AP-04D Pump Pit Valve	H-14-102086	5	0	Not Avail
AP04D-WT-(AP04D) 3	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-2	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-6	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-D	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	6	0	Not Avail
AP04D-WT-V-806	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	V	Check Valve	H-14-102086	6	0	Not Avail
AP104-WT-ZS-249	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	ZS	Position Switch	H-14-102086	5	0	Not Avail
AP104-WT-ZS-263	AP-104	AP-04D Pump Pit	Dilution/Flush	WT	ZS	Position Switch	H-14-102086	5	0	Not Avail
AP04D-WT-LDE-287A	AP-104	AP-04D Pump Pit	Monitoring	WT	LDE	AP-04D Pump Pit Leak Detector Element	H-14-102086	5	0	Not Avail
AP04D-WT-LDE-287B	AP-104	AP-04D Pump Pit	Monitoring	WT	LDE	AP-04D Pump Pit Leak Detector Element	H-14-102086	5	0	Not Avail
AP04D-WT-V-209	AP-104	AP-04D Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102086	5	0	Not Avail
AP04D-WT-V-210	AP-104	AP-04D Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102086	5	0	Not Avail
AP04D-WT-V-211	AP-104	AP-04D Pump Pit	Service Water	WT	V	Service Water Check Valve	H-14-102086	5	0	Not Avail
AP04D-WT-FE-264	AP-104	AP-04D Pump Pit	Transfer	WT	FE	Flow Element	H-14-102086	5	0	Not Avail
AP04D-WT-FE-270	AP-104	AP-04D Pump Pit	Transfer	WT	FE	Flow Element	H-14-102086	6	0	Not Avail
AP04D-WT-FIT-270	AP-104	AP-04D Pump Pit	Transfer	WT	FIT	Flow Indicating Transmitter	H-14-102086	6	0	Not Avail
AP104-WT-FIT-264	AP-104	AP-04D Pump Pit	Transfer	WT	FIT	Flow Indicating Transmitter	H-14-102086	5	0	Not Avail
AP04D-WT-(3&6)	AP-104	AP-04D Pump Pit	Transfer	WT	JMP	AP-04D Pump Pit Jumper Assembly	H-14-102086	5	0	Not Avail
AP04D-WT-(7&8	AP-104	AP-04D Pump Pit	Transfer	WT	JMP	AP-04D Pump Pit Jumper Assembly	H-14-102086	5	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP04D-WT-A-(1,4,5&7)	AP-104	AP-04D Pump Pit	Transfer	WT	JMP	AP-04D Pump Pit Jumper Assembly	H-14-102086	5	0	Not Avail
AP04D-WT-B-(10)	AP-104	AP-04D Pump Pit	Transfer	WT	JMP	AP-04D Pump Pit Jumper Assembly	H-14-102086	6	0	Not Avail
AP04D-WT-E-(F,5,8&9)	AP-104	AP-04D Pump Pit	Transfer	WT	JMP	AP-04D Pump Pit Jumper Assembly	H-14-102086	6	0	Not Avail
AP04D-WT-MOV-252	AP-104	AP-04D Pump Pit	Transfer	WT	MOV	2-Way Ball Valve	H-14-102086	6	0	Not Avail
AP04D-WT-MOV-246	AP-104	AP-04D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	5	0	Not Avail
AP04D-WT-MOV-247	AP-104	AP-04D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	5	0	Not Avail
AP04D-WT-MOV-248	AP-104	AP-04D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	5	0	Not Avail
AP04D-WT-MOV-250	AP-104	AP-04D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	6	0	Not Avail
AP04D-WT-MOV-251	AP-104	AP-04D Pump Pit	Transfer	WT	MOV	3-Way Ball Valve	H-14-102086	6	0	Not Avail
AP04D-WT-1	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-10	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	6	0	Not Avail
AP04D-WT-4	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-5	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-7	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-8	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-9	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	6	0	Not Avail
AP04D-WT-A	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-B	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	6	0	Not Avail
AP04D-WT-C	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	6	0	Not Avail
AP04D-WT-E	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	6	0	Not Avail
AP04D-WT-F	AP-104	AP-04D Pump Pit	Transfer	WT	NOZ	AP-04D Pump Pit Jumper Connection	H-14-102086	5	0	Not Avail
AP04D-WT-PE-266	AP-104	AP-04D Pump Pit	Transfer	WT	PE	WT Pump Discharge Pressure Element	H-14-102086	5	0	Not Avail
AP04D-WT-PE-271	AP-104	AP-04D Pump Pit	Transfer	WT	PE	WT Pump Discharge Pressure Element	H-14-102086	6	0	Not Avail
AP04D-WT-PIT-271	AP-104	AP-04D Pump Pit	Transfer	WT	PIT	Pressure Indicating Transmitter	H-14-102086	6	0	Not Avail
AP104-WT-PIT-266	AP-104	AP-04D Pump Pit	Transfer	WT	PIT	Pressure Indicating Transmitter	H-14-102086	5	0	Not Avail
AP04D-WT-TE-274	AP-104	AP-04D Pump Pit	Transfer	WT	TE	Temperature Element	H-14-102086	5	0	Not Avail
AP04D-WT-ZS-250	AP-104	AP-04D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	6	0	Not Avail
AP04D-WT-ZS-251	AP-104	AP-04D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	6	0	Not Avail
AP04D-WT-ZS-252	AP-104	AP-04D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	6	0	Not Avail
AP104-WT-ZS-246	AP-104	AP-04D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	5	0	Not Avail
AP104-WT-ZS-247	AP-104	AP-04D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	5	0	Not Avail
AP104-WT-ZS-248	AP-104	AP-04D Pump Pit	Transfer	WT	ZS	Position Switch	H-14-102086	5	0	Not Avail
AP104-WT-SN-624-M9	AP-104	AP-04D Pump Pit to AP-02D Pump Pit	Transfer	WT	PIPE	Tank Discharge Pipe Segment	H-14-102086	6	0	Not Avail
AP104-WT-SN-623-M25	AP-104	AP-04D Pump Pit to AP-04A Central Pump Pit	Transfer	WT	PIPE	Valve Pit Discharge Pipe Segment	H-14-102086	5	0	Not Avail
AP104-WT-SN-625-M9	AP-104	AP-04D Pump Pit to Vendor Tank	Transfer	WT	PIPE	Tank Discharge Pipe Segment	H-14-102086	6	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP104-WST-HS-214B	AP-104	AP-271 Annex	Transfer	WST	HS	2-Position Hand Switch	H-14-102086	4	0	Not Avail
AP104-WST-LI-224	AP-104	AP-271 Annex	Transfer	WST	LI	Level Indicator	H-14-102086	4	0	Not Avail
AP104-WST-PI-304	AP-104	AP-271 Annex	Transfer	WST	PI	Pressure Indicator	H-14-102086	4	0	Not Avail
AP104-WST-TI-215	AP-104	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	4	0	Not Avail
AP104-WST-TI-216	AP-104	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	4	0	Not Avail
AP104-WST-TI-217	AP-104	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	4	0	Not Avail
AP104-WST-TI-XX	AP-104	AP-271 Annex	Transfer	WST	TI	Temperature Indicator	H-14-102086	4	0	Not Avail
AP104-WST-VFD-213	AP-104	AP-271 Annex	Transfer	WST	VFD	Variable Frequency Drive	H-14-102086	4	0	Not Avail
AP104-WST-VFD-214	AP-104	AP-271 Annex	Transfer	WST	VFD	Variable Frequency Drive	H-14-102086	4	0	Not Avail
AP104-WST-VI-218	AP-104	AP-271 Annex	Transfer	WST	VI	Vibration Indicator	H-14-102086	4	0	Not Avail
AP104-WST-VI-219	AP-104	AP-271 Annex	Transfer	WST	VI	Vibration Indicator	H-14-102086	4	0	Not Avail
AP104-WST-YL-214D	AP-104	AP-271 Annex	Transfer	WST	YL	Event/State Light	H-14-102086	4	0	Not Avail
AP104-WST-ZI-220	AP-104	AP-271 Annex	Transfer	WST	ZI	Position Indicator	H-14-102086	4	0	Not Avail
AP04D-WT-FAH-261	AP-104	AP-271 Annex	Transfer	WT	FAH	Flow Alarm High	H-14-102086	6	0	Not Avail
AP04D-WT-FI-270	AP-104	AP-271 Annex	Transfer	WT	FI	Flow Indicator	H-14-102086	6	0	Not Avail
AP04D-WT-FIC-264	AP-104	AP-271 Annex	Transfer	WT	FIC	Flow Indicating Controller	H-14-102086	6	0	Not Avail
AP04D-WT-FQI-270	AP-104	AP-271 Annex	Transfer	WT	FQI	Flow Totalizer Indicator	H-14-102086	6	0	Not Avail
AP104-WT-PAH-275	AP-104	AP-271 Annex	Transfer	WT	PAH	Pressure Alarm High	H-14-102086	5	0	Not Avail
AP04D-WT-PAL-281	AP-104	AP-271 Annex	Transfer	WT	PAL	Pressure Alarm Low	H-14-102086	6	0	Not Avail
AP04D-WT-PI-271	AP-104	AP-271 Annex	Transfer	WT	PI	Pressure Indicator	H-14-102086	6	0	Not Avail
AP104-WT-PI-266	AP-104	AP-271 Annex	Transfer	WT	PI	Pressure Indicator	H-14-102086	5	0	Not Avail
AP104-WT-TI-274	AP-104	AP-271 Annex	Transfer	WT	TI	Temperature Indicator	H-14-102086	5	0	Not Avail
AP104-WT-VFD-264	AP-104	AP-271 Annex	Transfer	WT	VFD	Variable Frequency Drive	H-14-102086	5	0	Not Avail
AP04D-WT-ZC-250	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	6	0	Not Avail
AP04D-WT-ZC-251	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	6	0	Not Avail
AP04D-WT-ZC-252	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	6	0	Not Avail
AP104-WT-ZC-246	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	5	0	Not Avail
AP104-WT-ZC-247	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	5	0	Not Avail
AP104-WT-ZC-248	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	5	0	Not Avail
AP104-WT-ZC-249	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	5	0	Not Avail
AP104-WT-ZC-254	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	5	0	Not Avail
AP104-WT-ZC-263	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	5	0	Not Avail
AP104-WT-ZC-268	AP-104	AP-271 Annex	Transfer	WT	ZC	Position Controller	H-14-102086	5	0	Not Avail
AP104-WT-ZI-268	AP-104	AP-271 Annex	Transfer	WT	ZI	Position Indicator	H-14-102086	5	0	Not Avail
AP271-WT-LDK-287A	AP-104	AP-271 Leak Detector Relay Cabinet	Monitoring	WT	LDK	AP-04D Pump Pit Leak Detector Relay	H-14-102086	5	0	Not Avail
AP271-WT-LDK-287B	AP-104	AP-271 Leak Detector Relay Cabinet	Monitoring	WT	LDK	AP-04D Pump Pit Leak Detector Relay	H-14-102086	5	0	Not Avail
AP241-IA-Instrument Air for Camera WST-TV-230	AP-104	Bldg 241-AP-273	Instrument Air	IA	IA	Instrument Air Supply	H-14-102086	4	0	Not Avail
AP2750E-WSTA-CASS-2666	AP-104	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	4	0	Not Avail
AP2750E-WSTA-CASS-A-2363	AP-104	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	9	0	Not Avail
AP2750E-WSTA-CASS-A-2421	AP-104	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	9	0	Not Avail
AP2750E-WSTA-CASS-A-2670	AP-104	Bldg 2750	HVAC Annulus	WSTA	CASS	Computer Automated Surveillance Station	H-14-020503	9	0	Not Avail
AP242A-WSTA-RSH-104AP	AP-104	Evaporator Bldg 242-A	HVAC Annulus	WSTA	RSH	Radiation Switch High	H-14-020503	9	0	Not Avail
AP242A-WSTA-RXS-104AP	AP-104	Evaporator Bldg 242-A	HVAC Annulus	WSTA	RXS	Radiation Failure Switch	H-14-020503	9	0	Not Avail
AP271-WSTA-EY-104	AP-104	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	EY	Voltage Equipment	H-14-020503	9	0	Not Avail
AP271-WSTA-FAL-104	AP-104	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	FAL	Flow Alarm Low	H-14-020503	9	0	Not Avail
AP271-WSTA-RAH-104	AP-104	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	RAH	Radiation Alarm High	H-14-020503	9	0	Not Avail
AP271-WSTA-RR-104	AP-104	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	RR	Radiation Recorder	H-14-020503	9	0	Not Avail
AP271-WSTA-RXA-104	AP-104	Instr Bldg 241-AP-271	HVAC Annulus	WSTA	RXA	Radiation Failure Alarm	H-14-020503	9	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP104-WSTA-LDA-124	AP-104	Instr Bldg 241-AP-271	Monitoring	WSTA	LDA	Leak Detector Alarm	H-14-020503	4	0	Not Avail
AP104-WST-IY-	AP-104	Instrument Bldg 241-AP-271	Transfer	WST	IY	Current Equipment	H-14-102086	4	0	Not Avail
AP104-WST-PR-114	AP-104	Instrument Bldg 241-AP-271	Transfer	WST	PR	Pressure Recorder	H-14-102086	4	0	Not Avail
AP241-SW-Service Water for Transfer Pump WT-P-019	AP-104	Service Water Enclosure	Service Water	SW	SWS	Service Water System	H-14-102086	3	0	Not Avail
AP04A-WST-LDE-285	AP-104	Tank AP-104	Monitoring	WST	LDE	Leak Detector Element	H-14-102086	5	0	Not Avail
AP271-WT-LDK-285	AP-104	Tank AP-104	Monitoring	WT	LDK	Leak Detector Relay	H-14-102086	5	0	Not Avail
AP104-WST-IA-104-M31	AP-104	Tank AP-104	Service Air	WST	PIPE	Pipe Segment	H-14-102086	4	0	Not Avail
AP104-WST-V-143	AP-104	Tank AP-104	Service Air	WST	V	Gate Valve	H-14-102086	4	0	Not Avail
SW	AP-104	Tank AP-104	Service Water	SW	SWS	Service Water System	H-14-102086	7	0	Not Avail
AP104-WST-SW-304-M9	AP-104	Tank AP-104	Service Water	WST	PIPE	Valve Pit Discharge Pipe Segment	H-14-102086	4	0	Not Avail
AP104-WST-V-144	AP-104	Tank AP-104	Service Water	WST	V	Service Water Check Valve	H-14-102086	4	0	Not Avail
--Service Water System	AP-104	Tank AP-104	Service Water		SWS	Service Water System	H-14-102086	7	0	Not Avail
AP241-WST-104	AP-104	Tank AP-104	Transfer	WST	DST	AP Tank Farm Double-Shelled Tank	H-14-102086	4	0	Not Avail
AP104-WST-LIT-224	AP-104	Tank AP-104	Transfer	WST	LIT	Level Indicating Transmitter	H-14-102086	4	0	Not Avail
AP104-WST-TE-36	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-37	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-38	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-39	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-40	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-41	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-42	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-43	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-44	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-45	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-46	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-47	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-48	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-49	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-50	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-51	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-52	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-TE-53	AP-104	Tank AP-104	Transfer	WST	TE	Temperature Element	H-14-102086	4	0	Not Avail
AP104-WST-P-003	AP-104	Tank AP-104	Transfer	WST	WMP	Mixer Pump	H-14-102086	4	0	Not Avail
AP104-WST-ZT-220	AP-104	Tank AP-104	Transfer	WST	ZT	Position Transmitter	H-14-102086	4	0	Not Avail
AP04D-WT-PRV-113	AP-104	Tank AP-104	Transfer	WT	PRV	Pressure Reducing Valve	H-14-102086	5	0	Not Avail
AP04D-WT-PSE-275	AP-104	Tank AP-104	Transfer	WT	PSE	Rupture Disk	H-14-102086	5	0	Not Avail
AP04D-WT-PSH-275	AP-104	Tank AP-104	Transfer	WT	PSH	Pressure Switch High	H-14-102086	5	0	Not Avail
AP04D-WT-ZE-268	AP-104	Tank AP-104	Transfer	WT	ZE	Position Element	H-14-102086	5	0	Not Avail
AP104-WSTA-FIV-124A	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020503	4	0	Not Avail
AP104-WSTA-FIV-124B	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020503	4	0	Not Avail
AP104-WSTA-FIV-124C	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	FIV	Flow Indicator with Flow Adjust Valve	H-14-020503	4	0	Not Avail
AP104-WSTA-LIS-124A	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	LIS	Level Indicating Switch	H-14-020503	4	0	Not Avail
AP104-WSTA-LIS-124B	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	LIS	Level Indicating Switch	H-14-020503	4	0	Not Avail
AP104-WSTA-LIS-124C	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	LIS	Level Indicating Switch	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-100	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-101	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-27	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-28	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-29	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP104-WSTA-TE-30	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-31	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-32	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-33	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-34	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-35	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-54	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-55	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-56	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-57	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-58	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-59	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-60	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-61	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-62	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-63	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-64	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-65	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-66	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-67	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-68	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-69	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-70	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-71	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-72	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-73	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-74	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-75	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-76	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-77	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-78	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-79	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-80	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-81	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-82	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-83	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-84	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-85	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-86	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-87	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-88	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-89	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-90	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-91	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-92	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-93	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-94	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-95	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-96	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-97	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-98	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP104-WSTA-TE-99	AP-104	Tank AP-104 Annulus	HVAC Annulus	WSTA	TE	Temperature Element	H-14-020503	4	0	Not Avail
AP241-VTA-ENCL-211	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	ENCL	Enclosure	H-14-020203	1	1	Not Avail
AP241-VTA-F-262	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	FLT	Filter	H-14-020203	1	1	Not Avail
AP241-VTA-HTR-211	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	HTR	Heater	H-14-020203	1	1	Not Avail

