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FIRE HAZARD ANALYSIS FOR PROJECT W-320 TANK
241C106 WASTE RETRIEVAL

9/18/95
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241-C-106 Waste Retrieval

Release Date: September 12, 1995

**This document was reviewed following the
procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

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FIRE HAZARD ANALYSIS
FOR
PROJECT W-320
TANK 241-C-106 WASTE RETRIEVAL
WHC-SD-W320-FHA-001, Rev. 0

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ABBREVIATIONS, ACRONYMS, AND INITIALISMS
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AC	alternating current
ALARA	as low as reasonably achievable
BTU	British Thermal Unit(s)
cfm	cubic foot per minute
DBE	Design Basis Earthquake
dia.	diameter
DOE	U.S. Department of Energy
EDE	effective dose equivalent
FHA	Fire Hazards Analysis
FM	Factory Mutual
ft	foot or feet
ft ²	square feet
ft ³	cubic feet
G	gravitational constant
g	gram(s)
gal	gallon(s)
gpm	gallons per minute
HEME	high efficiency mist eliminator
HEMF	high efficiency metal filter
HEPA	high efficiency particulate
HFD	Hanford Fire Department
h, hr	hour(s)
HVAC	heating, ventilating, and air conditioning
ICF Kaiser	ICF Kaiser Hanford Company
in.	inch(es)
in ²	square inch(es)
ISO	Insurance Service Office
km	kilometer(s)
km ²	square kilometer(s)
kV	kilovolt
kVA	kilovolt-ampere
L	liter
lbf	pounds-feet
LEL	lower explosive limit
LFL	lower flammable limit
LLNL	Lawrence Livermore National Laboratories
m	meter(s)
m ³	cubic meter(s)
MCC	motor control center
MCFL	Maximum Credible Fire Loss
mi	mile(s)
min	minute(s)
MPFL	Maximum Possible Fire Loss

ABBREVIATIONS, ACRONYMS, AND INITIALISMS

(Page 2 of 2)

NFPA	National Fire Protection Association
PCBs	polychlorinated biphenyls
ppm	parts per million
s	second(s)
SC	Safety Class
sp gr	specific gravity
sq	square
SWBG	Solid Waste Burial Grounds
SWTS	sluicing waste transfer system
TRU	transuranic
UBC	Uniform Building Code
VERMS	Ventilation Exhaust Radiation Monitoring System
V	Volts
w.g.	water gauge
WRSS	Waste Retrieval Sluicing System
Westinghouse Hanford, WHC	Westinghouse Hanford Company
y, yr	year(s)

1.0 INTRODUCTION

This Fire Hazards Analysis (FHA) for Project W-320, "Tank 241-C-106 Waste Retrieval" addresses fire hazards or fire-related concerns in accordance with DOE 5480.7A (DOE 1993), resulting from or related to the processes and equipment to be installed or modified under Project W-320. It is intended to assess the risk from fire associated with Project W-320 to ensure that: there are no undue fire hazards to site personnel and the public; the potential for the occurrence of a fire is minimized; process control and safety systems are not damaged by fire or related perils; and property damage from fire and related perils does not exceed an acceptable level.

Elements within the FHA make recommendations for minimizing risk to workers, the public, and the environment from fire during the course of the operation's activity. Transient flammables and combustibles present that support the operation's activity are considered and included in the analysis.

The FHA analyzes and evaluates Project W-320 with respect to existing and documented proposed conditions to ascertain whether the objectives of DOE Order 5480.7A Fire Protection are met (DOE 1993). The graded FHA contains the following elements:

- Description of construction,
- Description of operations
- Protection of essential safety class equipment,
- Fire protection features,
- Description of fire hazards,
- Life safety considerations,
- Critical process equipment,
- High value property,
- Damage potential: Maximum Credible Fire Loss (MCFL) and Maximum Possible Fire Loss (MPFL),
- Fire Department/Brigade response,
- Recovery potential,
- Potential for a toxic, biological and/or radiation incident due to a fire,
- Emergency planning,
- Security considerations related to fire protection,
- Natural hazards (earthquake, flood, wind) impact on fire safety, and
- Exposure fire potential, including the potential for fire spread between fire areas.

Recommendations for limiting risk are made in the text of this report and printed in **bold type**. All recommendations are repeated in a list in Section 19.0.

Assumptions and Limitations

Assumptions regarding processes, equipment and operations are intended to be representative of actual conditions that exist during actual operations of Tank 241-C-106 as documented in the referenced materials of this report. The interim Safety Equipment List reflecting project design at 60 percent as well as the functional design criteria, Draft Revision 3 for Tank 241-C-106, Waste retrieval, Project W-320 was utilized as a basis for

determining the scope and function of the materials, equipment and structures to be installed or placed in service as part of this project. Additionally, a draft preliminary fire hazard analysis performed by the ICF Kaiser Hanford Company provided additional information used in this report. Changes in work scope, procedures, acceptance criteria or conditions, introduction of additional fuels or fuel sources, etc. may require additional analysis to assess whether these changes impact the conclusions and recommendations of this analysis.

It is assumed that the HEPA filter media and HEPA filter frame are constructed of noncombustible material.

From the safety documentation provided, it is assumed that after the wastes have been transferred to Tank 241-AY-102, the wastes will not be susceptible to ignition or be unstable, will not react violently with water, or form an explosive mixture (ICF Kaiser 1994).

From the safety documentation provided, it is assumed that Tank C-106 is actively ventilated prior to and during the sluicing process.

From the analysis provided and documented in Appendix B, it is concluded that the Tank C-106 waste does not contain significant quantities of flammable gases which could be released to the tank vapor space as a result of the sluicing processes. If changes within the analyses result in expected releases of significant quantities of flammable gases, these changes should be evaluated to determine the extent of impact on the FHA.

Monetary values assigned to equipment and structures that are cited in the development of the MPFL and MCFL are based on estimates prepared by ICF Kaiser in support of the Project W-320 and values cited in the preliminary FHA, prepared by ICF Kaiser.

2.0 SUMMARY AND CONCLUSIONS

This document represents the Fire Hazards Analysis for Project W-320, Tank 241-C-106 Waste Retrieval. The FHA was developed in accordance with the criteria contained in DOE Order 5480.7A and is intended to address the major fire hazards inherent to the operation (DOE 1993).

There are no fixed fire protection systems protecting the equipment and structures in the 241-C Tank Farm. A fire involving a trailer in this area is not likely to be controlled or extinguished without the use of hose streams flowing significant quantities of water. Installation of fire hydrants within the vicinity of the C-106 equipment and in accordance with the applicable requirements of DOE 6430.1A is recommended (DOE 1989).

From analysis/evaluation of wastes to date within the C-106 tank, there is no technical basis to conclude that significant quantities of flammable gases may be trapped within the waste solids.

Equipment installed to shutdown the sluicing transfer system during a seismic event has been identified as Safety Class, SC-1 equipment. The SC-1 equipment is designed with redundancy. It has been concluded that an accidental fire will not result in a loss of the capability of the safety class system to accomplish its required safety function.

Emergency guidelines for Project W-320 have not been completed. Review and approval of emergency guidelines addressing fire safety and fire protection by the Westinghouse Hanford Tank Farm fire protection engineer is recommended.

Accumulation of tumbleweeds as well as other transient combustibles are likely to occur periodically in and around Project W-320 equipment and structures. In keeping with Westinghouse Hanford policy to limit combustibles to a level as low as reasonably achievable, a procedure to ensure periodic removal of tumbleweeds and other unwanted transient combustibles in and around the project area is recommended.

DOE 6430.1A section 1530.99.0 stipulates that automatic water sprinkler coverage be provided throughout nonreactor nuclear facilities. Automatic sprinkler protection is not expected to prevent or reduce any subsequent loss that may result from an electrical failure. Based on the evaluation of combustibles and processes planned for the structure, a deviation from the DOE 6430.1A requirement for automatic water sprinkler protection is recommended.

3.0 DESCRIPTION OF CONSTRUCTION

3.1 LOCATION

Project W-320 involves processes, materials and equipment to be installed in or between the 241-C Tank Farm, and the 241-AY Tank Farm as shown in Figure 1.

3.2 BACKGROUND

The purpose of Project W-320 is to remove high heat generating solids presently stored within Tank 241-C-106 to Tank 241-AY-102 for future treatment and disposal. Tank 241-C-106 is a 2,000,000-L (530,000-gal) single shell storage tank that is currently considered to be sound. It has been used for radioactive waste storage since 1947 (WHC 1995a). Between mid-1963 and mid-1969, C-106 received about 500,000 L (132,000 gal) of high heat waste. Presently, approximately 100,000 BTU/hr of heat energy is generated within the sludge layer contained in the tank. This sludge layer contains various radioactive components, of which the most important is strontium. To prevent the tank contents from generating sufficient heat to damage the tank shell, about 6,000 gal per month of evaporative cooling water are added. The water cools the tank and prevents the sludge layer from drying (ICF Kaiser 1994).

Dependence upon water addition to control the heat generated within the tank is undesirable. Should a leak develop, the water additions will increase the leakage to the soil column. Additionally, the Tri-Party Agreement M-45-03A requires the initiation of sluicing retrieval of C-106 by October 31, 1997. This project fulfills that requirement. Additionally, removal of the heat-generating sludge allows cooling water additions to cease and enables operations to place C-106 in a safe, interim stabilized status. Tank 241-AY-102 is a double shell tank that can safely store the contents of both tanks (ICF Kaiser 1994).

3.3 PROJECT SCOPE

The scope of Project W-320 is to design and install a waste retrieval sluicing system (WRSS) to remove the radioactive and chemical sludge from Tank 241-C-106 and transport the material to double-shell Tank 241-AY-102 via a new, temporary, shielded, encased transfer line.