Table F-6	Unique Component List of Systems Associated with Waste Transfers from Source Tank 241-AN-105									
COMPLETE EIN	Farm-Tank	Equipment Location	System Type	System	Comp. Type	Component Description	Drawing Number	Sht	Rev	EQUIP. ORIGIN
AP241-VTA-PDIS-264	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	1	1	Not Avail
AP241-VTA-PDIS-265	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	PDIS	Pressure Differential Indicating Switch (High/Low)	H-14-020203	1	1	Not Avail
AP241-VTA-TS-262	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	TS	Temperature Switch	H-14-020203	1	1	Not Avail
AP241-VTA-V-213	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-214	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-215	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP241-VTA-V-216	AP-104	Tank AP-104 Enclosure 211	HVAC Annulus	VTA	V	3-Way Ball Valve	H-14-020203	1	1	Not Avail
AP104-WST-MUX-101A, 101B	AP-104	Transmitter Enclosure AP104-WST-ENCL-004	HVAC Annulus	WST	MUX	Multiplexer	H-14-020503	4	0	Not Avail
AP271-WT-LDK-216	AP-106	AP-06A Central Pump Pit	Monitoring	WT	LDK	AP-06A Central Pump Pit Leak Detector Relay	H-14-020803	4	0	Not Avail
AP06A-WT-LDE-216	AP-106	AP-06A Central Pump Pit	Transfer	WT	LDE	AP-06A Central Pump Pit Leak Detector Element	H-14-020803	4	0	Not Avail
AP904-VTP-PI-106	AP-106/AP-108	Annulus TK 106/108 CAM Instr Encl 241-AP-901	HVAC Primary	VTP	PI	Pressure Indicator	H-14-020103	1	1	Not Avail
AP904-VTP-V-116	AP-106/AP-108	Annulus TK 106/108 CAM Instr Encl 241-AP-901	HVAC Primary	VTP	V	3-Way Ball Valve	H-14-020103	1	1	Not Avail
--LDA-162	AZ?	Bldg AZ-156	Monitoring	WT	LDA	Leak Detector Alarm	H-14-102454	4	0	Not Avail
--LDA-163	AZ?	Bldg AZ-156	Monitoring	WT	LDA	Leak Detector Alarm	H-14-102454	4	0	Not Avail
ELEC	ELEC	Site	Electric Power	ELEC	ELEC	Electric Power System	UNKNOWN	0	UNKNOWN	Not Avail
ALL-ALL-OIE-8A8B01	OIE	ALL	OIE	OIE	OIE	Other Internal Events	N/A	0	0	Not Avail
RW	RW	Site	Raw Water	RW	RW	Raw Water System	UNKNOWN	0	UNKNOWN	Not Avail
ALL-ALL-SA-8A8B01	SA	ALL	SA	SA	SA	Spurious Alarm	N/A	0	0	Not Avail
ALL-ALL-SA-8A8B02	SA	ALL	SA	SA	SA	Spurious Alarm	N/A	0	0	Not Avail

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Appendix G. Case Study - Interconnected Tank Equipment Impacts to WFDS Operations

A major topic that must be addressed for O&M requirements and RAM implications is the potential impact of interconnected tank system requirements. Because of the lack of need for frequent transfers in the recent past, the TWRS Authorization Basis (AB) has been developed and interpreted conservatively to maximize safety of the storage mission. The TWRS AB interprets an interconnected tank as any tank that has a transfer line physically connected to the transfer route. This definition of "physically connected" encompasses any transfer line that is not separated from the active transfer line by a blank or air space. For all interconnected tanks, the AB currently requires verification of selected equipment in all interconnected tanks in order to initiate a waste transfer, stringent operability requirements for that equipment during waste transfers, including immediate responses to spurious alarms that interrupt active waste preparation and transfer operations.

G.1. Operability Requirements

Plant Operating Procedure TO-025-005 addresses equipment verifications of the following systems as well as other operational checks. In general, the operability of selected systems for all interconnected tanks must be verified before a waste transfer may begin. Following the completion of W-314 Project upgrades, interconnected tanks in the 200 East Area will include the AN (seven tanks), AW (six tanks), AY (two tanks), AZ (two tanks), AP (eight tanks) waste tanks, the 204-AR storage tank (TK-01), and the 151-AZ catch tank. In addition, transfer facilities and systems that will no longer be required after completion of the W-314 transfer system upgrade are not currently funded for retirement. Examples of these facilities and systems include 244-A, 244-CR, A-complex transfer lines and clean out boxes, valve pits (e.g. AX-A/B, A-AB), A-350 drain lines and catch tank, and the old cross-site transfer system. Components supporting these systems include leak detectors, pressure switches, and radiation monitors that will still be connected to the master pump shutdown (MPS) and, therefore, will also restrict operations until deactivated. Thus, for the planned waste movement from an east area DST there are potential impacts from the operability status of 27 other tanks and potentially numerous inactive facilities/systems.

G.1.1. Systems with Operability Requirements

The following table provides an approximate breakdown of systems that must be operable to begin and continue a waste transfer from any east area DST.

System	Approximate No. of Components/ Systems in the 200E Area	Required to be Operable to Initiate a Transfer	Required to Remain Operable to Continue a Transfer
Tank Primary Leak Detectors	65	All 200E	All Interconnected
Transfer System Leak Detectors	135	All Interconnected Systems	All Interconnected Systems
Tank Level Monitors	28	All Interconnected Systems	All Interconnected Systems
Service Water Pressure Detection Systems	20	All Interconnected Systems	All Interconnected Systems
Transfer System Cover Blocks	6 sets	All Interconnected Systems	All Interconnected Systems
Stack Radiation Monitor and HEPA Differential Pressure Monitors	5	Direct Path Only	Direct Path Only
Transfer Line Encasement Seal Drain Valves	Unknown	All Interconnected Systems	All Interconnected Systems
Primary Tank Ventilation CAM Interlocks	5	All Interconnected Systems	All Interconnected Systems
Primary Tank Ventilation Systems	5 Systems, each containing many components	All Interconnected Systems	Direct Path Only
Waste Temperature Monitors	450	Direct Path Only	Direct Path Only
Hydrogen Monitoring Systems	6	Direct Path Only	Not Required
Annulus Ventilation Systems	6	Direct Path Only	Direct Path Only

These systems provide diverse means to detect the unintended transfer of waste that could pose additional risks of safety related events. The attachment discusses each system in more detail and provides some rationale for the above numbers and designations. The question is whether this degree of defense-in-depth provides a safety benefit for an activity that is local in nature, especially considering its potential to interrupt those activities when no unintended transfer of waste exists.

G.1.2. Reliability of Other Interconnected Systems

Other systems that impact waste transfer operations include transfer system covers, encasement seal drain valves, and CAM interlocks. Transfer system covers and encasement seal drain valves are not likely to affect ongoing waste transfers. Transfer system cover removal requires a large planning effort and the use of cranes; however, once they are verified as in place and operable, a change in their status without massive

human intervention is extremely unlikely. Encasement seal drain valves cannot change position on their own and are not under pressure. Therefore, once they are in position for the initiation of a transfer, they are not likely to further affect the ongoing transfer. Thus, from an equipment failure perspective, continuing in-progress waste transfers is not highly dependent on the failure of these other interconnected tank systems.

G.1.3. Availability of Other Interconnected Systems

Although they are not required to continue ongoing transfers, there are a significant number of components and systems required to be operational for initiating waste transfers. This is due primarily to the requirement that all primary tank ventilation systems be operational. However, the primary ventilation systems have backup capability, and all of the existing systems will be verified available during transfer preparations.

G.2. Frequency of Spurious Transfer Shutdown Events

Excessive spurious alarms are important from several perspectives. The first is the accumulated delay from responding to alarms. If the alarm rate is high, it may not become feasible to continue transfers until the cause of the spurious alarms is resolved. Additionally, shift operations managers must decide when spurious alarm recovery has taken too long and the line should be flushed. Finally, each shutdown due to a spurious alarm creates an additional demand on the waste transfer pump to restart, which is a major contributor to pump failure.

G.2.1. Analysis of CMAS Data

Because the RAM model used an industry generic failure mode and rate for spurious alarms generated from internal mechanisms or external mechanisms that may not be fully representative of Hanford experience, an effort was undertaken to establish a reasonable site-specific spurious alarm rate for RPP by reviewing central monitoring alarm station (CMAS) data and interviewing operations and engineering personnel.

Approximately three months of CMAS data were reviewed and categorized into alarm events. Table G-1 presents an example of the results of the review (Sheets 1-2 of 22 sheets). For the purpose of this evaluation, an alarm event was defined as a set of alarm signals generated from the same external event over a relatively short period of time. Such an alarm event might include a series of alarms during one weather-induced interruption, or the alarm signals resulting from attempts to clear the initial alarm. Alarms that might have been due to maintenance activities were treated as actual alarms. The discrete alarm events monitored by the CMAS system include virtually all of the DST system leak detectors, approximately one-half of the level monitors, ventilation system operability status and all of the ventilation system radiation alarms. The tank monitoring and control system (TMACS) alarm monitoring system primarily covers tank waste temperature monitoring, half of the tank level monitoring systems, and hydrogen monitoring systems (SHMS). SHMS alarms do not result in a termination of transfer activities.

There were several difficulties in estimating a potential spurious alarm rate. There are approximately 2,700 alarms within the 200 East Area TWRS complex. Approximately 700 of these were monitored by the CASS system and subsequently moved to the CMAS system. Unfortunately, the use of the CMAS system by operations personnel is optional, since the primary monitoring method is in-field monitoring during daily rounds surveillance activities. This provides operations with the ability to deactivate the CAMS when they have such a need. However, the data sample received from the CMAS system seemed reasonably complete. Another difficulty was the method of monitoring for the remaining 2,000 TWRS alarms. These alarms are trended on a continuous basis, and within the RPP, discrete alarms are not logged by the system. A final difficulty arose from the lack of an authoritative list of those alarms and equipment items linked to the master pump shutdown system.

The CMAS data review yielded 164 events in 86 days, which is equivalent to an alarm event rate of approximately two unique events per day. There were some days with no events, and one day with 10 unique events. During this preliminary evaluation, the source, validity, and operational response to the alarms were not investigated. Consequently, this estimate should be considered only a preliminary order-of-magnitude estimate. The prototype CMAS data collection system has uncertainties, such as the ability of operations personnel to deactivate the system and the incomplete coverage of all of the systems. Interviews with RPP personnel indicated that level monitors and temperature monitors do not have a large spurious alarm rate. Thus, the existing CMAS data are more likely just an indication of the order-of-magnitude of the spurious alarm rates that impact transfer operations.

G.2.2. Quantification of Schedule Impact

The RAM was used to quantify the impact of both random failures and spurious shutdown signals from interconnected systems. Recovery from spurious shutdowns was assumed to be recovered within one to six hours, while random failures required about two days to recover. The evaluation considered a range of shutdown frequencies that represented additional random failures and an increasing rate of spurious shutdown signals.

Table G-2 shows the results of the cases that were run, while Figure G-1 shows the result of a simulation of delays caused by spurious shutdowns at the rate of one per two days (0.021/hr). It can be seen in Table G-2 that the overall effect of the increasing additional shutdown rate is compounding. The overall delay increases not only because of the necessity to recover from the spurious alarms, but also because the additional demands and operating time give system safety and transfer equipment more opportunity to fail. For this first order RAM model, the simulation results in Figure G-1 show that a rate of one spurious shutdown per two days produces a probability of incurring idle facility penalties of 50%. At a rate of one shutdown event per day, there is no success path. The delays get longer and longer. Higher failure rates are probably outside the valid range of the model, since multiple repairs can be done in parallel. However, the model is adequate to indicate that the problem is real and adequately illustrated by the approximation.

G.3. Impacts to Waste Feed Delivery Activities

Delays resulting from interconnected systems actually arise from at least two sources: the shutdown of an operating system discussed above, but also the requirement that a wide variety of equipment be available and not be subjected to maintenance during a transfer.

G.3.1. Equipment Availability in Order to Initiate Transfers

Summary of Problem

The BIO establishes the basis for what systems must be operable prior to beginning a waste transfer. These systems and components are currently handled with plant operating procedure TO-025-005, "Equipment Verifications." It is estimated that the time required to prepare for a waste transfer is extended from two days to five days given all of the additional equipment that must be verified operational for the interconnected tanks. The O&M Concept currently accounts for the full five days of preparation time. If the verification requirements for the interconnected tanks are limited to those justified by a graded approach, the pre-transfer verification effort could be reduced by approximately three days.

A related impact is the availability of the required equipment, which includes the requirements that all calibrations and functional tests must be current through the end of the transfer. If equipment is found to require testing or calibration, or is found to not be operational, additional time must be allocated to accomplish these activities. As transfers are accomplished more frequently, the maintenance time required to keep the equipment surveillance and calibration current and the time required to align and accomplish transfers may come into conflict often. Quantification of the unavailability of equipment due to scheduled maintenance is beyond the current scope of the RAM analysis, but its impact could be significant.

Operations relies heavily on a central remote monitoring capability to achieve the transfer monitoring requirements specified in the TWRS AB. Loss of this capability would require operators to locally monitor each of the tank levels and leak detectors. This effort could not be sustained for more than a couple of shifts and would be very costly and difficult to orchestrate.

Possible Solutions

The most obvious solution to this problem for interconnected systems is to verify that each system required to be operable is playing a significant role in maintaining safety. This requires that the authorization basis considers the likelihood and consequences of misrouting events and that a graded approach to safety and administrative controls is taken. For example, two closed valves in series may be shown to provide adequate protection against misrouting events that produce increase in safety-related risk when both sides of the pipe provide containment for the waste. Under these circumstances, the combination of the low probability that two valves will experience significant leakage after verification, coupled with a limiting condition for operation provision that provides

for investigation of signals, could provide assurance that the safety envelope is maintained. Recognition should be given to the fact that vitrification of the waste will ultimately reduce overall risk. Although safety will always remain first priority, activity constraints should have an identifiable and reasonable safety benefit.

A second solution is the closer coordination of operations and maintenance activities so that maintenance of specific equipment can be scheduled when it is not critical to the mission. The MAR has recognized this problem by stating:

> *The effective scheduling of maintenance is essential in meeting waste feed production commitments. Most maintenance activities will be scheduled during planned equipment downtime or scheduled system outages. Planned outages will be identified on the integrated schedule with each outage having its own detailed schedule. This outage planning and scheduling will enable TWRS Maintenance to plan, schedule, stage materials, and execute corrective and preventive maintenance for a single system within the time constraints permitted without impacting the production schedule.* (MAR Section 6.2)

During project development, the RAM can be used to provide justification for discretionary testing and calibrations, as well as for quantifying the impact of unavailability due to planned maintenance on transfer activities. The ultimate resolution of this problem will require the close coordination of planning within the PASSPORT maintenance database and the P-3 operations schedules.

G.3.2. Spurious Alarms and Equipment Failures during Transfers

Summary of Problem

The second set of impacts addresses which systems must continue operate to complete an ongoing transfer operation. Responding to spurious alarms from the set of interconnected tank alarms has a major impact on waste transfer operations. This issue is less clear and requires some interpretation of the BIO and in-field judgement by operations staff. In general, every alarm must be responded to in accordance with alarm response procedures, and many alarms generate automatic shutdown signals or require an immediate manual shutdown of waste transfers. In many cases, spurious alarms of some monitoring equipment such as leak detectors can be recovered from quickly by clearing the alarm or providing a manual monitoring mechanism (i.e., in-field monitoring with personnel). In these cases, the delay associated with the spurious alarm only becomes significant if the spurious alarm rate becomes excessive.

Possible Solutions

The boundaries for response and the LCO for response play an important role in mitigating the impact of spurious alarms and failures. The update of the BIO needs to address this question by considering the potential consequences of continuing operations until the alarm can be verified and the actions that will allow completion of the transfer as opposed to shutdown while waste is in the transfer lines.

G.4. Conclusions

This analysis evaluated the potential impacts of interconnected tank systems on the initiation and continuation of the first three Phase 1 waste feed delivery system transfers. In general, spurious alarm rates will have the largest impact in initiating and continuing waste transfers. Most of the interconnected components that are required to operate during transfers are instrumentation or are related to primary ventilation systems. These systems provide diverse means to detect the unintended transfer of waste that could pose additional risks of safety-related events. The question is whether this degree of defense-in-depth provides a safety benefit for an activity that involves only a few specific tanks directly, especially considering its potential to interrupt those activities when no unintended transfer of waste exists. A sensitivity evaluation using the RAM analysis has shown that spurious shutdowns have a significant effect on the potential for accruing penalties. As the spurious shutdown rates approach that which was estimated during an 86 day period, multiple failures and spurious shutdown events compound into an essentially indefinite delay.

The existing authorization basis TSRs and ACs have been developed with conservative assumptions that have not placed undue burdens on O&M personnel to perform the safe storage mission. However, the development of the O&M concept is pointing out the current TSRs and ACs do generate restrictions on the flexibility of the O&M staff to plan and execute schedule-sensitive waste transfer activities. The results and insights of this O&M Concept Document are being coordinated with TWRS Nuclear Safety & Licensing to ensure that the TSRs and ACs will provide operational flexibility while maintaining safety. It is important that this balance be recognized when the updated authorization basis is submitted to DOE for approval.