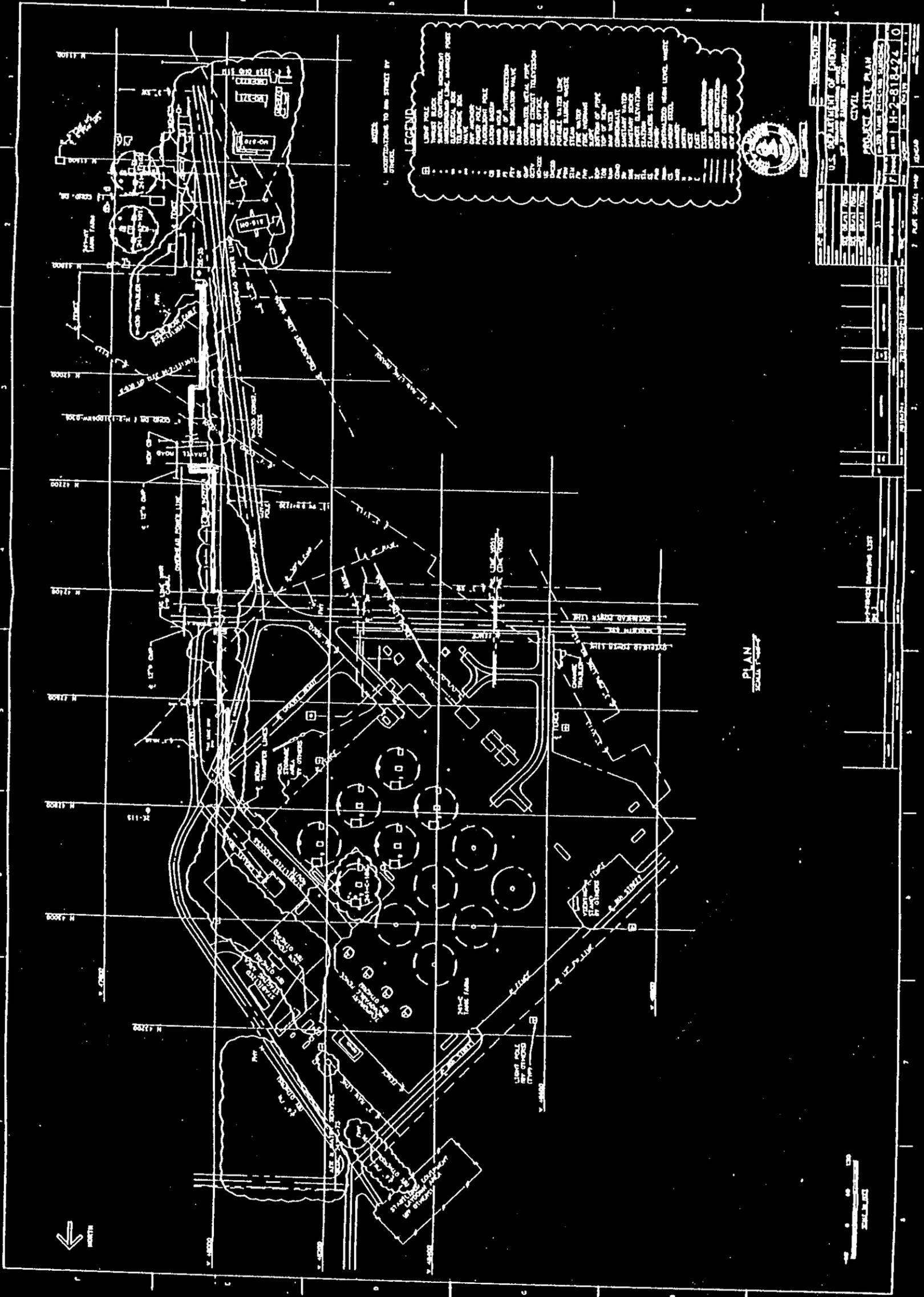
The WRSS includes hardware specific to:

- Retrieval of waste tank contents,
- Waste tank modifications,
- Receiver tank system modifications necessary to retrieve Tank 241-C-106 waste,
- The transfer line to and from the double-shell tank system, and
- All associated support equipment.

Figure 1.
Project W-320

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FHA for Project W-320 Tank 241-C Waste Retrieval

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Project W-320 also includes the following:

- Deploying the retrieval equipment and systems,
- Mobilizing and retrieving waste in Tank 241-C-106,
- Conveying waste out of Tank 241-C-106,
- Transferring waste to double-shell waste Tank 241-AY-102,
- Confining and filtering of hazardous vapors and airborne radioactive particulates at Tank 241-C-106,
- Removing heat as required to maintain acceptable temperature levels in Tank 241-C-106,
- Avoiding any tank dome or riser loading in excess of allowable limits,
- Supplying electrical power and all other support utilities,
- Providing replacement tank pit cover block assemblies as required,
- Monitoring and control operations,
- Shielding and maintenance actions,
- Providing the required heating, ventilating, and air conditioning (HVAC) for Tank 241-106 and retrieval support facilities,
- Recirculating clarified supernate from Tank 241-AY-102 to Tank 241-C-106, and
- Minimizing the operating liquid content in Tank 241-C-106

(WHC 1995c).

3.3.1 Building/Equipment Construction

The following sections identify building and equipment by area as shown in the attached Figures 2 and 3.

3.3.2 Area 1

- Sluice Pit 06C, C-106 (existing) consisting of an 11-ft by 12-ft underground concrete pit.
- Pump Pit 06A, C-106 (existing) consisting of an 16-ft by 18-ft pit with a new cover and related equipment.

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Figure 2.
Project W-320.
241-C Tank
Farm Areas

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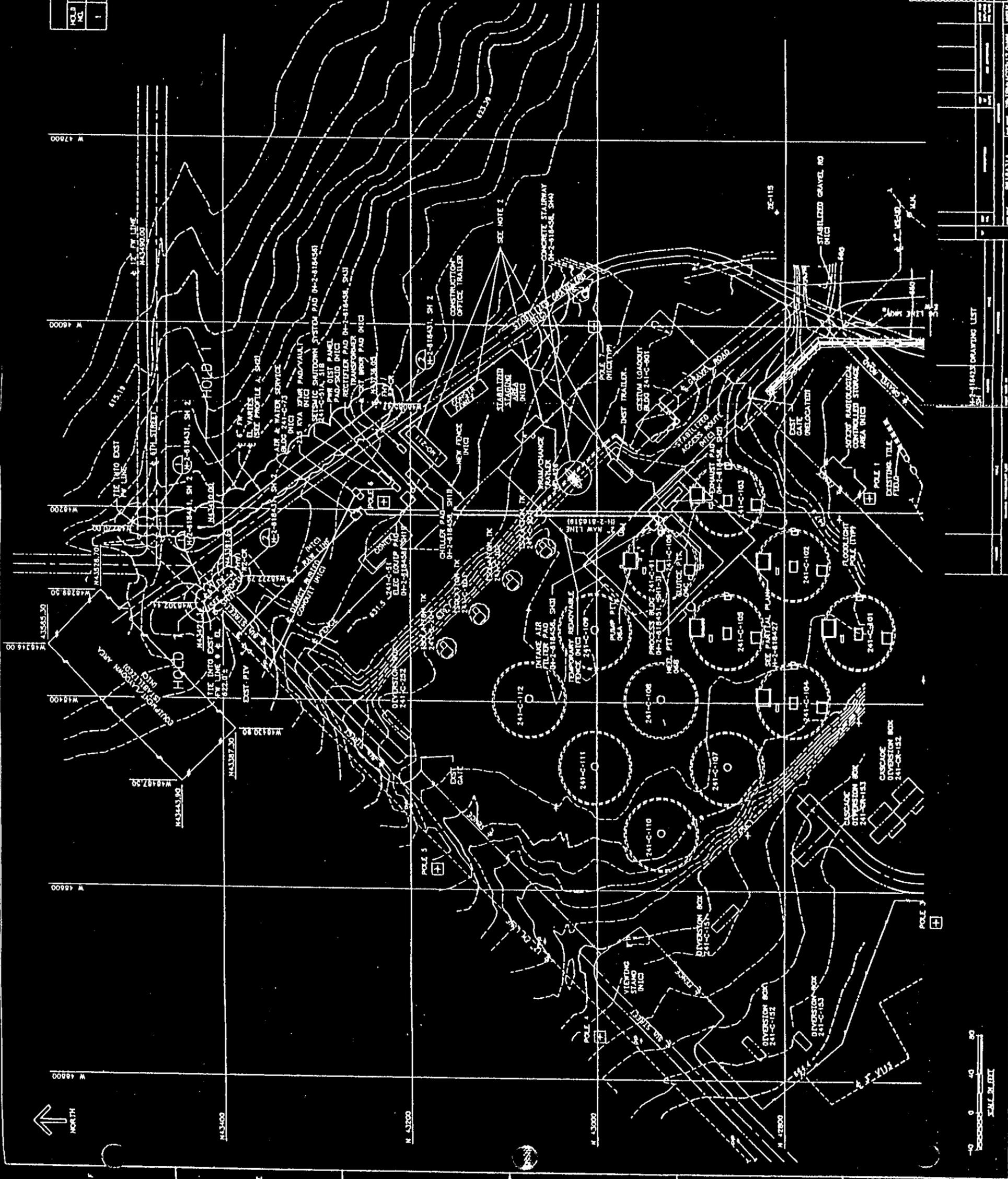
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HOLD NO.	DESCRIPTION	EXPECTED RELEASE DATE
1	FHA RECOMMENDATION	TBD

NOTES:

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- WORK INCLUDED IN OTHER CONTRACT PACKAGES IS DENOTED "NOT IN CONTRACT INTC".



PROJECT NO.	W-320	DATE	11-1-71
PROJECT NAME	241-C TANK FARM	SCALE	AS SHOWN
PROJECT LOCATION	W-320 TANK FARM, 241-C-108, SUTCLIFF	PROJECT NO.	W-320
PROJECT TYPE	CIVIL	PROJECT NO.	W-320
PROJECT DESCRIPTION	241-C TANK FARM SITE PLAN	PROJECT NO.	W-320
PROJECT STATUS	PRELIMINARY	PROJECT NO.	W-320
PROJECT OWNER	U.S. DEPARTMENT OF ENERGY	PROJECT NO.	W-320
PROJECT CONTRACT	241-C TANK FARM CONTRACT	PROJECT NO.	W-320
PROJECT CONTRACT NO.	H-2-818431	PROJECT NO.	W-320
PROJECT CONTRACT DATE	11-1-71	PROJECT NO.	W-320
PROJECT CONTRACT VALUE		PROJECT NO.	W-320
PROJECT CONTRACT TYPE		PROJECT NO.	W-320
PROJECT CONTRACT NO.	H-2-818431	PROJECT NO.	W-320
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PROJECT CONTRACT TYPE		PROJECT NO.	W-320