Table G-1. Example of CMAS Alarm Reports

		Month	Day	Year	Time	Status	Description	New SD Event?	Cum SD Count
A	2421	03	2	1999	1:31 PM	Activated	TK 104-AP ANNULUS EXHAUST RADIATION MONITOR SYSTEM FAILURE		-
A	2363	03	2	1999	1:33 PM	Activated	TK 104-AP ANNULUS EXHAUST HIGH RADIATION DETECTED		-
A	1303	03	2	1999	4:39 PM	Activated	AZ TANK FILL PW LINES 4507, 4508-LEAK	1	1
A	1764	03	2	1999	5:25 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN	1	2
A	1764	03	2	1999	5:27 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:33 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:33 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:35 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:35 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:36 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:36 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1130	03	2	1999	5:37 PM	Activated	702-A ISOLATION VALVE PIT LEAK DETECTED		-
A	1764	03	2	1999	5:37 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:37 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1507	03	2	1999	5:38 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:38 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:38 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:38 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	2	1999	5:39 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:39 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1507	03	2	1999	5:40 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:40 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	2	1999	5:41 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:42 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:42 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:42 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:44 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:44 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1507	03	2	1999	5:45 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-

Table G-1. Example of CMAS Alarm Reports (continued)

		Month	Day	Year	Time	Status	Description	New SD Event?	Cum SD Count
A	1764	03	2	1999	5:45 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:47 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:47 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:47 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:49 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:49 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1507	03	2	1999	5:49 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:49 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:51 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:51 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	2	1999	5:52 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:52 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1507	03	2	1999	5:55 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:55 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1507	03	2	1999	5:56 PM	Activated	AN FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	2	1999	5:56 PM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1167	03	2	1999	8:00 PM	Activated	TK 102-AY ANNULUS VENT SYSTEM-FAILURE		-
A	1167	03	2	1999	8:09 PM	Activated	TK 102-AY ANNULUS VENT SYSTEM-FAILURE		-
A	1167	03	2	1999	8:19 PM	Activated	TK 102-AY ANNULUS VENT SYSTEM-FAILURE		-
A	1167	03	2	1999	8:20 PM	Activated	TK 102-AY ANNULUS VENT SYSTEM-FAILURE		-
A	1167	03	2	1999	8:21 PM	Activated	TK 102-AY ANNULUS VENT SYSTEM-FAILURE		-
A	1506	03	2	1999	8:35 PM	Activated	AN FARM COB COMMON ALARM-LEAK	1	3
A	1506	03	2	1999	8:36 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:36 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:38 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:38 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:39 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:39 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:40 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:41 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-

Table G-1. Example of CMAS Alarm Reports (continued)

		Month	Day	Year	Time	Status	Description	New SD Event?	Cum SD Count
A	1506	03	2	1999	8:42 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:42 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:43 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:44 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:45 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	8:45 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	9:23 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	9:23 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	9:24 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1506	03	2	1999	9:24 PM	Activated	AN FARM COB COMMON ALARM-LEAK		-
A	1246	03	3	1999	1:07 AM	Activated	TK 101-AZ ANNULUS EXHAUST-FAILURE		-
A	1407	03	3	1999	1:56 AM	Activated	244A EXHAUST FAN OR SAMPLE PUMP-FAILURE		-
A	1450	03	3	1999	3:23 AM	Activated	AW FARM SN ENCASEMENT LINE-LEAK	1	4
A	1764	03	3	1999	3:23 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1450	03	3	1999	3:23 AM	Activated	AW FARM SN ENCASEMENT LINE-LEAK		-
A	1764	03	3	1999	3:23 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1466	03	3	1999	3:24 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	3	1999	3:24 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1047	03	3	1999	3:25 AM	Activated	TK 417 WEIGHT FACTOR HIGH		-
A	1764	03	3	1999	3:26 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1466	03	3	1999	3:26 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	3	1999	3:26 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	3	1999	3:27 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1466	03	3	1999	3:27 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1466	03	3	1999	3:28 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	3	1999	3:28 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	3	1999	3:29 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	3	1999	3:29 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1450	03	3	1999	3:29 AM	Activated	AW FARM SN ENCASEMENT LINE-LEAK		-
A	1764	03	3	1999	3:30 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-

Table G-1. Example of CMAS Alarm Reports (continued)

		Month	Day	Year	Time	Status	Description	New SD Event?	Cum SD Count
A	1450	03	3	1999	3:30 AM	Activated	AW FARM SN ENCASEMENT LINE-LEAK		-
A	1450	03	3	1999	3:30 AM	Activated	AW FARM SN ENCASEMENT LINE-LEAK		-
A	1764	03	3	1999	3:31 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1450	03	3	1999	3:31 AM	Activated	AW FARM SN ENCASEMENT LINE-LEAK		-
A	1463	03	3	1999	3:31 AM	Activated	AW FARM DRAIN ENCASEMENT LINE 361-LEAK		-
A	1764	03	3	1999	3:31 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	3	1999	3:32 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	3	1999	3:34 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1466	03	3	1999	3:34 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	3	1999	3:35 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1466	03	3	1999	3:35 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	3	1999	3:36 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1466	03	3	1999	3:36 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1466	03	3	1999	3:37 AM	Activated	AW FARM PROCESS PITS COMMON ALARM-LEAK		-
A	1764	03	3	1999	3:37 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		-
A	1764	03	3	1999	5:03 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN	1	5
A	2346	03	3	1999	5:03 AM	Activated	AP FARM CENTRAL PUMP PITS-LEAK DETECTED		-
A	1050	03	3	1999	7:42 AM	Activated	401 CONDENSER COOLING WATER – HIGH RADIATION		-
A	1104	03	3	1999	7:42 AM	Activated	702A FAN INLET-VACUUM LOW		-
A	1110	03	3	1999	7:42 AM	Activated	702-A STACK-RADIATION HIGH		-
A	1121	03	3	1999	7:43 AM	Activated	TK 101-AX LEAK DETECTION PIT-LEVEL HIGH	1	6
A	1126	03	3	1999	7:43 AM	Activated	702-A STACK MONITOR-FAILURE		-
A	1145	03	3	1999	7:43 AM	Activated	TK 101-AY ANNULUS VENT SYSTEM-FAILURE		-
A	1162	03	3	1999	7:43 AM	Activated	TK 101-AY LEAK DETECTION PIT-LEVEL HIGH		-
A	1246	03	3	1999	7:43 AM	Activated	TK 101-AZ ANNULUS EXHAUST-FAILURE		-
A	1262	03	3	1999	7:43 AM	Activated	TK 101-AZ-LIQUID LEVEL HIGH		-
A	1322	03	3	1999	7:43 AM	Activated	TK 102-AZ LEAK DETECTION PIT-WT. FACTOR HIGH		-
A	1326	03	3	1999	7:43 AM	Activated	101/102-AZ ENCASEMENT LEAK DETECTION PIT-WT. FACTOR HIGH		-
A	2164	03	3	1999	7:43 AM	Activated	TK-241-A-302A LEAK DETECTION-PUMP PIT LEAK		-
A	1424	03	3	1999	8:13 AM	Activated	244A ENCASEMENT LINE V-229-LEAK DETECTED	1	7

Table G-1. Example of CMAS Alarm Reports (continued)

		Month	Day	Year	Time	Status	Description	New SD Event?	Curn SD Count
A	1427	03	3	1999	8:13 AM	Activated	244A PIT-LEAK		_
A	1505	03	3	1999	8:13 AM	Activated	AN FARM SERVICE PIT-LEAK		_
A	1550	03	3	1999	8:13 AM	Activated	244A EXHAUST STACK-RADIATION HIGH		_
A	2427	03	3	1999	8:14 AM	Activated	AP FARM K-2 ANNULUS EXHAUST STACK FLOW LOW		_
A	1047	03	3	1999	8:15 AM	Activated	TK 417 WEIGHT FACTOR HIGH		_
A	1050	03	3	1999	8:15 AM	Activated	401 CONDENSER COOLING WATER - HIGH RADIATION		_
A	1061	03	3	1999	8:15 AM	Activated	101-AX LEAK DETECTION PIT - RADIATION HIGH		_
A	1121	03	3	1999	8:15 AM	Activated	TK 101-AX LEAK DETECTION PIT-LEVEL HIGH		_
A	1122	03	3	1999	8:15 AM	Activated	TK 102-AX LEAK DETECTION PIT-LEVEL HIGH		_
A	1123	03	3	1999	8:15 AM	Activated	TK 103-AX LEAK DETECTION PIT-LEVEL HIGH		_
A	1125	03	3	1999	8:15 AM	Activated	TK 104-AX LEAK DETECTION PIT - LEVEL HIGH		_
A	1130	03	3	1999	8:15 AM	Activated	702-A ISOLATION VALVE PIT LEAK DETECTED		_
A	1143	03	3	1999	8:15 AM	Activated	TK 101-AY-PRESSURE LOW		_
A	1164	03	3	1999	8:16 AM	Activated	TK 101-AY-LEVEL HIGH		_
A	1105	03	3	1999	8:16 AM	Activated	K1-5-2A DEENTRAINER HIGH PRESSURE ACROSS LOWER PAD		_
A	1106	03	3	1999	8:16 AM	Activated	702A-LOSS OF SEAL		_
A	1764	03	3	1999	8:18 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN	1	8
A	1764	03	3	1999	8:23 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		_
A	1764	03	3	1999	8:27 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		_
A	1764	03	3	1999	8:28 AM	Activated	204AR VP-241-A-A/ENCASEMENT LINE-3 inch LIQW-702 LEAK OR A COMPLEX MASTER PUMP SHUTDOWN		_
A	1106	03	3	1999	8:34 AM	Activated	702A-LOSS OF SEAL		_
A	1050	03	3	1999	8:43 AM	Activated	401 CONDENSER COOLING WATER - HIGH RADIATION		_
A	1104	03	3	1999	8:43 AM	Activated	702A FAN INLET-VACUUM LOW		_
A	1110	03	3	1999	8:43 AM	Activated	702-A STACK-RADIATION HIGH		_
A	1121	03	3	1999	8:43 AM	Activated	TK 101-AX LEAK DETECTION PIT-LEVEL HIGH	1	9
A	1128	03	3	1999	8:43 AM	Activated	702-A STACK MONITOR-FAILURE		_
A	1145	03	3	1999	8:43 AM	Activated	TK 101-AY ANNULUS VENT SYSTEM-FAILURE		_
A	1162	03	3	1999	8:43 AM	Activated	TK 101-AY LEAK DETECTION PIT-LEVEL HIGH		_
A	1246	03	3	1999	8:44 AM	Activated	TK 101-AZ ANNULUS EXHAUST-FAILURE		_
A	1262	03	3	1999	8:44 AM	Activated	TK 101-AZ-LIQUID LEVEL HIGH		_

Table G-1. Example of CMAS Alarm Reports (continued)

		Month	Day	Year	Time	Status	Description	New SD Event?	Cum SD Count
A	1322	03	3	1999	8:44 AM	Activated	TK 102-AZ LEAK DETECTION PIT-WT. FACTOR HIGH		-
A	1326	03	3	1999	8:44 AM	Activated	101/102-AZ ENCASEMENT LEAK DETECTION PIT-WT. FACTOR HIGH		-
A	1047	03	3	1999	8:45 AM	Activated	TK 417 WEIGHT FACTOR HIGH		-
A	1050	03	3	1999	8:45 AM	Activated	401 CONDENSER COOLING WATER - HIGH RADIATION		-
A	1081	03	3	1999	8:45 AM	Activated	101-AX LEAK DETECTION PIT - RADIATION HIGH		-
A	1121	03	3	1999	8:45 AM	Activated	TK 101-AX LEAK DETECTION PIT-LEVEL HIGH		-
A	1122	03	3	1999	8:45 AM	Activated	TK 102-AX LEAK DETECTION PIT-LEVEL HIGH		-
A	1123	03	3	1999	8:45 AM	Activated	TK 103-AX LEAK DETECTION PIT-LEVEL HIGH		-
A	1125	03	3	1999	8:45 AM	Activated	TK 104-AX LEAK DETECTION PIT - LEVEL HIGH		-
A	1130	03	3	1999	8:45 AM	Activated	702-A ISOLATION VALVE PIT LEAK DETECTED		-
A	1143	03	3	1999	8:45 AM	Activated	TK 101-AY-PRESSURE LOW		-