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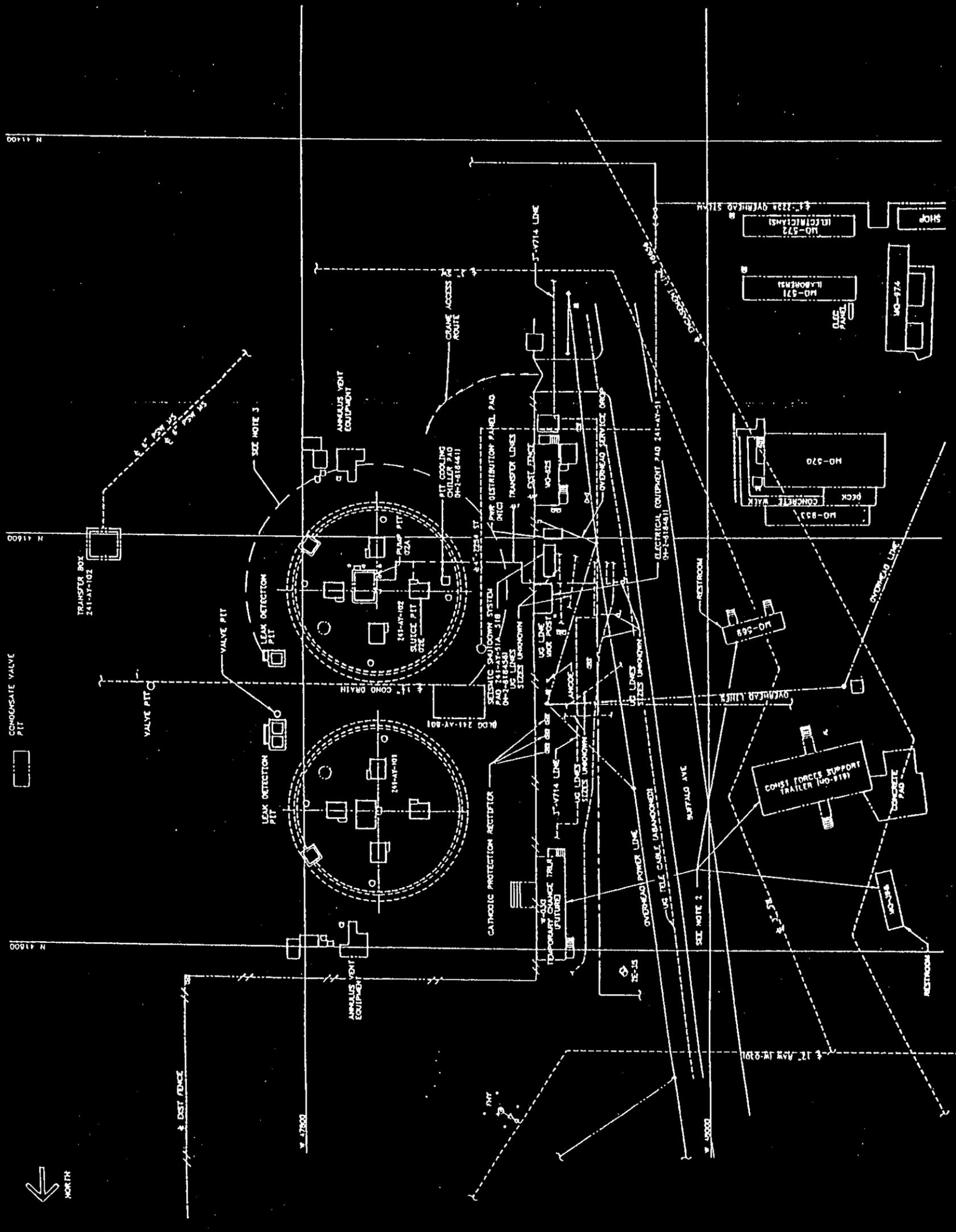
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Figure 3.
 Project W-320
 241-AY Tank
 Farm Areas.

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- SEE DWG H-2-818432 FOR LEGEND. (NFC)
 - THESE TRAILERS/FACILITIES ARE INSTALLED BY OTHERS ON AN AS RENTED BASIS AND MAY NOT ALWAYS BE PRESENT, BUT WHEN REQUIRED, ARE LOCATED AS SHOWN.
 - A LEAK DETECTION BOUNDARY SHALL BE ESTABLISHED AROUND AT-ICE TANKS A MINIMUM OF 20 FT FROM OUTSIDE PERIMETER EDGE OF TANK WALL FOR HEAVY CONSTRUCTION OPERATING EQUIPMENT/CRANES. INSIDE TRACKS OR WHEEL LOADS FOR SUCH EQUIPMENT SHALL NOT STRADDLE OR EXTEND INTO THIS LEAK DETECTION BOUNDARY AREA.
 - WORK INCLUDED IN OTHER CONTRACT PACKAGES IS DENOTED "NOT IN CONTRACT" IN RED.



PROJECT NUMBER	3	PRELIMINARY
DATE		
U.S. DEPARTMENT OF ENERGY		
OFFICE OF ENVIRONMENTAL RESTORATION		
CONTRACT NUMBER		
241-AY TANK FARM		
SITE PLAN		
SCALE	AS SHOWN	
PROJECT TITLE	H-2-818432	
DATE	08/13/82	

PLAN
 SCALE: 1"=20'-0"

NO.	DESCRIPTION	DATE	BY	CHKD.
1	ISSUED FOR PERMITTING			
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- Intake Air Filter, C-106 consisting of structure-mounted filtering equipment located on two 1-ft, 6-in. pads.
- Exhaust Skid/Pad, C-106 consisting of a skid-mounted exhaust equipment on a 8-ft by 27-ft concrete pad.
- Process Building, (241-C-91) consisting of a single story, 15-ft by 25-ft insulated, preengineered metal building that will house equipment for air treatment.
- WRAM/Change Trailer, C-Farm consisting of an existing wood-frame unit designated MO-826, located 80 ft to the northeast of pump pit 06A and approximately 80 ft south of the instrument trailer.

3.3.3 Area 2

- Air and Water Service Building, a single story, 9-ft by 10-ft preengineered metal building, housing an air compressor, raw water service connection, and backflow prevention device.
- Seismic Shutdown System Pad consisting of two seismic shutdown switches located on a 6-ft by 16-ft concrete pad. The equipment for each switch will be housed in 5-ft by 6-ft metal boxes with a 1-ft separation between the boxes.
- Electrical Equipment Skid/Pad and related equipment will be in a preengineered metal building located on a 10-ft by 12-ft concrete pad.
- Rectifier Pad containing cathodic protection.
- Chiller Pad containing a chilled water system on a 10-ft by 26-ft pad.
- 225 kVA Transformer Pad/Vault (existing). The unit contains 163 gal of mineral oil.
- Power Distribution Pad located 30-ft south of the 225 kVA transformer and will house breakers and wiring in metal boxes.
- Transformer and Circuit Breaker Pad will be located 60-ft southeast of the 225 kVA transformer pad/vault and contains a dry type transformer, breakers, and switches.
- Office Trailer is a 14-ft by 60-ft wood framed unit located 20 ft southeast of the chiller pad.
- Construction Conex is a 60-ft steel cargo container located 35 ft southeast of the Office Trailer that will be used for the storage of construction materials and supplies.
- Conex, existing, furnished by others, is two existing 40-ft metal shipping containers.

3.3.4 Area 3

- Pump Pit 02A (Tank 241-AY-102), existing will have a distributor installed.
- Sluice Pit 02E, existing will have a new pump installed. A sluicer may be installed at a future time.
- A chiller unit will be installed in Sluice Pit 02E. The unit will provide cooling for the sluice pump electric motor.

3.3.5 Area 4

- Seismic Shutdown System Pad consisting of two metal boxes located on a 6-ft by 16-ft concrete pad. The two switches will be housed in a 5-ft by 6-ft metal box with a 1-ft separation between the boxes. The seismic shutdown system pad will be located 3 ft north of the Power Distribution Pad and 2 ft south of the variable speed drive panel.
- Power Distribution Pad located approximately 10 ft north of existing trailer MO-825 and will consist of circuit breakers in noncombustible enclosures on a skid structure.
- Electrical Equipment Skid/Pad located 12 ft north of the seismic shutdown system pad and will consist of electrical equipment in metal boxes located in a noncombustible metal housing on a skid structure.

3.3.6 Design Life

All WRSS process components and supporting equipment are specified to have a minimum design life of 2 yr, including 1 yr for retrieval operations. Materials that have a standard design life greater than 2 yr will not be degraded to meet these minimum requirements (WHC 1995b).

4.0 DESCRIPTION OF OPERATIONS

Note: The following operations and systems descriptions are from WHC-SD-WM-SEL-033 (WHC 1994c) unless noted otherwise.

4.1 SLUICING WASTE TRANSFER SYSTEM (WHC 1994c)

The sluicing waste transfer system (SWTS) consists of:

- a seismic switch,
- primary and secondary transfer pipes between C-106 and AY-102,
- a slurry distributor,
- syphon protection,
- waste transfer pits,
- waste transfer equipment in pits that include a slurry pump, a sluice pump, sluicers, valves, etc.,
- a chiller unit to provide cooling for the sluice pump electric motor, and
- raw water supply and transfer line flushing system.

The high heat waste solids in C-106 will be transferred to AY-102 by using an updated form of past practice sluicing. The sluicing is a continuous process with the supernatant or alternate liquid in AY-102 serving as the sluicing fluid. This fluid is mixed with the solids by the sluicer action producing a slurry in C-106. The slurry is transferred to AY-102 via a variable speed slurry transfer pump, with a maximum capacity of 1,200 L/min (350 gpm) through an encased slurry transfer pipe, and a distributor located in AY-102.

The sluicer is installed in Pit 241-C-06C. The sluicer will use an FM-approved Class II hydraulic oil for direction control. The slurry distributor is located in pit 241-AY-02A. The distributor distributes the solids in AY-102 as evenly as possible. A majority of the solids settle in AY-102. The unsettled solids in AY-102 are recirculated along with supernatant (or alternate fluid) to C-106. Thus, a continuous process of sluicing is maintained until at least 75 percent of high heat solids are transferred into AY-102 (WHC 1994c).

Descriptions of the primary components of the SWTS follow below.

4.1.1 Seismic Switch

A postulated break of both supply and return transfer lines during a seismic event has been postulated. Seismic switches will be installed to shut down the WRSS sluicing transfer system during a seismic event.

4.1.2 Primary Transfer Pipes

The two primary transfer lines (delivering supernatant to the sluicing nozzles in C-106 and high heat slurry waste to the receiver tank, AY-102), will be of all welded construction of 4-in. Schedule 40 stainless steel pipe within a 6-in. Schedule 40 carbon steel encasement pipe.

The piping system is installed near grade and bermed to provide radiation shielding (ICF Kaiser 1994).

4.1.3 Secondary Transfer Pipes

The 6-in. secondary transfer (encasement or outer) pipes are provided for leak detection and secondary confinement to drain any liquid leaked from the 4-in. primary transfer lines to the appropriate.

4.1.4 Slurry Distributor

The slurry distributor pipe is designed to maximize solids settling and to provide distribution of solids as evenly as possible within AY-102.

4.1.5 Syphon Protection

The design of the supernatant line will incorporate anti-syphon holes on the sluice pump discharge line located inside AY-102 in order to prevent syphoning of AY-102 via the supernatant line. Similarly, anti-syphon holes are also provided on the slurry distributor line located inside AY-102 to prevent syphoning of AY-102 via slurry line. In the event of a break in the lines or when the system is shutdown or stopped, the anti-syphon holes will prevent draining of AY-102 to C-106 and a consequent overflow of C-106.

4.1.6 Waste Transfer Equipment in Pits

The C-106 WRSS provides new and modified waste transfer piping, pumps, flanges, and jumpers located in pits. These pits are constructed of reinforced concrete. An epoxy coating will be applied to the inner surfaces of the concrete to prevent migration of liquid from the pits to the surrounding soil. The pits are provided with drains that will route leakage directly to the pit's associated tank. The drains are sized to accommodate three to four times the pipeline flow (WHC 1995b).

With a properly installed pit cover block, the pump, pipe, gaskets, flanges, jumpers, or valves could leak, spray, or burst with little consequence to the environment.

4.1.7 Raw Water Supply and Transfer Line Flushing

The WRSS systems will be designed to be capable of flushing all components with raw water.

4.2 VENTILATION SYSTEM (WHC 1994c)

The ventilation system will provide control of temperature and humidity, and confinement of hazardous aerosols and vapors within the C-106 tank vapor space using a recirculation and an exhauster system. The ventilation system for Tank C-106 includes gas bleeding from tank C-105 via the cascade line connecting the two tanks. Gases will be monitored to ensure that the exhaust at the stack meets ALARA

principles. Leaving the existing cascade line in place avoids personnel exposure associated with isolating or removal of this line.

The ventilation system consists of a recirculation and prefiltration system, a chiller skid, and an exhaust skid. The raw water and compressed air systems provide necessary support for operation of the HVAC system.

Descriptions of the primary components of the ventilation system follow.

4.2.1 Seal Loop

A seal loop is provided to mitigate the tank under- or over-pressurization scenario, and is designated to limit differential pressure between C-106 vapor space and the external atmosphere.

4.2.2 Recirculation and Prefiltration System

This system consists of a condenser, a moisture separator, a heating coil, a recirculation fan, a high efficiency mist eliminator (HEME) and a high-efficiency metal filter (HEMF). Gases enter from C-106 through a 10-in. duct and are cooled by the condenser. Part of the flow is directed to the exhaust skid and the balance circulates through the moisture separator, heating coil and returns to C-106 through an 8-in. duct. The condenser cools the recirculation and exhaust gases from C-106. The HEME and HEMF are part of the prefiltration system, and are considered part of the exhaust train. A portable exhaust hook-up is provided between the moisture separator and the heating coil on the recirculation line.

4.2.3 Chiller Skid

This skid consists of an air-cooled chiller and a glycol cooling system. The glycol cooling system consists of make-up storage tank, air separator, expansion tank, and circulating pumps. The propylene glycol solution is used to cool the ventilation recirculation and exhaust gas via the condenser. The glycol solution is cooled by the air cooled chiller system.

4.2.4 Exhaust Skid

This skid directs exhaust air from the prefiltration system through an electric heating coil, two HEPA filters with a test section for each filter, and exhaust fan and a stack. The stack includes a ventilation exhaust radiation monitoring system.

4.3 AC POWER SYSTEMS

Electrical systems provide AC power for C-106 and AY-102. Descriptions of the primary components of the electrical systems follow below.

4.3.1 AC Power for C-106

Power from the Hanford Site Power Grid will be used to provide 480 V AC via a portable substation, skid-mounted on a concrete slab outside the fence, near the C farm. The new portable substation will include a transformer, switchgear, and two motor control centers.

The AC power system provides electrical power to components for C-106 systems, instrumentation, and controls. Failure of normal power will secure the slurry pump, heel pump, and HVAC including instrumentation and controls, and will place these components in a safe shutdown condition.

4.3.2 AC Power for AY-102

Normal 480 V AC power will be provided by using the existing 13.8 kV pole line C8-L6. This line will be tapped to supply a new 13.8 kV to 480 V transformer. A 480 V line will be used to supply power to the sluice pump located in AY-102. The power panel will be located in a new skid mounted enclosure located outside the fenced area of 241-AY tank farm and AY-102.

The AC power system provides electrical power to components for AY-102 systems, instrumentation, and controls. Failure of normal power will secure the sluice pump including instrumentation and controls and will place these components in a safe shutdown condition.

4.4 INSTRUMENTATION AND CONTROL

This section includes existing and new instrumentation systems required for monitoring and control of the WRSS. Descriptions of the primary components of these systems follows below.

Existing instrumentation for tank liquid-level, temperature, pressure/vacuum, and leak detection systems will be used as required to monitor operating conditions in C-106 and AY-102 during WRSS operation.

Instrumentation will monitor and control the facility retrieval and transfer operations, HVAC, and support systems necessary to perform all functions required to mobilize, retrieve, and transport C-106 waste.

4.4.1 Seismic Switch

Two sets of redundant seismic switch modules are installed, one set at C farm and the other set at AY farm. At the onset of seismic activity, the respective motor control centers (MCCs) supplying power to each of the farms will shut down the WRSS operation. The MCC at C farm shuts down the slurry pump, HVAC for C-106, and WRSS slurry transfer system. The MCC at AY farm shuts down the sluice pump and the WRSS sluicing system. Alarms will annunciate to alert the operator of abnormal situations.

4.4.2 Sluice Pump

The variable speed submersible sluice pump monitoring and control instrumentation will be located in the WRSS control room. A remotely operated winch will be provided for the sluice pump. This will allow operators to raise or lower the pump from the control room, to accommodate liquid level changes in AY-102.

4.4.3 Slurry Pump

Controls will be provided for the submersible slurry pump. A remotely operated winch will be provided for the pump.

4.4.4 Treated Water System

Treated water will be provided via trucks and supplied through hose connections to flush the transfer piping system. Flushing of the transfer piping will be controlled by the operator through the use of remotely operated valves.

4.4.5 WRSS Leak Detection System

New leak detection sensors are provided for pump pit 241-C-06A, Heel Pit 241-C-06B, Sluice Pit 241-C-06C, and Sluice Pit 241-AY-02E. These sensors will shut down the WRSS pumps upon detection of leaks in the pits, and provide signals for alarm and interlock functions. A remotely operated valve will be located in the encasement drain line for each pit to permit the operator to isolate the encasement line from the pit for leak containment or pressure testing.

4.4.6 Transfer System Interlocks

The seismic activity as detected by seismic detectors in C and AY farms will shut down the WRSS. The leak detection system and radiation monitoring system associated with transfer lines and pits will be integrated with a misrouting prevention system.

4.4.7 Recirculation and Prefiltration System

Instrumentation will be provided to monitor the condenser outlet temperature, heater outlet temperature, fan differential pressure, and fan motor current. Instruments are also provided for monitoring HEME differential pressure, HEME outlet temperature, and HEMF differential pressure.

Heater controls will be capable of regulating air flow from 10°F to 60°F above the entering airstream temperature.

The condenser cooler system controls will allow the ventilation gas stream to be cooled from 35°C to 4.5°C (95°F to 40°F) by use of a 40 percent propylene glycol solution.

4.4.8 Exhaust System

The instruments provided for monitoring this system include heater inlet and outlet temperature, HEPA filter differential pressure, fan inlet temperature, and fan inlet damper position.

4.4.9 HVAC System Controller and Interlocks

The HVAC system controller will provide diagnostic information relating the system performance and status. Should the operations be automatically terminated or fail to restart upon demand, the cause of the shutdown or failure will be clearly identified.

An interlock will be provided to cause shutdown of the exhaust fan when a high radiation condition is detected by the Ventilation Exhaust Radiation Monitoring System (VERMS).

4.4.10 Ventilation Exhaust Radiation Monitoring System (VERMS)

The exhaust flow, temperature, and radiation monitoring instrumentation are provided as part of the VERMS.

5.0 FIRE PROTECTION FEATURES

Fire Protection features are active or passive fire protection systems and equipment. They include sprinkler systems, special extinguishing systems, emergency communications, fire detection, alarm and reporting systems, standpipes, portable and wheeled fire extinguishers, smoke and ventilation control systems, fire barrier systems and their associated protective devices.

There are no fixed fire protection systems serving Project W-320 facilities and equipment located in the 241-C Tank Farm. There is one fire hydrant located within approximately 250 ft of the seismic shutdown equipment pad located in the 241-AY Tank Farm.

Applicable Requirements for Fire Hydrant Design and Placement

DOE 6430.1A, Section 0266-4, *System Design Considerations*, Section 1530-3.3.3, *Fire Hydrant Demand*, and Section 1530-9, *Water Storage and Distribution*, stipulate the following requirements regarding the installation of fire hydrants (DOE 1989):

- Fire hydrant branches shall not be less than 6 in. in dia. and no longer than 300 ft,
- Fire hydrants shall be placed so that hose lays from hydrants to all exterior portions of a protected building are no more than 300 ft., and
- Hydrants shall not be closer than 50 ft to all exterior portions of a protected building.

The cited water storage and distribution requirements ensure that there is an adequate water supply available for fire department use in the event of a fire.

From discussions with the Hanford Fire Marshall, fire department vehicles used in the initial response to a fire in the tank farms carry less than 500 gal water capacity. Significant quantities of water are expected to be used for fire extinguishment as well as exposure protection with the purpose of cooling nearby buildings, structures, or equipment to prevent further fire damage or fire propagation. Calculations performed (Appendix) to estimate the water supply needed to control and mitigate a typical trailer fire indicate that a reliable water supply is necessary to control a trailer fire and to protect nearby exposures.

Installation of fire hydrants within the vicinity of the C-106 equipment and in accordance with the applicable requirements of DOE 6430.1A is recommended (Rec. 5-1).

Applicable Requirements for Automatic Sprinkler Protection

DOE 6430.1A section 1530.99.0 stipulates that automatic water sprinkler coverage shall be provided throughout nonreactor nuclear facilities, except where nuclear

criticality or other hazards specifically preclude its use or where Halon systems are required to reduce equipment damage.

A strict interpretation of this requirement would require that the 15 ft. by 25 ft. process building located in the C-tank farm (area 1) and designed to house air treatment equipment be protected with an automatic water sprinkler system. However, a review of the equipment and instrumentation drawings indicates that there are no significant combustible loadings. The only identified ignition source results from electrical failure. Any resulting fire is expected to be limited in size and is not expected to spread due to the very low combustible loading. Automatic sprinkler protection is not expected to prevent or reduce any subsequent loss that may result from an electrical failure. Consequently, automatic water sprinkler protection is not recommended. **Based on the evaluation of combustibles and processes planned for the structure, a deviation from the DOE 6430.1A requirement for automatic water sprinkler protection is recommended (Rec. 5-2).**

6.0 DESCRIPTION OF FIRE HAZARDS

Fire hazards are defined as conditions or practices related to fire that have the potential to contribute to or directly cause injury, illness, onsite or offsite release of radiological and/or other hazardous material, property damage, or mission impairment. Fire hazard identification and evaluation for Project W-320 is by geographic area as illustrated in Figures 2 and 3.

There are no passive fire protection barriers scheduled for installation which would create separation between the four areas. However, there is sufficient separation distance between areas that a fire in one area is not expected to propagate to or expose equipment in another area.

6.1 AREA 1

6.1.1 Pits 06A and 06C

The only identified potential ignition source in the pits is an electrical failure resulting in an electrical arc or overheating of electrical equipment. A fire resulting from electrical failure is expected to be limited in size and is not expected to spread due to the very low combustible loading.

6.1.2 Intake Air Filter/Exhaust Skid/Pad and Process Buildings

The only identified potential ignition source in the intake air filter, exhaust skid/pad, and process buildings is an electrical failure. A fire resulting from electrical failure is expected to be limited in size and is not expected to spread beyond the equipment of origin due to the very low combustible loading.

This type of fire is not expected to result in a breach or failure of the HEPA filters.

6.1.3 Existing WRAM/Change Trailer

The existing WRAM/Change Trailer is a typical wood framed unit and will have fire hazards that are a typical of this type of occupancy. These include: combustible materials such as anti-contamination clothing, wood furniture, plastic bags, materials, etc. Fire loading is expected to be in the range of 80,000 to 120,000 BTU/ft². A fire could result from an electrical failure. This fire could spread to other combustibles and result in the complete loss of the trailer.

6.1.4 Expected Transient Combustible Materials

Transient combustible materials are expected in the intake air filter, the process building, exhaust skid, and the pits only during maintenance operations or when the pits are open. They should be limited to maintenance materials and supplies.

The WRAM/Change Trailer could have transient combustible materials that vary with current operations.