Table G-2. Impact of Interconnecting System Spurious Shutdown Signals on LAW Schedule Delay

	Composite Failure Rate (/hr)	No. Failures During Transfer	Total Schedule Delay
Baseline	None	5.6	236
Random Failures in Interconnected "Systems"	8E-04	6.1	249
With additional random failures and spurious alarm shutdown events			
Spurious Shutdown (SD) Events	Spurious Shutdown Events per hour	No. Failures During Transfer	Total Schedule Delay
.1/day	4.2E-03	8.4	285
.2/day	8.3E-03	11.3	331
.4/day	1.7E-02	19.7	467
.5/day	2.1E-02	27, of which 14 are due to Spurious Alarms	576
1/day	4.2E-02	Too many failures for success	

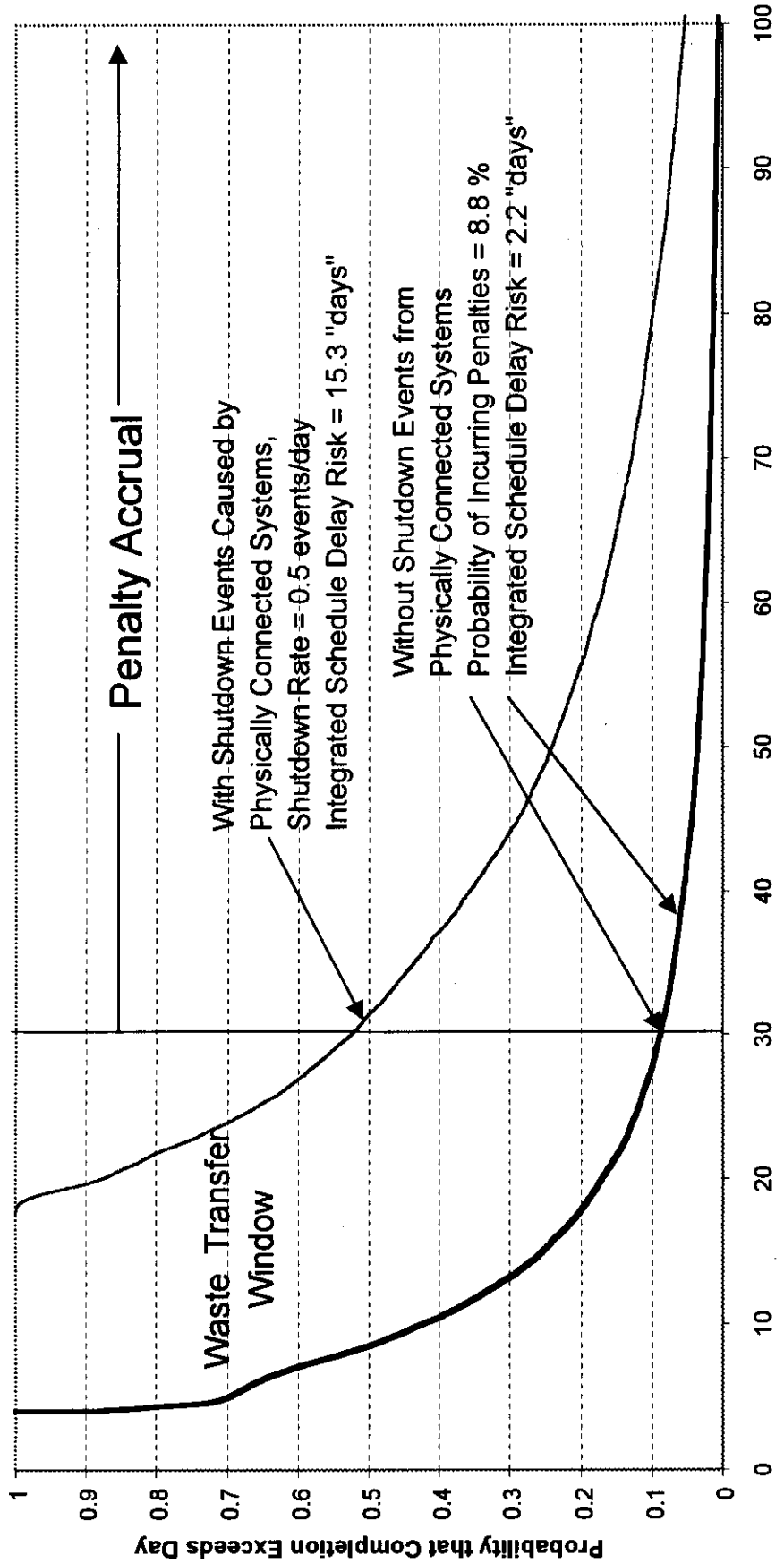

Figure G-1. Comparison of Risk of Idle Facility Penalties With and Without Interacting (Physically Connected) Systems (for LAW Transfer from AP-102) to BNFL

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Attachment G-1.

Rationale for Operability Requirements of Selected Interconnected Systems

Tank Primary Leak Detectors – Tank primary leak detectors are located in the tank annulus and serve to indicate when the inner wall of a double-shell tank begins to leak. They sit on the floor of the tank annulus approximately one inch above the floor surface. They are not tied into the master pump shutdown system but are required to be operational at all times. TSR LCO 3.2.6 also allows for use of the annulus continuous air monitors for this function. However, TWRS operations personnel no longer take credit for this in order to satisfy Washington State Department of Ecology requirements. Currently, the RAM model analyzes only the affected tank leak detection systems (TSR LCO 3.2.6).

Transfer System Leak Detectors – All waste transfer lines for the WFDS will be double-walled pipe with leak detection capability. The transfer line encasement leak detectors provide an indication of leaking into the outer pipe annulus. All transfer system process pits also have associated leak detectors, which sit on the floor of the pit above the drain. They are designed to detect leaks when the leaking liquid level reaches a one-inch depth in the pit. There are other leak detectors as well, such as cleanout box leak detectors and diversion box leak detectors.

The transfer system leak detectors have historically been unreliable, providing numerous spurious alarms, especially during wet weather. These leak detectors are tied into the master pump shutdown system and are all required to function at all times. Currently, the RAM model analyzes only the affected tank leak detection systems (TSR LCO 3.1.3).

Tank Level Monitors – Several designs of tank level monitors exist. In general, they are designed to measure the distance of the top waste level to the top of the tank after which the depth of the waste is calculated. They are used for material balance purposes during waste transfers. There are two types of level monitors employed in the 200 East Area tank farms. One type uses a manual tape or automatic indicator that is lowered down to touch the top waste level and provide a reading to the operator above. The second type measures buoyancy effects to indicate the position of the top of the waste.

Since all tanks are interconnected and a close material balance must be maintained during waste transfers, the TSR requires all tank level monitors to be operational before and during waste transfers. Currently, the RAM model analyzes only the affected tank level monitoring systems TSR AC 5.12.2.b).

Service Water Pressure Detection Systems – Service water is supplied to the discharge side of the waste transfer pump to provide a flushing capability at the conclusion of waste transfers. It is possible that the service water line could become pressurized with tank waste materials during transfers if isolating valves fail. Should this occur, the service water system pressure detection switch is designed to detect a rise in pressure and engage the master pump shutdown system to prevent the inadvertent contamination of the service water system and loss of waste materials.

Since all tanks and transfer lines are potentially interconnected and could be charged with tanks waste materials, the TSRs require that all service water pressure detection switches must operate before and during all waste transfers. The RAM model currently contains only the affected tank farm service water pressure detection systems. (TSR LCO 3.1.2)

Transfer System Cover Blocks – Coverblocks are provided for each tank pump pit and all transfer line valve pits. Their primary function is to provide access to transfer system valving and to prevent a spray leak of waste materials outside the boundaries of the covered pit. Coverblocks are required to be in place and operational during waste transfers unless the pit is isolated using double valving during ongoing maintenance in the pit. Coverblocks are not modeled in the RAM analysis. (TSR LCO 3.1.1)

Stack High Radiation Monitors and HEPA Low Differential Pressure Monitors – Either system is required to be operational in order to initiate and continue a waste transfer operation as applicable for the affected tanks. Their primary function is to monitor and control radioactive air emissions from tank systems. These systems are currently modeled within the RAM analysis. (TSR LCO 3.1.4A)

Transfer Line Encasement Seal Drain Valves – Transfer line encasement drain valves are provided to drain liquids from the transfer line encasement pipe. They operate in three modes:

1. Drain – valve is in the drain position;
2. Operate – valve is in the closed position; and
3. Test – valve is in the hydro test position.

The valves must be in the "operate" or "closed" position prior to initiating a transfer. If the valve is in the closed position, leaking liquids will be contained in the encasement. When the valve is in the operate position, leaking liquids will drain into a valve/pump pit. All transfer line encasement seal drain valves must be operational before and during transfers. The RAM model currently contains only the affected tank to tank transfer line drain valves. (TSR AC 5.13)

Primary Tank Ventilation CAM Interlocks – Primary ventilation system continuous air monitors are provided for the exhaust stack downstream of all filtration. The CAMs serve a safety function so as not to continue waste disturbing operations in the event of a filtration failure. Associated record samplers provide the recording mechanism for all radiological releases. They also serve an environmental monitoring function required for the Washington State Department of Health to monitor radiological emissions. The CAMs are interlocked with the primary ventilation system to provide a shutdown of the ventilation motive force during failure conditions. The CAMs and interlocks are required to be operational before and during transfers for the sending and receiving tank farms only. They are modeled in this fashion for the RAM analysis. (TSR LCO 3.1.4)

Primary Tank Ventilation System – The primary tank ventilation system main function is to keep a negative pressure in the tank dome space to ensure containment of airborne materials. Currently, all primary tank ventilation systems must be operational prior to the initiation of a waste transfer. Only failures of the sending and receiving tank farm ventilation systems are required to continue an ongoing waste transfer. Most

components within the tank farm primary ventilation system are redundant and are modeled so for the RAM analysis. (TSR LCO 3.2.1)

Waste Temperature Monitors – Waste temperature monitors ensure the waste is monitored so as to remain below the BIO waste temperature limits to prevent boiling of waste materials. Only the sending and receiving tanks require operational temperature monitoring before and during waste transfers. Temperature monitoring is modeled as being required for continuing ongoing transfers for the sending and receiving tanks. (TSR LCO 3.3.2)

Standard Hydrogen Monitoring System – Hydrogen monitoring is provided to measure the concentration of flammable gas release from certain east area tanks. During manned operations in intrusive systems such as maintenance evolutions within valve pits, the tank dome space must remain below 25% of the lower flammability limit for hydrogen. The hydrogen monitoring system provides the means to measure the concentration. For unmanned operations such as waste transfers, there is no current requirement to maintain hydrogen-monitoring capability. However, current safe storage practice is to ensure the 25% LFL limit for manned operations is met prior to initiation of a transfer. Hydrogen monitoring is not required to continue an ongoing waste transfer. (TSR LCO 3.2.1)