6.1.5 General Evaluation of Area 1 Fire Hazards

Project W-320 does not introduce exposed combustibles to the pits within Area 1. Electrical wiring is in conduits. The hydraulic oil to be used in the sluice pit, Houghto-Safe 1120 (or approved substitute), meets Factory Mutual (FM) approval guide requirements. A hydraulic liquid which meets its approval standards is considered by FM to have reduced any associated fire hazard to an acceptable degree. Electrical motors will have limited combustibles.

The condenser and pit cooling systems will use approximately 500 gal of a 46 percent propylene glycol solution in water. The flash point of pure propylene glycol is 210°F (99°C). Its ignition temperature is 700°F (371°C) (NFPA 1994b). Flashpoint and ignition properties of a 46 percent propylene glycol solution are not known. However, normal sluicing temperatures of 140°F (ICF Kaiser 1994) are well below the flash point of pure propylene glycol, and dilution with water would significantly reduce or eliminate any associated fire hazard.

Identified electrical fire hazards are inherent to the operation of the equipment and do not warrant additional protection.

A fire in the WRAM/Change Trailer could result in the complete loss of the structure and contents. The trailer is separated from all identified equipment and structures by the minimum separation distances stipulated by DOE-STD-1088-95 (DOE 1995). No additional fire protection measures are warranted.

With the noted exception, of the concern cited in Section 6.4, it is concluded that there are no undue fire risks or fire hazards in Area 1, introduced by the identified buildings/equipment which warrant additional fire protection measures.

6.2 AREA 2

6.2.1 Air and Water Service Building

The only identified potential ignition source is electrical failure in the wiring or equipment. Combustible materials in the air and water service building will be the electrical wiring in conduit, an electrical motor and air compressor. Due to the limited combustibles, a fire in the air and water service building is not expected to damage electrical equipment located nearby, specifically the existing 225 kVA transformer pad/vault spaced approximately 10 ft from the building.

6.2.2 Seismic Shutdown System Pad

The seismic shutdown system pad consist of two metal boxes containing seismic shutdown switches and associated equipment. These switches are Safety Class 1 Components. The seismic shutdown system combustible materials will be electrical wiring in the conduit and other electrical equipment. Due to the limited combustibles, a fire in the seismic shutdown equipment is expected to be limited to the equipment of origin and is not expected to damage the power distribution panel located approximately 5 ft away.

6.2.3 Office/Instrument Trailer (MO-211)

The Office Trailer/Instrument Trailer will have fire hazards common to that type of occupancy. This is primarily electrical wiring, electrical equipment and typical office furnishings. Wall interior finish is primarily wood paneling. The wood paneling has been previously exempted via DOE Memorandum (DOE 1993) from the flame spread requirements of NFPA 101. The fire load due to proposed installed equipment and furnishings is expected to be light to moderate, but is increased by the presence of the wood paneling. However, a fire resulting from electrical failure could result in the complete loss of the trailer and its contents. Separation distances between the chiller and circuit breaker pad are less than the required 23 ft stipulated by DOE-STD-1088-95 (DOE 1995). Consequently, a fire in the Office/Instrument Trailer could result in the loss or failure of some or all of the equipment. The separation distance from the seismic shutdown system pad is approximately 45 ft. No additional fire protection measures to protect the seismic shutdown system pad are deemed warranted.

6.2.4 Conexes

The contents of the conexes have not been determined, but are considered to contain ordinary combustible materials. Without further identification of the contents, an ignition source cannot be postulated. However, the contents are considered susceptible to ignition and assumed to burn. Such a fire could result in the loss of the structure and the contents. The construction conex is separated from the Office/Instrument Trailer (MO-211) by 30 ft. It meets the required separation distance of 30 ft stipulated by DOE-STD-1088-95 (DOE 1995).

6.2.5 Electrical Equipment Skid

The only identified potential ignition source is electrical failure in the wiring or equipment. The electrical equipment skid will consist of electrical equipment such as motor controllers, and a small power panel in metal boxes. Due to the limited combustibles, a fire in the electrical equipment is not expected to damage the rectifier pad equipment located approximately 5 ft away.

6.2.6 Rectifier

The rectifier will have electrical equipment in a metal box. The units will be filled with 36 gal of insulating mineral oil. An electrical fault could result in unit rupture and ignition of the spilled oil. Since the mineral oil does not contain polychlorinated biphenyls (PCBs), contamination from soot and smoke spread would be similar to that expected with the burning of organic compounds. The fire could damage the chiller and electrical equipment pad located approximately 5 ft away. Damage to other equipment is not expected.

6.2.7 Chiller

The chiller pad will contain mechanical equipment to supply chilled water as well as pumps, motors, and other electrical equipment. The only identified potential

ignition source is electrical failure in the wiring or equipment. Due to the limited combustibles, a fire in the chiller equipment is not expected to damage the rectifier equipment located nearby.

6.2.8 225 kVA Transformer Pad/Vault

The existing 225 kVA Transformer Pad/Vault is mounted on top of the vault with wiring inside the vault. The transformer contains 163 gal of insulating mineral oil. An electrical fault could result in unit rupture and ignition of the spilled oil. Since the mineral oil does not contain polychlorinated biphenyls (PCBs), contamination from soot and smoke spread would be similar to that expected with the burning of organic compounds. The fire could expose and damage the air and water service building located approximately 10 ft away.

6.2.9 Power Distribution Pad

The power distribution pad will contain electrical equipment in metal boxes mounted on a skid. The only identified potential ignition source is electrical failure in the wiring or equipment. Due to the limited combustibles, a fire in the power distribution equipment is not expected to damage the rectifier equipment located nearby.

6.2.10 Transformer and Circuit Breaker Pad

The transformer and circuit break pad will contain a transformer, breakers, and other electrical equipment in metal boxes. The only identified potential ignition source is electrical failure in the wiring or equipment. Due to the limited combustibles, a fire in the transformer and circuit breaker equipment is not expected to damage any other equipment.

6.2.11 Expected Transient Combustible Materials

Transient combustible materials throughout the area may be expected during routine maintenance operations. They should be limited to maintenance materials and supplies.

6.2.12 General Evaluation of Area 2 Fire Hazards

Transient combustible materials throughout the area may be expected during routine maintenance operations. They should be limited to maintenance materials and supplies.

A fire in the Office/Instrument Trailer could result in the loss or failure of some or all of the equipment and possibly the conex and its contents located nearby.

A fire involving the rectifier containing 36 gal of insulating mineral oil could also damage the chiller and electrical equipment pad located nearby. Damage to other equipment is not expected. A fire involving the existing 225 kVA Transformer Pad/Vault containing 163 gal of insulating mineral oil could also damage the air and water service building located nearby.

An estimate of the monetary losses associated with these fire events provided within Section 11.0 of this FHA indicates that they are within the acceptable loss limits stipulated by DOE 5480.7A. No additional fire protection measures are warranted.

6.3 AREA 3

6.3.1 Pump Pit 02A

The existing pump pit will have a distributor installed. Combustible materials within this pit are limited to wiring in conduits and motors. The only identified potential ignition source is electrical failure in the wiring or equipment. Due to the limited combustibles, a fire is limited to the area within the pit.

6.3.2 Sluice Pit 02E

The sluice pit will have a new pump and a chiller unit installed. The only identified potential ignition source is electrical failure in the wiring or equipment. Due to the limited combustibles, a fire is limited to the area within the pit.

6.3.3 Expected Transient Combustible Materials

Transient combustible materials throughout the area may be expected during routine maintenance operations. They should be limited to maintenance materials and supplies.

6.3.4 General Evaluation of Area 3 Fire Hazards

The two pits are located below grade. A fire from an electrical source in the pits is not expected to spread due to lack of combustibles and the location within the pit. No additional fire protection measures are warranted.

6.4 AREA 4

6.4.1 Seismic Shutdown System Pad

The seismic shutdown system pad consists of two metal boxes containing seismic shutdown switches and associated equipment. These switches are Safety Class 1 Components. The only identified potential ignition source is electrical failure in the wiring or equipment. The seismic shutdown system combustible materials will be electrical wiring in the conduit and other electrical equipment. Due to the limited combustibles, a fire in the seismic shutdown equipment is expected to be limited to the equipment of origin.

6.4.2 Power Distribution Pad

The power distribution pad will consist of electrical equipment in noncombustible enclosures. The only identified potential ignition source is electrical failure in the wiring or equipment. Due to the limited combustibles, a fire is not expected to extend beyond the system pad.

6.4.3 Electrical Equipment Skid/Pad

The electrical equipment pad will consist of electrical equipment in noncombustible enclosures. The only identified potential ignition source is electrical failure in the wiring or equipment. Due to the limited combustibles, a fire is not expected to extend beyond the system pad.

6.4.4 Expected Transient Combustible Materials

Transient combustible materials throughout the area may be expected during routine maintenance operations. They should be limited to maintenance materials and supplies.

6.4.5 General Evaluation of Area 4 Fire Hazards

There are limited fire hazards identified which are inherent to the operation of the wiring and equipment. The existing office trailer, MO-825, south of the area, and not part of Project MO-320 is considered to be a fire exposure and therefore is considered a fire hazard for this area.

MO-825 is located approximately 12 ft from the power distribution pad and approximately 20 ft from the seismic shutdown system pad. Given that the exposing wall length of MO-825 is 25 ft, DOE-STD-1088 stipulates a minimum separation distance (between relocatable structures) to be no less than 35 ft (DOE 1995). A fire involving the MO-825 trailer is considered to expose the power distribution panel, the seismic shutdown pad equipment and could damage or make inoperable equipment at both locations. Since there are no radiological sources at these locations, no radiological contamination is expected to occur.

6.5 EVALUATION OF WASTES

The aqueous mixed waste contains 1 to 1,000 ppm quantities of inorganic salts, metals, and organic materials. The waste is classified as transuranic (TRU) as well as high-heat complexed radioactive. Heat is generated by the radioactive decay of strontium. The wastes are deposited in layers within the tank and were generated by several different processes that were employed in succession. Beginning with the layer nearest to the bottom, wastes originated as follows: uranium recovery operations waste, Purex cladding waste, Purex sludge, B plant low level waste, and a supernate layer resulting primarily from the addition of water in the amount of 6,000 gal per month for cooling (ICF Kaiser 1994).

After the wastes have been transferred to an underground double shell storage tank (241-AY-102), the wastes will not be susceptible to ignition. It has been concluded (by the reference), that they do not react violently with water or form an explosive mixture. Analysis, based on the characterization, indicates that there is more than twice the required amount of water to suppress the limiting exothermic reaction that might be postulated resulting from the presence of organic carbon. The analysis assumes (to achieve the worst-case limiting reaction) that all of the organic carbon present is in the form of sodium acetate (ICF Kaiser 1994).

Additionally, it was determined that plutonium concentration is so minimal that criticality can not be reached prior to, during, or following waste transfer. Any gas that may be generated can then be removed from the tank by the existing HVAC system (ICF Kaiser 1994).

An evaluation of flammable gases in non-burping tanks (WHC 1994a), calculated the time to reach LFL for hydrogen (H_2) within tank 241-C-106 to be 280 days and 69 days to reach 25 percent LFL assuming sealed tank conditions. Assuming passive breathing of the headspace volume of 0.0045 times the headspace volume/day, the reference concluded that the tank takes 85 days to reach a 25 percent LFL condition and would never reach a 100 percent LFL condition. It should be noted that this evaluation did not include ammonia (NH_3). The reference concludes that there is potential for high-level waste tanks to release NH_3 . It also concludes that NH_3 released in any tank has the potential to significantly increase the tanks' flammability hazard and states that this area requires further investigation.

An analysis of the chemical compatibility of tank wastes in Tanks 241-C-106 and 241-AY-102 includes evaluation of the potential for the waste transfer to Tank 241-AY-102 to lead to accumulation of flammable gases within the waste. The analysis indicates that specific gravity, a measure of waste concentration, can be used as a parameter to identify which tanks may retain (flammable) gas. It indicates that a specific gravity of 1.4 seems a prudent limit to set until further study can define better limits. The value used in this analysis appears to be based on two phenomena:

- Below about 1.35 sp gr, the waste is liquid with only small amounts of solids. Once the wastes are concentrated above the 1.35 sp gr, chemicals start to precipitate from the waste.
- It was noted that all the double-shell tanks on the flammable gas watch list had an average specific gravity of greater than 1.4. None of the double-shell tanks not on the flammable gas watch list had an average specific gravity of greater than 1.4 (WHC 1994b).

It was noted that the specific gravity for solids within Tank 241-C-106 was determined to be approximately 1.43 g/ml (WHC 1994b).

The analysis states that mixing disturbs the solids and allows any trapped gases to escape. The sluicing activity will consequently perform the same function for the wastes in C-106 and AY-102. The analysis states that:

"The ventilation system will be operating in both tanks and will sweep away any hydrogen that is released. The balance of tank farm experience and modeling of hydrogen radiolysis indicates that the generation of steady state hydrogen is not a problem – either the hydrogen generation is low enough, natural ventilation of the tank is high enough, or a combination of both indicate this is so."

The analysis also states that the highest flammable gas concentration ever measured in naturally aspirated Hanford Site waste tanks has only been a few percent

of the lower explosive limit (WHC 1994b).

Analysis and evaluation of the potential for Hanford tank wastes to trap gas has been conducted and documented (PNL 1995). The analysis concludes that gas entrained as small bubbles or gas entrained in stiff sludge can potentially "hide" gas from the detection method that was described in the report. The report also highly recommends doing a calculation to determine whether each tank had enough data to reliably detect a significant quantity of trapped gas.

Additional analysis was then performed to determine if significant quantities of trapped gas, those that could reach 25 percent LFL, could be released.

This analysis documented in Appendix B, utilized current data compiled for Tank C-106. The analysis cites assumptions which are considered to be conservative. The analysis concludes that the instantaneous release of the estimated trapped gas volume results in a calculated flammable gas concentration below 25 percent LFL.

From analysis/evaluation of wastes to date within the C-106 tank, there is no technical basis to conclude that significant quantities of flammable gases may be trapped within the waste solids.

6.6 EVALUATION OF WASTE TRANSFER LINES

The two primary waste transfer lines are welded Schedule 40 stainless steel pipe encased within Schedule 40 carbon steel pipe. The piping system is installed near grade and bermed for shielding. There are no identified ignition or fuel sources.

7.0 PROTECTION OF ESSENTIAL SAFETY CLASS SYSTEMS

Safety Class Equipment is defined as systems structures, or components including primary environmental monitors and portions of process systems, whose failure could adversely affect the environment, or the safety and health of the public. Safety Class 1 (SC-1) is the highest classification which may be applied to any system, component, and/or structure and typically is assigned to systems which mitigate event severities up to and including design basis accidents. Safety Class 2 (SC-2) provides function and/or structural integrity for mitigation of event severities up to and including operating basis accidents. Safety Class 3 (SC-3) provides function and/or structural integrity for mitigation of event severities up to and including the Uniform Building Code (UBC 1994) and those that are industrial safety related (DOE 1989).

The following systems included within Project W-320 have been identified with a safety classification.

SC-1 Classification

- **Seismic Switch System.** The seismic switch system is designed to shut down the WRSS sluicing transfer system during a seismic event by interrupting power to the sluicing transfer system. This is based on evaluation of the WRSS design and the Effective Dose Equivalent (EDE) dose consequences caused by a postulated break of both supply and return transfer lines during a seismic event. The seismic switch system is designed with redundant capability. There are two control circuits arranged in series intended to interrupt power to downstream components in a seismic event. The control circuits installed in equipment enclosures installed side-by-side as illustrated in Figure 4. A seismic switch system will be installed in each tank farm as shown in Figures 2 and 3. The switch will significantly reduce the impact to personnel safety and health caused by dose consequences.
- **Waste transfer pits.** During waste transfer or recirculation of liquid waste within C-106 pits, spray leak scenario could be postulated that would lead to SC-1 consequences.
- **Seal loop.** The seal loop is provided to mitigate the tank under or over pressurization scenario and is designed to limit differential pressure between the C-106 vapor space and the external atmosphere. Redundant seal loops are provided to relieve the differential pressure if it exceeds 10.3 cm (4 in.) w.g. in order to maintain the structural integrity of C-106.

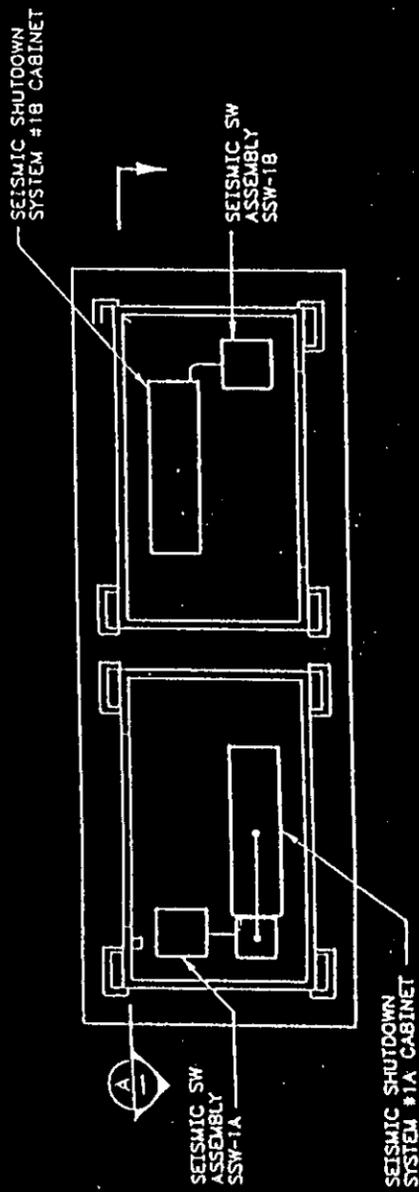
Of the equipment with SC-1 designation, only the Seismic Switch System has been determined to be impacted by a fire event. This system has been designed with redundancy. Further, upon loss of power or failure of the seismic switch system, the system is arranged to shut down the WRSS sluicing transfer system.

Where a fire could cause damage to safety class equipment, DOE 5480.7A stipulates redundant capability of the equipment or protection by a redundant fire

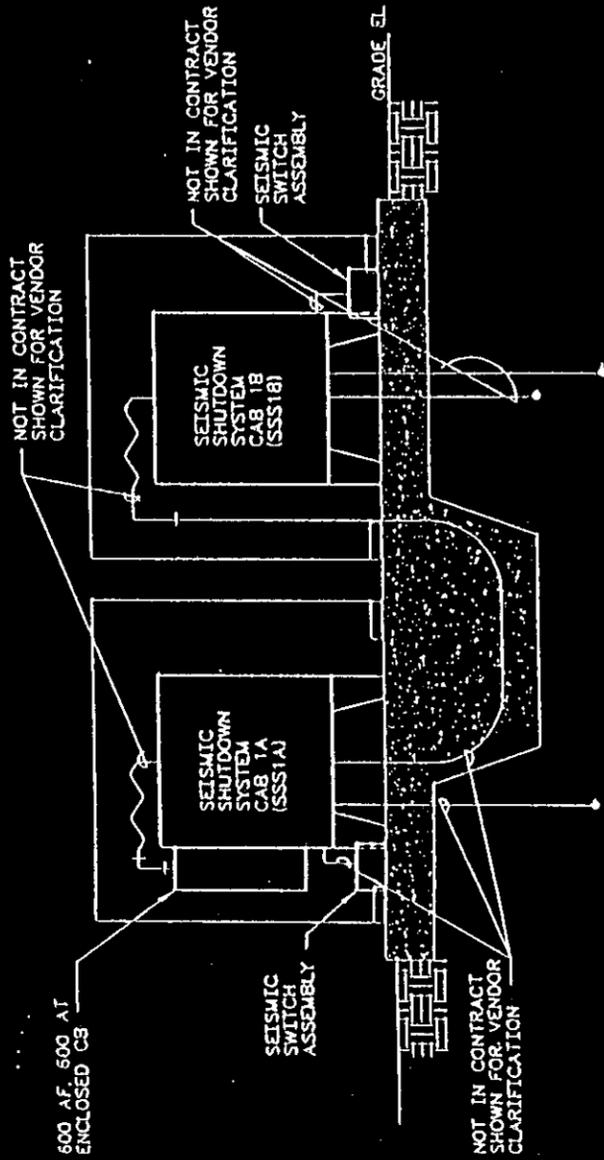
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NOTES:

1. SSS'S CABINETS ARE APPROXIMATE REPRESENTATIONS. EXACT DIMENSIONS WILL BE DETERMINED BY THE VENDOR.
2. CIRCUIT BREAKER IS GENERAL PURPOSE NEMA 1 ENCLOSED TYPE 1 PHASE MOUNTED CASE RATED FOR 600VAC. CIRCUIT BREAKER FOR C-FARM IS 800AFR/600AT. AND FOR AT FARM IT IS 400AF/350AT.



ENLARGED PLAN



A ELEVATION
NTS

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protection system. For new facilities, redundant Safety Class equipment is stipulated to be located in separate fire areas.

DOE 6430.1A stipulates that a single failure will not result in the loss of the capability of a safety class system to accomplish its required safety functions.

A fire is not expected to spread from switch to switch. Irrespective of this, a fire which results in a loss of power or failure of the seismic switch system causes a shut down of the WRSS sluicing transfer system, the intended function of the seismic switch system. Therefore, there is no loss of the capability of the system to accomplish its required safety function. It is concluded that the design meets the intent of DOE 6430.1A and DOE 5480.7A. No fire protection changes or enhancements are recommended.

8.0 LIFE SAFETY CONSIDERATIONS

Project W-320 will provide emergency egress from the normally occupied buildings or areas of operation in accordance with NFPA 101 (NFPA 1994a).

9.0 CRITICAL PROCESS EQUIPMENT

The W-320 project will add pumps and support equipment to move sludge from one tank to another. This operation is not a process in the sense of producing a product. Therefore, no critical process equipment will be used for Project W-320.

10.0 HIGH VALUE PROPERTY

High value property is defined as property with monetary worth of \$1,000,000 or more. There is no high value property identified within the scope of Project W-320.

11.0 DAMAGE POTENTIAL

11.1 DEFINITIONS

11.1.1 Maximum Credible Fire Loss (MCFL)

DOE Order 5480.7A defines MCFL as the property damage that would be expected from a fire, assuming that:

- All installed fire protection systems function as designed, and
- The effect of emergency response is omitted except for post-fire actions such as salvage work, shutting down water systems, and restoring operation.