Annulus Ventilation Systems – Annulus ventilation systems are provided for all double-shell tanks. The primary function of the annulus ventilation system is to control emissions from the annulus should the inner tank shell leak. It also provides cooling and serves as a backup leak detection system should the primary tank leak detection system fail. The annulus ventilation system is modeled as being required to continue an ongoing transfer for affected tanks. (TSR LCO 3.2.6)

Appendix G Acronyms & Abbreviations

AB	authorization basis
AC	administrative control
BIO	basis for interim operation
CAM	continuous air monitor
CASS	computer automated surveillance system
CMAS	central monitoring alarm station
DST	double-shell tank
LCO	limited conditions for operation
LFL	lower flammability limit
MAR	mission analysis report
O&M	operations and maintenance
RPP	River Protection Project
SHMS	standard hydrogen monitoring system
TMACS	tank monitoring and control system
TSR	technical safety requirement
TWRS	Tank Waste Remediation System

Appendix H.
Peer Review of Preliminary RAM Analysis

Figures

H-1 Letter, Fluor Daniel Northwest, "NHC-C-97-0005, CO-99-TWRS-302." Subject: PEER REVIEW

Tables

H-1 Response to Peer Review Recommendations

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Figure H-1.
Letter, Fluor Daniel Northwest, "NHC-C-97-0005, CO-99-TWRS-302."
Subject: PEER REVIEW

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FLUOR DANIEL NORTHWEST, INC.
P.O. Box 1050
Richland, Washington 99352-1050

August 17, 1999

NHC-C-97-0005
CO-99-TWRS-302

Mr. A. B. Carlson
Numatec Hanford Corporation
P. O. Box 1300
Richland, Washington 99352-1300

Dear Mr. Carlson:

PEER REVIEW OF THE RIVER PROTECTION PROJECT (RPP) WASTE FEED DELIVERY (WFD) SYSTEM RELIABILITY, AVAILABILITY, AND MAINTAINABILITY (RAM) ANALYSIS

Response Requested By: N/A

Responds To: Letter, B. L. Ayers, NHC, to J. W. Viita, FDNW, "Contract 3759, Contract Release 2 for Peer Review of RAM Analysis," dated May 24, 1999. Letter No. NHC-9953530.

The River Protection Project (RPP) Waste Feed Delivery System (WFDS) RAM analysis was reviewed by Fluor Daniel Northwest, Inc. (FDNW) personnel on the basis of the Statement of Work (SOW) provided by Numatec Hanford Corporation (NHC) in April of this year (NHC-9952792).

The document, *Waste Feed Delivery System Phase 1 Preliminary RAM Assessment,* was reviewed according to the criteria provided in the SOW. The Crystal Ball™/Excel spreadsheet models for both the Low Activity Waste (LAW) and High Level Waste (HLW) were also reviewed on the basis of the SOW criteria.

The results of the document and model reviews are provided in Attachment 1 of this letter report. The structure of the review and Attachment 1 is based on the review items listed in the SOW. A *Checklist for Technical Peer Review* is provided as Attachment 2.

A copy of Volume IV of the *Waste Feed Delivery Technical Basis* document was provided to FDNW personnel to be used as background information in the review process. The scope of work did not include a formal review of this document.

Conclusions

Based on the Statement of Work provided by PLG to the customer, the intended purpose of the reviewed analysis is:

- Define and quantify critical RAM figures of merit;
- Develop RAM based input to the Level 2 component specifications; and
- RAM should support the definition of a spare parts inventory.

Mr. A. B. Carlson
NHC-C-97-0005
August 17, 1999
Page 2, CO-99-TWRS-302

The figure of merit for both the High Level and Low Activity Waste Feed Delivery System has been developed and used in the RAM analysis for the RPP Waste Feed Delivery Program. It is provided in figure format for both HLW and LAW. The Critical Items List (CIL) developed in the analysis and provided in Appendices E and F address the last two bulleted items.

The reviewed document addresses the issues in the customer's *Statement of Purpose*. This version of the document is a significant improvement over the previous draft.

Recommendations

The RAM analysis of these two waste transfer systems are based on two key factors:

- All of the waste transfer components evaluated in the RAM analysis were analyzed for failure modes and effects via the FMEA, (failure modes and effects analysis) process. Many of the components failure modes were analyzed as resulting in the shutdown of the waste transfer process based on incomplete knowledge of system function and requirements; and

- The failure rates used in the RAM analyses are based on generic failure rates (obtained from the Savannah River Site) of the waste transfer components.

Further work needs to be done in the area of defining the functions associated with the waste qualification and transfer process. With a more complete definition of the waste feed delivery system functions a smaller component list could be used in the RAM analysis resulting in shorter calculated delay times for the waste transfer process.

The second bulleted item increases the uncertainty of the RAM results that are reported in the reviewed document. Without specific Hanford data to update major component failure rates there is a large degree of uncertainty associated with the results that are provided in the reviewed document. Only one waste transfer component (mixer pump) was updated with actual Hanford data.

Collection of site-specific failure rate data should be focused into the area of the waste transfer components that are at the top of CIL and the major component type contributors.

Sincerely,

M. W. Manderbach
Project Manager

MWM:BEH:gjr

ATTACHMENT 1

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Review of Waste Feed Delivery System Phase 1 Preliminary RAM Assessment

The following items of the PLG, INC. *Waste Feed Delivery System Phase 1 Preliminary RAM Assessment* analysis were covered in this review:

- Document Waste Feed Delivery System Phase 1 Preliminary *RAM Assessment*
- Excel Spreadsheet and Crystal Ball Model (Version 4.0c) *HLW Simulation.xls, HLW A Simulation.xls, HLW B Simulation.xls*
- Excel Spreadsheet and Crystal Ball Model (Version 4.0c) LAW ABC Simulation.xls, LAW ABCD Simulation.xls, LAW D Simulation.xls, LAW E Simulation.xls
- Access Database File - *HLW RAM CILs 9906 A-B.mdb and LAWRAM9906.mdb*

The review covered the following bulleted items. Each of these items was defined in a Statement of Work that was provided to FDNW by Numatec Hanford Company at the start of the review process.

- **Problem statement completely defined?**

The *Statement of Purpose* of the analysis was clearly stated in Section 1.1 of the above document. In an abbreviated form the Statement of Purpose is defined as:

The purpose of the RAM analysis of the HLW and LAW waste feed delivery system is to provide a clear rationale for the implementation of operating and maintenance policies and procedures supporting Phase I waste transfers. This will provide quantitative support for O&M personnel and material resource commitments. This will support the modification of annual budgets to keep the facility operating safely, reliably, and cost-effectively.

The customer's *Statement of Purpose* is contained in a document titled "Statement of Work For Reliability, Availability, and Maintainability Analysis for the TWRS Waste Feed Delivery Program," dated December 10, 1998. It states that the RAM evaluation will support the Operations and Maintenance program concept in four areas:

1) Define and quantify critical RAM figures of merit
2) Provide a quantitative baseline for supporting decisions during the Alternatives Generation and Analysis (AGA)
3) Developing RAM based input to the Level 2 component specifications
4) As the component configuration for the design is established, the RAM will be used to support the definition of the spare parts inventory.

The Statement of Purpose by PLG directly and indirectly addresses items 1, 3, and 4. Due to the lack of information on the AGA (2) one can not come to any conclusion if PLG's statement of purpose supports this item.

- **Is the methodology valid, including derivation of logic networks?**

On page 2-1 the RAM, logic models are discussed. A FMEA was used to identify single component failures, which would result in the failure of the waste transfer system.

The high level waste RAM models are contained in the combined Excel-Crystal Ball spreadsheets of *HLW A Simulation.xls and HLW B Simulation.xls*. The low-level waste RAM models are contained in the combined Excel-Crystal Ball spreadsheets of *LAW ABC Simulation XLS and LAW ABCD Simulation XLS, LAW D Simulation.xls, and LAW E Simulation.xls*. Crystal Ball is a program capable of handling probability distribution functions and failure rate frequencies for user identified variables. Monte Carlo simulations can be developed using these probability variables to determine a probability distribution functional result called a *Forecast*.

The forecast defined in the Excel-Crystal Ball model is the Delay Time associated with waste transfer system of Tank AN-105 and Tank AZ-101 due to system component failures and mean-time-to-repair. The total time needed for the delivery of the waste to the contractor's receiver tank is determined using the Delay Time and the nominal time to perform the each of the qualification and delivery functions. This addresses the Figure of Merit as defined in Appendix B of the *Operations and Maintenance Concept for the Waste Feed Delivery System* Phase 1 document. The *Figure of Merit (FOM)* requires an estimate for the total time needed for the delivery of the waste to the contractor's receiver tank. This delivery time would then be compared to the *Figure of Merit* requirement of (30 + 2) days.

- **Are calculations valid (spot checks)?**

The data sheet "A" from the file " HLW A Simulation.xls" was assessed. The following equations were evaluated for correctness and validity.

- Random Number
- Log Normal and Triangular Distributions
- Results If statements (Expanded into three Columns)
- Total Number of Failures
- Total Delay Hours

A spot check was made for a number of components from this data sheet and is provided in Table 1.

Spot checks were made on some of the failure rates used in this file going back to reference WSRC-TR-93-262. Bases for mean-time-to-repair was spot-checked back to the Access *LAWRAM9906.mdb* with subfile *Consolidated FMA FR Table*. The type of components, failure modes, mean failure rates, error factors (Range Factor), and reference sources that were part of the spot check are provided in Table 2. The type of components, failure modes, repair time identifier, and mean-time-to-repair that were spot-checked are provided in Table 3. There were no errors detected for the spot checks that were performed.

- **Are modeling assumptions valid and explicitly stated?**

All of the assumptions used in the RAM analysis are provided in Appendix A in tabular format. The assumptions used in the RAM analysis are explicitly stated and are valid for the analysis performed with the following exceptions.

A number of concerns exist about three of the assumptions listed in Appendix A. The three assumptions are:

- All component failures for front line systems were assumed to result in the termination of transfer activities;
- Generic component failure rates are taken primarily from Savannah River Site data for chemical systems (Section 3.3);
- Replacement and repair parts are assumed to be available to the extent that their availability does not dominate failure event restoration time. It is assumed that at least one spare of each repair/replacement part is on hand or is procurable during the normal job preparation time (Section 4).

The assumption that all component failures for front line systems were assumed to result in the termination of transfer activities may have a significant impact on the total delay time for a waste transfer process. This assumption is conservative resulting in longer calculated delay times than will actually occur.

Using generic component failure rates from another DOE site has some drawbacks with respect to applicability. The Savannah River Site has a different waste composition from what is handled at Hanford, which

could have a significant impact on failure rates of certain waste transfer system components (piping, pumps, and valves).

Not taking into account the lack of availability of a replacement component has a large impact on restoration times for key components of the waste transfer system, such as the waste tank mixer pumps. For a catastrophic failure of one of these pumps it may take two to six months to get a replacement for it, if they are not on hand. These types of time delays could overwhelm any of the delay times calculated by the RAM model for the key components of the system.

- **Are the models appropriate and used within their range of validity or is use outside the established validity range justified?**

Reference to Failure Modes and Effects Analysis (FMEA) is made in the report and the data files, as being the basis for the single component failure modes used in the RAM analysis. It is implied that each of the FMEA evaluated failures result in the shutdown of the waste transfer process. The FMEA is not referenced in a separate document.

It appears that generic failure mode and effects for component types are provided in the LAWRAM9906.mdb database file in the CompFMEA table. These generic failure modes are then applied to the specific components of the transfer systems via a query process. This appears to be extremely conservative from the standpoint of determining what components will actually shut down the transfer system.

An extensive description of the waste transfer system is provided in chapter two of the document.

- **Are raw data (input probability distributions) reasonable and checked for consistency with original source information as applicable? Is there a basis stated?**

The raw data for the component failure rate frequencies was spot checked and traced back to its original source. The component failure rate frequencies that were spot-checked are provided in Table 2. Some of the failure rates used in the analysis are based on PLG experience and are documented as so. The mean time to repairs for each waste transfer component identified is approximated in the RAM analysis via a lognormal or a triangular probability distribution function. For the triangular probability distribution a low value, mode, and high value mean time to repair are estimated for each of the component types (Table 1). A mean value and standard deviation are used for the lognormal probability distribution function. The basis and assumptions used for these values are provided in an Access database file.

- **Does software appear to be working, with computer codes and data files documented, inputs correct and consistent with document reviewed, and output consistent with input and results documented in the report reviewed?**

The Access data files and Crystal Ball/Excel spreadsheets were accessed for both the HLW (HLW RAM CILs 9906 A-B.mdb, HLW A Simulation.xls, HLW B Simulation.xls) and the LAW (LAWRAM9906.mdb, LAW ABC Simulation .XLS, LAW ABCD Simulation .XLS, LAW D Simulation.xls, LAW E Simulation .XLS). Data was reviewed on a spot basis. The Crystal Ball models were run to determine functionality of model. They appear to provide results that are consistent with the results listed in the document and the spreadsheet itself. The calculational procedure was tracked from cell to cell of the spreadsheet to determine calculational process and correctness. No errors were detected.

- **Do the numerical results support the reports' conclusions?**

The major conclusion of the report is that the risk of the transfer system is dominated by the mixing pump for the HLW batch transfer and the transfer pump for the LAW batch transfer. This is supported by the Critical Items

List (CIL) of Table E-2 and F-2. The mixing and transfer pumps are the major contributors to the unreliability of the waste transfer system for both the HLW and LAW.

Based on the delay time simulation results of the analysis for the transfer of HLW and LAW, the conclusions expressed in Section 5.0 of the report are valid.

- **Are limitations or caveats on the use of the numerical results and the conclusions clearly and accurately stated?**

Some limitations in using the results of the RAM analysis are specified in the Section 5.5 of the report. Some discussion should be added to detail the limitations of the results of the report based on the generic component failure rates and mean time to repair probability distribution functions used in the analysis. There should be some discussion on the Uncertainty of the results of the analysis. The ordering of system components in the Critical Items List has an uncertainty associated with it based on the uncertainty range of the generic failure rates and the MTTR distribution functions/values used in the analysis.

- **Does the report provide the answer for which equipment, process steps, and operational or maintenance activities drive the combined schedule duration and the probability of delivering feed on time (that is, critical path or critical resources/equipment)?**

The critical components of the waste transfer system are provided in the CIL of Table E-2 and F-2 for the HLW and LAW transfer systems respectively. The maintenance activities for recovery from system component failures are included in the MTTR for the particular component.

A table of human actions and process steps is provided for the major activities associated with the transfer of HLW waste in Table D-3 and LAW waste in Table D-4. Probability of human error and mean time to recover are identified for each activity. Expected delay for each incident is also provided. The total human action failure delay time is approximately 2% and 12% of the total delay time for component failures and recovery for HLW and LAW waste transfer, respectively.

Delay Times are provided for several external events in Table 5-5 that could delay the transfer process. A total of 34 off-normal external events are expected to occur during a typical year.

- **Does the report provide the cumulative probability curves for how long it takes to retrieve and qualify feed?**

Cumulative probability curves for how long it takes to retrieve and qualify feed for HLW and LAW are not provided in this report. Cumulative probability curves for Total Schedule Delay Times are provided for each of the waste types: HLW (E-6) and LAW (F-6).

- **Does the report provide the cumulative probability curves for completion of the delivery transfer within the feed delivery window?**

The report does provide probability distribution curves for how long it takes to qualify feed and retrieve feed for HLW (Figure 5-2 and 5-3) and LAW (Figures 5-5/6 and Figure 5-7). These curves are plots of probability versus time or "Days After WTD." These plots are the result of simulation runs using Crystal Ball/Excel spreadsheet models and account for system component failures, external events, human errors and mean time to repair/recover. Based on the results provided in the report there is 10.8% and 8.8% probability of performing the waste transfer within the FOM.

- **Is the report suitable for its intended purpose?**

Based on the Statement of Work provided to PLG by the customer the intended purpose of the analysis is:

- Define and quantify critical RAM figures of merit;
- Develop RAM based input to the Level 2 component specifications; and
- RAM should be used to support the definition of the spare parts inventory.

The Figure of Merit for both the HLW and LAW has been developed and used in the RAM analysis for the RPP Waste Feed Delivery Program. It is provided in figure format for both HLW and LAW. The Critical Items List (CIL) developed in the analysis and provided in Appendices E and F address the input to the last two bullet items.

General Observations

In the first paragraph of the introduction and in Section 1.1 there are no mention of the qualification and retrieval of the HLW only LAW. The table of contents for the Appendix Tables needs some format work done on it. The abbreviation "TWRS" is used in the document. "RPP" should be used in place of it. On page 3-3 at the end of the first paragraph of section 3.2.1 a reference is made to a share drive which is not provided.

In Appendix E starting on page E-73 a unique component list is provided for the Waste Feed Delivery from source tank 241-AN-105. In Appendix F no such list is provided for the Waste Feed Delivery from source tank 241-AZ-101.

Summary

The RAM analysis of these two waste transfer systems are based on two key factors:

- All of the waste transfer components that are identified in the FMEA are assumed to result in the shutdown of the waste transfer process upon failure; and
- The failure rates used in the RAM analyses are based on generic failure rates obtained from the Savannah River Site of the waste transfer components.

The first item could result in a lower reliability of the waste transfer systems resulting in a calculation of higher delay times than will actually occur during the transfers.

Further work needs to be done in the area of defining the functions associated with the waste qualification and waste transfer process. With a more complete definition of the waste feed delivery system functions perhaps a smaller critical component list could be used in the RAM analysis resulting in shorter delay times.

The second item increases the uncertainty of the RAM results that are reported in the reviewed document. Without specific Hanford data to update major component failure rates there is a large degree of uncertainty associated with the results that are provided in the reviewed document. Only one waste transfer component (mixer pump) was updated with actual Hanford data.

Collection of site-specific failure rate data should be focused into the area of the waste transfer components that are at the top of Critical Items List and the major component type contributors.

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Table 1. Simulation Sheet Spot Check

COMPLETE EIN	MTTR (LOW)	MTTR (MODE)	MTTR (HIGH)	CLOCK HOURS (MEAN)	CLOCK HOURS (Std Dev)	FREQUENCY PER ACTIVITY (DELAY)	F(DELAY) PER ACTIVITY THAT IMPACT SCHEDULE	RAND()	Off-Normal Event?	Log Normal or Triangular Distribution	Delay Hours	Number of Off-Normal Events	A = Delay in Qualifying HLW in AZ-101
AZ Record Sampler Vacuum Pump	12	24	120	163	99	0.06	0.03	7.7E-02	Succeeds	354.3	No Delay	4	567.6
AZ101 CAM Unit Vacuum Pump	12	24	120	163	99	0.06	0.03	9.0E-01	Succeeds	206.0	No Delay		
AZ102 CAM Unit Vacuum Pump	12	24	120	163	99	0.06	0.03	4.1E-02	1	54.6	No Delay		
AZ-PC-P-1	12	24	120	155	93	0.06	0.03	4.1E-01	Succeeds	132.6	No Delay		
AZ-K1-9-1	12	24	120	98	43	0.05	0.02	7.9E-01	Succeeds	74.9	No Delay		
AZ101-EW-SP-1	12	24	120	90	39	0.04	0.02	8.2E-01	Succeeds	68.5	No Delay		
AZ101-W-P-1	12	24	120	90	39	0.04	0.02	4.3E-01	Succeeds	55.0	No Delay		
AZ101-CA-P-1	12	24	120	90	39	0.04	0.02	1.3E-02	1	100.2	100.2		
CAM-101-AZ	12	24	120	163	99	0.03	0.01	6.0E-02	Succeeds	92.2	No Delay		
CAM-102-AZ	12	24	120	163	99	0.03	0.01	8.2E-01	Succeeds	61.4	No Delay		
AZ101-K4-5-1	12	24	120	298	180	0.03	0.01	1.7E-01	Succeeds	222.6	No Delay		
Process Air	1	2	6	90	39	0.02	0.01	2.7E-01	Succeeds	87.1	No Delay		
Instrument Air	1	2	6	90	39	0.02	0.01	6.1E-01	Succeeds	37.6	No Delay		
FA-AZ Annulus	12	24	120	187	113	0.02	0.01	3.5E-02	Succeeds	142.9	No Delay		
FA-AZ-RS	12	24	120	187	113	0.02	0.01	3.1E-01	Succeeds	157.4	No Delay		
K16-1	12	24	120	155	93	0.00	0.00	1.94E-04	1	383.8	383.8		
ALL-ALL-EE-TR1FL101	5	9	14			0.21	0.10	7.5E-01	Succeeds	8.5	No Delay		
ALL-ALL-EE-TR1FL101	5	9	14			0.21	0.10	9.2E-01	Succeeds	9.2	No Delay		
ALL-ALL-EE-TR1FL101	5	9	14			0.21	0.10	8.8E-01	Succeeds	11.0	No Delay		
ALL-ALL-EE-TR1FL101	5	9	14			0.21	0.10	3.8E-01	Succeeds	9.4	No Delay		
ALL-ALL-EE-TR1FL101	5	9	14			0.21	0.10	7.4E-01	Succeeds	5.6	No Delay		
WST-P-AZ101A	4	72	120			0.03	0.03	2.4E-03	1	83.6	83.6		
WST-P-AZ101B	4	72	120			0.03	0.03	5.5E-01	Succeeds	37.4	No Delay		