In the absence of installed fire protection systems the MCFL is the same as the maximum possible fire loss.

11.1.2 Maximum Possible Fire Loss (MPFL)

DOE Order 5480.7A defines MPFL as the value of property, excluding land, within a fire area, unless a Fire Hazards Analysis (FHA) demonstrates a lesser (or greater) loss potential. This assumes the failure of both automatic fire suppression systems and manual fire fighting efforts.

In determining the MPFL, it is necessary to also define what is meant by "fire loss." Per DOE Order 5480.7A, fire loss refers to the dollar cost of restoring damaged property to its pre-fire condition (DOE 1993). In determining loss, the estimated damage to the facility and contents shall include replacement cost, less salvage value. Losses exclude property that is scheduled for demolition and property decommissioned and not carried on books as a value. The loss determination includes the cost of decontamination and cleanup, and the loss of production or program continuity.

For Project W-320, most of the equipment which can be subject to a fire loss is new. Estimates of equipment cost, decontamination and cleanup are based on Kaiser cost estimate data. From discussion with Kaiser estimating personnel who assisted in preparing the project W-320 cost estimate, it is difficult to accurately estimate the actual cost of replacing a single piece of project equipment. This is due largely to inherent costs which are shared as a project and are not attributed solely to one piece of equipment or area. Additionally equipment to be installed in radiation areas may incur significant costs associated with decontamination, potential personnel exposures to radiation, as well as general equipment accessibility problems. Per the discussion, it was concluded that tripling the procurement equipment cost for equipment to be installed in areas where radiation contamination is anticipated or expected, and doubling the procurement equipment cost for equipment installed in areas where no contamination is anticipated or expected provides a rough order of magnitude of the costs associated with equipment replacement, demolition, decontamination and cleanup, losses typically accounted for in the MPFL. Since there is no production associated with Project W-320, nor has this project been identified as a vital program, there are no monetary losses attributed for loss of production or program continuity.

11.2 AREA 1

11.2.1 Pits 06A and 06C

The two pits are located below grade. The sluicer is housed in an above grade steel box (4 ft high by 45 in. wide by 50 in. long). The sluicer housing is more than 30 ft away from any other equipment and, thus, is not considered vulnerable to failure from an exposure fire. A fire from an electrical source (such as an electrical short circuit) in one of these pits would not spread due to the lack of combustibles and the below grade location. A fire in the W-320 equipment will not breach the steel piping due to the lack of combustibles. Therefore, significant contamination cleanup costs are not anticipated. The actual damage from the fire is expected to be limited to wiring insulation and any combustible materials inherent to the equipment. The actual damages from the fire is estimated to be limited to wiring insulation and any combustible materials inherent to the equipment. Though it is not expected it possible that the initiating event (i.e. electrical short circuit) could result in equipment failure.

The equipment vulnerable to this event is the booster pump located within the pit. From discussions with knowledgeable personnel, the unburdened equipment value of the pump is estimated to be \$258,000. Accounting for 7.8% sales tax, 7% MPR and 13% G&A, the estimated procurement value of the pump is \$329,000. Since the pump pit is expected to be radiation contamination area, the cost of the equipment is tripled to estimate the MPFL. This value is determined to be \$989,000. This value is nearly one million dollars, the loss threshold stipulated by DOE 5480.7A, for installing an automatic fire suppression system in structures. It should be noted however, that installation of an automatic fire suppression system would not be expected to prevent equipment failure, or result in a substantial reduction of the MPFL. Installation of an automatic fire suppression system within the pump pit is not recommended. Since there are no fixed fire protection systems the MPFL equals the MCFL.

11.2.2 Intake Air Filter/Exhaust Pad and Process Building

The existing intake air filter pad, exhaust pad and process building are located within 10 ft of each other. An electrical fire involving this equipment is expected to be limited to the equipment area of origin. The MPFL for this equipment involves the HEPA filter valued at \$143,000.

Since the equipment is expected to be in a radiation contamination area, the cost of the equipment is tripled to estimate the MPFL. This value is determined to be \$429K,000. Since there are no fixed fire protection systems the MCFL equals the MPFL.

11.3 AREA 2

11.3.1 Air and Water Service Building

A fire in the air and water service is not likely to damage the transformer spaced 5 ft away as there are not adequate combustibles in the building to sustain a fire. However, in the absence of fire-rated separation, the MCFL assumes loss of the transformer valued at \$125,000, and \$25,000 for building damage. This area does not contain any known radiological material, so no resulting contamination is postulated to

occur. The cost of the equipment is doubled to estimate the MPFL. This value is determined to be \$275,000. Since there are no fixed fire protection systems, the MCFL equals the MPFL.

11.3.2 Electrical Equipment/Rectifier/Chiller/MO-211

The MCFL for equipment in this area is a fire involving the rectifier's 36 gal of insulating mineral oil. This fire could damage the chiller, rectifier, and the electrical equipment. However, the largest MCFL would be a fire in the Office Trailer (MO-211). This fire could result in a loss of the Office Trailer, as well as damage to the chiller and electrical equipment due to heat exposure. The following property values for equipment were identified: trailer, \$27,000; existing building contents, \$5,000 (Note: RL property values for existing building contents were reported to be \$434,000. However, a physical survey of the trailer did not identify any equipment or contents of significant value.); Project W-320 controls equipment, \$51,000; chiller, \$185,800; and electrical equipment, \$137,500. Since there is no radiation contamination expected, the cost of the equipment is doubled to estimate the MPFL. This value is determined to be \$812,600. Since there are no fixed fire protection systems, the MCFL equals the MPFL.

11.4 AREA 3

11.4.1 Pump Pit 02A/Sluice Pit 02E

A fire from an electrical source in one of these pits would not spread due to the lack of combustibles and the below grade location. A fire in the W-320 equipment will not breach the steel piping due to the lack of combustibles. Therefore, significant contamination cleanup costs are not anticipated. The actual damage from the fire is expected to be limited to wiring insulation and any combustible materials inherent to the equipment. Though it is not expected, it is possible that the initiating event (i. e. electrical short circuit) could result in equipment failure. The equipment vulnerable to this event is the booster pump located within the pit. From discussions with knowledgeable personnel, the unburdened equipment value of the pump estimated to be \$258,000. Accounting for 7.8% sales tax, 7% MPR and 13% G&A, the estimated procurement value of the pump is \$329,000. Since the pump pit is expected to be a radiation contamination area, the cost of the equipment is triple to estimate the MPFL. This value is determined to be \$989,000. This value is nearly one million dollars, the loss threshold stipulated by DOE 5480.7A, for installing automatic fire suppression systems in structures. It should be noted however, that installation of an automatic fire suppression system would not be expected to prevent equipment failure or result in a substantial reduction of the MPFL. Installation of an automatic fire suppression system within the pump pit is not recommended. Since there are no fixed fire protection systems, the MCFL equals the MPFL.

11.5 AREA 4

11.5.1 Seismic Shutdown Pad/Power Distribution Panel/MO-825

A fire in the existing trailer, not part of Project W-320 scope, would expose and potentially damage the seismic shutdown pad equipment and the power distribution panel. The equipment which could be damaged as a result of this event is the trailer

valued at \$18,000; trailer contents valued at \$80,000; the power distribution panel valued at \$32,000; and the seismic shutdown system valued at \$97,200. Since the equipment is not expected to be within a radiation contamination area, the cost of the equipment is doubled to estimate the MPFL. This value is determined to be \$454,000. Since there are no fixed fire protection systems, the MCFL equals the MPFL.

12.0 FIRE DEPARTMENT/BRIGADE RESPONSE

The HFD consists of four fire stations covering the 1450 km² (560 mi²) Hanford Site. These stations are strategically located across the site to ensure minimum response time to all facilities. Front-line engines in all stations are aerial device/pumpers, with additional pumpers for backup. HFD maintains 39 vehicles representing a diversified range of capabilities. Of these, 29 are specifically equipped fire/emergency response apparatus, 24 are first-line apparatus, and five are listed as backup (reserve) apparatus.

The 200 Area Fire Station is the closest to the project site. This station is located midway between 200 West Area and 200 East Area. Estimated response time, from the time the alarm is received at the central dispatch/communications center until the time the first piece of fire apparatus arrives on the scene of an incident northwest of the intersection of Dayton Avenue and 23rd Street, is less than 10 min. This response time assumes the fire fighters are in the 200 Area Fire Station and normal road and traveling conditions exist.

Fire department notification is likely to occur via phone or radio. The present scenario for a Hanford Site Fire Emergency Response is to dispatch a single aerial device/pumper from the fire station closest to the incident with a backup aerial device/pumper from the next closest fire station to the incident. This provides a two-engine response. The first engine due constitutes what is termed "Initial Attack Response Capability."

First response will be for fire unless the initial alarm or call to HFD indicates another emergency. Other responses are for a medical emergency or for a hazardous material emergency.

HFD has an established mutual/automatic aid agreement with the surrounding jurisdictions. The agreement enables (and obligates) the HFD to augment its own fire and emergency medical resources in case of large fires, conflagrations, or other disasters. This agreement, known as the "Tri-Cities Mutual Aid Agreement," has been in existence at least since 1985 and includes the cities of Richland, Kennewick and Pasco and the Fire Protection Districts of Benton County No. 1, Benton County No. 2, Benton County No. 3, Benton County No. 4, Benton County No. 5, Benton County No. 6, Franklin County No. 3 and Walla Walla County No. 5. Participation in the agreement is delivered using existing labor and equipment.

13.0 RECOVERY POTENTIAL

If a fire were to occur involving buildings and/or equipment of Project W-320, it is expected that the damaged materials would be replaced/restored as quickly as possible to resume operations. Recovery time would include demolition of fire-damage equipment and procurement and installation of replacement equipment. For a major loss, it is estimated that six months would be required for demolition, cleanup, and procurement followed by an additional 18 months for construction, training, readiness review and startup.

14.0 POTENTIAL FOR A TOXICOLOGICAL, BIOLOGICAL, AND/OR RADIOLOGICAL INCIDENT DUE TO A FIRE

This project equipment and processes being installed are intended to minimize the potential for toxic, biological, and/or radiation incident due to a fire loss. The judicious selection of construction/equipment materials has minimized the risk of fire-induced releases.

14.1 TOXICOLOGICAL RELEASE

Toxic releases may be caused by a fire event due to damage to a containment vessel or pipeline, allowing a spill of toxic process fluid or emission of toxic combustion products.

Project W-320 minimizes the use of dangerous materials capable of producing a toxicological release. Hydraulic fluid for the sluicers was selected for its low toxicity and flammability. The condenser and pit coolers use a water-based propylene glycol solution which is less toxic than the more common ethylene glycol.

Combustion of plastic materials can generate large quantities of potentially toxic gases and vapors. A fire in the MO-211 trailer could induce this condition, and a fire in a confined space emitting such gases and vapors could be lethal. However, operations personnel are expected to be capable of immediate evacuation from the MO-211 trailer in a fire event. Therefore, additional protective measures are not recommended.