Table 2. Component Failure Mode and Failure Rate Spot Check

ID	System	Component	Component Sub-Category	Failure Mode	Mean Failure Rate	Units	Range Factor	Generic Failure Data References
1	Water	Valve (Standby or Safety)	Manual	Fails to Close	3.00E-04	D	10	WSRC-TR-93-262, Table 1a
2	Water	Valve (Standby or Safety)	Manual	Plugs	5.00E-08	H	10	WSRC-TR-93-262, Table 1a
9	Water	Valve (Standby or Safety)	Check	Plugs	5.00E-08	H	10	WSRC-TR-93-262, Table 1a
10	Water	Valve (Standby or Safety)	Check	Leakage (internal)	1.00E-06	H	10	WSRC-TR-93-262, Table 1a
13	Water	Valve (Standby or Safety)	Check	Rupture (external)	5.00E-10	H	30	WSRC-TR-93-262, Table 1a
19	Water	Valve (Standby or Safety)	Motor-Operated	Leakage (internal)	1.00E-06	H	10	WSRC-TR-93-262, Table 1a
20	Water	Valve (Standby or Safety)	Motor-Operated	Rupture (internal)	5.00E-08	H	30	WSRC-TR-93-262, Table 1a
21	Water	Valve (Standby or Safety)	Motor-Operated	Leakage (external)	1.00E-08	H	10	WSRC-TR-93-262, Table 1a
79	Water	Pump	Motor-Driven	Rupture (external)	1.00E-09	H	30	WSRC-TR-93-262, Table 1a
103	Water	Vessel	Tank (Pressurized)	Leakage (external)	1.00E-08	H	10	WSRC-TR-93-262, Table 1a
136	Chemical Process	Valve (Standby or Safety)	Motor-Operated	Fails to open	3.00E-03	D	10	WSRC-TR-93-262, Table 1b
137	Chemical Process	Valve (Standby or Safety)	Motor-Operated	Fails to close	3.00E-03	D	10	WSRC-TR-93-262, Table 1b
176	Chemical Process	Valve (Standby or Safety)	Explosive	Fails to open	1.00E-04	D	10	WSRC-TR-93-262, Table 1b
178	Chemical Process	Valve (Standby or Safety)	Explosive	Rupture (internal)	5.00E-08	H	10	WSRC-TR-93-262, Table 1b
187	Chemical Process	Valve (Control)	Air-Operated	Fails open	3.00E-06	H	10	WSRC-TR-93-262, Table 1b
188	Chemical Process	Valve (Control)	Air-Operated	Fails closed	3.00E-06	H	10	WSRC-TR-93-262, Table 1b
201	Chemical Process	Pump	Motor-Driven	Fails to start	2.00E-03	D	10	PLG ESTIMATE
202	Chemical Process	Pump	Motor-Driven	Fails to run	1.00E-04	H	10	WSRC-TR-93-262, Table 1b
248	Chemical Process	Heat Exchanger	Strainer/ Filter	Rupture (internal)	5.00E-07	H	10	WSRC-TR-93-262, Table 1b
249	Chemical Process	Heat Exchanger	Orifice	Plugs	1.00E-06	H	10	WSRC-TR-93-262, Table 1b
305	Compressed Gas	Valve (Control)	Motor-Operated	Fails open	3.00E-06	H	10	WSRC-TR-93-262, Table 1c
306	Compressed Gas	Valve (Control)	Motor-Operated	Fails closed	3.00E-06	H	10	WSRC-TR-93-262, Table 1c
317	Compressed Gas	Valve (Control)	Solenoid-Operated	Fails open	3.00E-06	H	10	WSRC-TR-93-262, Table 1c
318	Compressed Gas	Valve (Control)	Solenoid-Operated	Fails closed	3.00E-06	H	10	WSRC-TR-93-262, Table 1c
326	Compressed Gas	Compressor	Motor-Driven	Fails to stop	5.00E-03	D	5	WSRC-TR-93-262, Table 1c
328	Compressed Gas	Compressor	Motor-Driven	Rupture (external)	1.00E-08	H	30	WSRC-TR-93-262, Table 1c
462	Electric Power	Circuit Breaker	Reactor Trip	Fails to open	5.00E-03	D	5	WSRC-TR-93-262, Table 1e
463	Electric Power	Circuit Breaker	Reactor Trip	Spurious operation	3.00E-06	H	10	WSRC-TR-93-262, Table 1e
464	Electric Power	Relay	Protective	Fails to open	1.00E-03	D	10	WSRC-TR-93-262, Table 1e
465	Electric Power	Relay	Protective	Fails to close	1.00E-03	D	10	WSRC-TR-93-262, Table 1e
563	Electric Power	Electrical System	Electrical System	Failure	1.00E-05	H	30	PLG ESTIMATE
564	Water	Raw Water System	Raw Water System	Failure	1.00E-05	H	30	PLG ESTIMATE

Table 3. Component, Failure Mode and Mean-Time-To-Repair Spot Check

ID2*	Component Description	Failure Mode	RT ID	MTTR (LOW)	MTTR (MODE)	MTTR (HIGH)	MTTR (MEAN)
5736	Mixer Pump	Fails to Run	RTTMPSML01	4	72	120	65.33333
5738	Mixer Pump	Fails to Start	RTTMPSML01	4	72	120	65.33333
5737	Mixer Pump	Fails to Run	RTTMPLRG01	200	1900	2400	1500
5739	Mixer Pump	Fails to Start	RTTMPLRG01	200	1900	2400	1500
5740	Mixer Pump	Leakage (external)	RTTMPLRG01	200	1900	2400	1500
5742	Mixer Pump	Rupture (external)	RTTMPLRG01	200	1900	2400	1500
1612	Pressure Differential Alarm High	Spurious Operation	RTOTHSML02	6	12	24	14
196	Motor Operated Butterfly Valve	Leakage (internal)	RTOTHSML01	1	2	6	3
869	Pump	Fails to Run	RTOTHSML01	1	2	6	3
1868	Temperature Element	Failure	RTOTHSML01	1	2	6	3
3900	Variable Frequency Drive	Failure	RTOTHLRG01	2	60	120	60.66667
82	2-Gate Valve Assembly	Leakage (internal)	RTFRMSML03	12	24	120	52
23	Flow Control Valve	Fails to Respond	RTFRMSML03	12	24	120	52
67	Butterfly Valve	Leakage (internal)	RTFRMSML03	12	24	120	52
1434	Fan	Fails to Run	RTFRMSML03	12	24	120	52
1497	Temperature Switch	Failure	RTFRMSML03	12	24	120	52
1515	Damper	Fails Closed	RTFRMSML03	12	24	120	52
5381	Instrument Air Supply	Failure	RTFRMLRG03	6	144	408	186
477	Pressure Control Valve	Fails Closed	RTFRMLRG02	24	48	168	80
5741	Mixer Pump	Overspeed	RTFRMLRG01	4	24	168	65.33333

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ATTACHMENT 2

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FLUOR DANIEL NORTHWEST

TECHNICAL PEER REVIEWS

CHECKLIST FOR TECHNICAL PEER REVIEW

Document Reviewed: HNF-2863 Rev 1 Draft
Title: Waste Feed Delivery System Phase 1 Preliminary RAM Assessment
Author: Andrew Dykes, PLG
Date: August 17, 1999
Scope of Review: Technical Review of Document and Supporting RAM Models

Yes	No*	NA	
[ ]	[ ]	[X] **	Previous reviews complete and cover analysis, up to scope of this review, with no gaps.
[X]	[ ]	[ ]	Problem completely defined.
[ ]	[ ]	[X]	Accident scenarios developed in a clear and logical manner.
[X]	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[X]	[ ]	[ ]	Computer codes and data files documented.
[X]	[ ]	[ ]	Data used in calculations explicitly stated in document.
[X]	[ ]	[ ]	Data checked for consistency with original source information as applicable.
[X]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[X]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[X]	[ ]	[ ]	Hand calculations checked for errors. Spreadsheet results should be treated exactly the same as hand calculations.
[X]	[ ]	[ ]	Software input correct and consistent with document reviewed.
[X]	[ ]	[ ]	Software output consistent with input and with results reported in document reviewed.
[X]	[ ]	[ ]	Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references.
[ ]	[ ]	[X]	Safety margins consistent with good engineering practices.
[X]	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[X]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.
[ ]	[ ]	[X]	Format consistent with applicable guides or other standards.
[X]		[ ] **	Review calculations, comments, and/or notes are attached.
[X]	[ ]	[ ]	Traceability
[X]	[ ]	[ ]	Document approved (for example, the reviewer affirms the technical accuracy of the document).

David J. Braun David J Braun — Reviewer (printed name and signature)

8-17-99 — Date

* All "no" responses must be explained below or on an additional sheet.

** Any calculations, comments, or notes generated as part of this review should be signed, dated, and attached to this checklist. Such material should be labeled and recorded in such a manner as to be intelligible to a technically qualified third party.

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Table H-1. Response to Peer Review Recommendations

Item	Location	Recommendation	Response
1	H-4, Letter, 2nd page	Further work needs to be done in the area of defining the functions associated with the waste qualification and transfer process. With a more complete definition of the waste feed delivery system functions a smaller component list could be used in the RAM analysis resulting in shorter calculated delay times for the waste transfer process.	Agree. The system design and process description is evolving to the point where component specific failure modes may now defined for individual activities. The next revision of the RAM model will define component functions based on these documents.
2	H-4 Letter, 2nd page	Collection of site-specific failure rate data should be focused into the area of the waste transfer components that are at the top of CIL and the major component type contributors.	Agree. The next revision will revisit existing data for SSCs at the top of the CILs. However, it should be recognized that the DST system design includes many new SSCs for which site-specific data will not be available. The data analysis will therefore focus on ensuring that relevant and representative data is being used in the RAM model.
3	H-7 Modeling Assumption Concerns - 1st bullet	All component failures for front line systems were assumed to result in the termination of transfer activities.	See Item 1
4	H-7 Modeling Assumption Concerns - 2nd bullet	Generic component failure rates are taken primarily from Savannah River Site data for chemical systems (Section 3.3).	See item 2
5	H-7 Modeling Assumption Concerns - 3rd bullet, plus comments on H-8.	Replacement and repair parts are assumed to be available to the extent that their availability does not dominate failure event restoration time. It is assumed that at least one spare of each repair / replacement part is on hand or is procurable during the normal job preparation time (Section 4).	Agree. The assumption was stated because of concerns similar to the reviewer. The project developers recognize the importance of having sufficient spares. However, since the final design has not been completed and suppliers have not been identified, quantification of potential delays due to the lack of spares was judged to be premature. As specific issues regarding spares are identified, they will be factored into the analysis.

Table H-1. Response to Peer Review Recommendations (continued)

Item	Location	Recommendation	Response
6	H-8 Are the models appropriate...? 1st para.	Reference to Failure Modes and Effects Analysis (FMEA) is made in the report and the data files, as being the basis for the single component failure modes used in the RAM analysis. It is implied that each of the FMEA evaluated failures result in the shutdown of the waste transfer process. The FMEA is not referenced in a separate document.	The development of the FMEA of the activities is discussed in Section 2.3 of the preliminary RAM report. A sample FMEA is presented in Appendix A. The remaining FMEA can be generated from the RAM database, but would be very voluminous to print. Given the current generic nature of the FMEA, it was judged that providing a complete printout would not be beneficial.
7	H-8 Are the models appropriate...? 2nd para.	It appears that generic failure mode and effects for component types are provided in the LAWRAM9906.mdb database file in the CompFMEA table. These generic failure modes are then applied to the specific components of the transfer systems via a query process. This appears to be extremely conservative from the standpoint of determining what components will actually shut down the system.	Agree. See Item 1.
8	H-9 Are limitations or caveats...?	There should be some discussion of the uncertainty of the results of the analysis. The ordering of system components in the Critical Items List has an uncertainty associated with it based on the uncertainty range of the generic failure rates and the MTTR distribution functions/values used in the analysis.	The following was added to the introduction of both the HLW and LAW CIL tables: *It should be recognized that the order of systems and component types on the CILs are based on the mean values of uncertain failure rates and restoration times. Consequently, systems and component types whose contribution percentages are close should be considered equivalent in importance.*

Table H-1. Response to Peer Review Recommendations (continued)

Item	Location	Recommendation	Response
9	H-9 Does the report provide cumulative probability curves...?	Cumulative probability curves for how long it takes to retrieve and qualify feed are not provided in this report. Cumulative probability curves for Total Schedule Delay Times are provided for each of the waste types: HLW (E-6) and LAW (F-6). The report does provide probability distribution curves for how long it takes to qualify feed and retrieve feed for HLW (Figures 5-2 and 5-3) and LAW (Figures 5-5/6 and Figure 5-7).	Figures 5-1 and 5-4 provide this information in graphical form.
10	H-10 General Observations	In the first paragraph of the introduction and in Section 1.1, there is no mention of the qualification and retrieval of the HLW, only LAW.	Corrected.
11	H-10 General Observations	The table of contents for the Appendix Tables needs some format work done on it.	Corrected.
12	H-10 General Observations	The abbreviation "TWRS" is used in the document. "RPP" should be used in place of it.	"TWRS" has been replaced with "RPP" where it is not part of the title of a published report.
13	H-10 General Observations	On page 3-3 at the end of the first paragraph of Section 3.2.1, a reference is made to a share drive that is not provided.	Reference to the shared disk was deleted. A CD-ROM containing all of the files associated with the preliminary RAM assessment analysis is being provided.
14	H-10 General Observations	In Appendix E, starting on page E-73, a "Unique Components List" is provided for the Waste Feed Delivery from source tank 241-AN-105. In Appendix F, no such list is provided for the Waste Feed Delivery from source tank 241-AZ-101.	Unique components lists are provided for both HLW and LAW activities as Tables E-6 and F-6, respectively.

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