14.2 BIOLOGICAL RELEASE

Project W-320 has no biological processes or equipment; therefore, the potential for fire-induced biological releases is considered minimal.

14.3 RADIOLOGICAL RELEASE

Materials which are candidates for a radiological release are the sluicing fluid, waste slurry, and headspace vapors.

The sluicing fluid and waste slurry are contained in a double-encased, Schedule 40 steel pipe, which is bermed for radiation shielding. Therefore the potential for a fire induced-rupture is considered low.

The ventilation system recirculates 800 cfm headspace gases containing aerosols of sluicing fluid (90 percent) and high level waste (10 percent). The system has been designed to remove aerosols in a high efficiency metal filter that will be flushed periodically to maintain radionuclide inventories below a level that could cause an onsite consequence if released. Dose consequences resulting from a catastrophic failure of the HEPA filters just before filter change is addressed in WHC-SD-WM-SAD-024, Rev. 0. There are no identified or postulated fires which are expected to result in a breach of the ductwork or induce HEPA filter failure.

15.0 EMERGENCY PLANNING

Guidelines for emergency planning for Project W-320 have not been completed.

Review and approval of Project W-320 emergency guidelines addressing fire safety and fire protection by the Westinghouse Hanford Tank Farm fire protection engineer is recommended (Rec. 15-1).

16.0 SECURITY AND SAFEGUARDS CONSIDERATIONS RELATED TO FIRE PROTECTION

Security-controlled areas are not included as a part of this project. There were no additional security and safeguards considerations identified as part of this project which impact fire protection.

17.0 NATURAL HAZARDS IMPACT ON FIRE SAFETY

17.1 FLOODS

The 200 Area is located on a plateau 53 to 69 m (175 to 225 ft) above the highest elevation of the probable maximum flood postulated by the U. S. Army Corp of Engineers. The probable maximum flood in this situation requires severe climatic conditions in combination with a breach of Grand Coulee Dam. This breach scenario for the Grand Coulee Dam is from a hypothetical nuclear attack and is not projected to occur from any known natural event. It would result in a brief duration maximum flow of 227,000 m³/s (8,000,000 ft³/s) and flood elevations of 143 to 148 m (469 to 486 ft) in the 100 Areas. The 100 and 300 Areas as well as downstream cities along the Columbia River would be flooded. However, the 200 Area plateau would not be affected. With the 200 Area Fire Station on the 200 Area plateau, there is no postulated flood that would compromise fire safety.

17.2 TORNADOES

Hanford Meteorological Station and the National Severe Storm Forecast Center database list 21 tornadoes within a 161-km (100-mi) radius of the Hanford Site between 1916 and 1982. The recurrence interval cited is one per 146,000 yr. However, at least two tornadoes have been sighted within a 161-km (100-mi) radius since 1982. Maximum wind speeds for a design basis tornado used at the site are 145 km/h (90 mi/h). The differential pressure is equivalent to a 0.75 lbf/in² ambient pressure drop in three seconds, held for one second and returned to ambient at the same rate.

With the low frequency of tornadoes on the Hanford Site, no additional fire safety precautions are warranted to protect against tornados.

17.3 EARTHQUAKES

The Design Basis Earthquake (DBE) is taken to have a return period of 1,000 yr, which means the annual occurrence is 1.0 E-03. The repository siting group selected an application that gave 0.25 and 0.40 G as suggested preliminary maximum horizontal peak accelerations with 50 percent and 16 percent exceedance levels for use in preliminary design estimates. The Hanford Plant Standards specify a 0.13-G horizontal acceleration for the design basis earthquake for non-reactor structures having a moderate- or low-hazard safety classification.

Components are designed for a seismic event in accordance with the Uniform Building Code (UBC 1994), University of California Lawrence Radiation Laboratory UCRL 15910 *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards*, (LLNL 1988), and Hanford Plant Standard, Standard Design Criteria 4.1 (ICF Kaiser 1995a). Therefore, no additional fire protection measures are needed to mitigate the threat of earthquakes.

17.4 LIGHTNING

A direct strike to a trailer building or piece of equipment could cause structural damage to the point of impact and would also cause a voltage surge through the structural frame of the building or equipment. These voltage surges could cause substantial damage to electronic components. Lightning protection will meet the applicable requirements of NFPA 780 (NFPA 1992).

18.0 EXPOSURE FIRE POTENTIAL

Range fires are the only postulated exposure fire potential not yet addressed within this FHA. The buildings and equipment being installed as part of W-320 is set back from the natural grasses and ground cover that could burn during a range fire. Periodic winds can cause accumulation of tumbleweeds in and around equipment and buildings.

In keeping with Westinghouse Hanford policy to limit combustibles to a level as low as reasonably achievable, a procedure to ensure periodic removal of tumbleweeds and other unwanted transient combustibles in and around the project area is recommended (Rec. 18-1).

19.0 RECOMMENDATIONS

The fire hazards and associated risks which have been identified warrant as a minimum, preventative or mitigative measures consistent with the loss limitations stipulated by DOE 5480.7A, *Fire Protection* (DOE 1993). The following recommendations are provided in keeping with DOE 5480.7A's objective and Westinghouse Hanford's commitment to minimize the potential for the occurrence of a fire or related perils.

1. Installation of fire hydrants within the vicinity of the C-106 equipment and in accordance with the applicable requirements of DOE 6430.1A is recommended (Rec. 5-1).
2. Based on the evaluation of combustibles and processes planned for the process building, a deviation from the DOE 6430.1A requirement for automatic water sprinkler protection is recommended (Rec. 5-2).
3. Review and approval of Project W-320 emergency guidelines addressing fire safety and fire protection by the Westinghouse Hanford Tank Farm fire protection engineer is recommended (Rec. 15-1).
4. In keeping with Westinghouse Hanford policy to limit combustibles to a level as low as reasonably achievable, a procedure to ensure periodic removal of tumbleweeds and other unwanted transient combustibles in and around the project area is recommended (Rec. 18-1).

20.0 REFERENCES

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APPENDIX A

Calculation of Fire Flow Rates

BACKGROUND

The following method for estimating fire flow is found in the Insurance Services Office's (ISO's) *Fire Suppression Rating Schedule*. Although ISO is not cited as a requirement source in DOE 5480.7A, the flows determined by this method are generally considered a good estimate, and as a result, the ISO method has received widespread use (NFPA 1991).

$$\text{Equation 1: } \text{NFF}_i = (C_i)(O_i)(X + P)_i$$

Where: NFF_i = needed fire flow
 C_i = a construction factor
 O_i = an occupancy factor dependent upon the combustibility of the occupancy
 $(X + P)_i$ = an exposure factor dependent upon the extent of exposure from and to adjacent structures

$$\text{Equation 2: } C_i = 18 F \sqrt{A_i}$$

Where: F = coefficient related to class of construction
 A_i = effective building area

Note: The value of C_i should not be less than 500 gpm nor greater than 6800 gpm for a combustible construction class (C-3), or any single, one-story building, regardless of construction.

$$\text{Equation 3: } X_i = 1 + \sum_{i=1}^n x_i + P_i$$

The exposure factor, x_i , reflects the need for additional water to reduce the exposure to adjacent buildings. It is dependent upon separation distance, construction of exposed building wall, and a length-height value, the length of the exposed wall in feet multiplied by the height in stories. The communication factor, P_i , reflects the potential fire spread through open or enclosed communicating passageway between buildings.

W-320 EVALUATION

For the 241-C Tank Farm, the MO-211 trailer is considered to be a good indicator of the water demand necessary to control or extinguish a fire in this area.

Define Construction Parameters

MO-211 Building Area: $50 \text{ ft} \times 15 \text{ ft} = 750 \text{ ft}^2$
Class of Construction: Class 1 - Frame; $F = 1.5$

Solving Equation 2: $C_i = 18 F \sqrt{A_i}$
 $C_i = 739.4$

Determine Occupancy Factor: C-3, Combustible; $O_i = 1.00$

Determine Exposure and Communication Factors:

No Communicating Pathways: $P_i = 0$

The closest exposure is the 10 ft x 5 ft circuit breaker pad, located approximately 10 ft from MO-211. From Table 5-3B of the NFPA Handbook (NFPA 1991), $x_i = 0.22$.

Solving Equation 3: $x_i = 1 + 0.22$
 $x_i = 1.22$

Solving Equation 4: $NFF_i = (C_i) (O_i) (x + P)_i$
 $= (739.4) (1.0) (1.22)_i$

$NFF_i = 901.6 \text{ gpm} \approx 900 \text{ gpm}$

Note: For practical reasons, ISO recommends that the needed flow not be less than 500 gpm.

ABOUT FIRE WATER DURATION

The recommended fire flow is given in hours and varies from 2 to 10 hrs.

CONCLUSION

In order to provide reasonable assurance that a fire involving a Project W-320 trailer can be controlled or extinguished, installation of a reliable fire protection water supply source is required.

APPENDIX B

Analysis of Potential Entrapped Gas Within the Waste

APPENDIX B SUMMARY

Appendix B documents the analysis and information used to conclude that potential entrapped gases within the C-106 waste does not contain significant quantities of flammable gases which could be released to the tank vapor space as a result of the sluicing process.

Using assumptions considered to be conservative, the analysis concludes that an instantaneous release of flammable gas would not reach 25% LFL. This is based on two scenarios: Scenario 1 releases 25% of the entrapped gas and results in a flammable gas concentration amounting to 4% of the LFL; Scenario 2 releases 100% of the trapped gas and results in a flammable gas concentration amounting to 17% of the LFL.

At the time of the issuance of the FHA, this analysis had not been peer reviewed nor had the work been released as a formal report. However, peer review and release as a formal report is expected as documented in this Appendix. If changes within the analysis result in expected releases of significant quantities of flammable gases, these changes should be evaluated to determine the extent of impact on the FHA.

Author: James D (Dave) Hopkins at -WHC55
Date: 8/18/95 9:04 AM
Priority: Urgent
Receipt Requested
TO: John C Conner at -WHC150
CC: Paul D Whitney at -SMTPLink
Subject: Re[2]: C-106 screen with barometric slope
----- Message Contents

8/18/95 8 AM

John,

First, some clarification: WHC-EP-0702 and WTSFG95.13 have already been formally issued. Paul Whitney's analysis of C-106 data last Friday was above and beyond the analysis he had already done for his report, so this analysis will have to be written up in a separate, peer-reviewed document. You need to call him to arrange that.

On my end, I used the barometric slope from Paul to estimate the amount of flammable gas entrapped in the tank. This was a very limited screen done by plugging Whitney's barometric slope into a spreadsheet I already had set up to estimate the amount of gas that would correspond to the slope, given a set of assumptions about the gas's behavior.

I haven't done a full-fledged evaluation of C-106 in accordance with EP-0702 -- surface level rise, etc -- since the surface level rises and falls so much with evaporation, and there is no such evaluation planned for this tank. However, we do have it on our tentative schedule to evaluate 3 other C farm tanks, with a report due out in October. We could include in that report, with little extra effort, a description of the work I have already done on C-106.

If this scope and timing aren't OK, please get back to me (373-5701) or my manager, Blain Barton (376-5581)

Tx!

Dave - 373-5701

Dave:

The safety documentation for sluicing of C-106 is being scrutinized very closely so my desire is to close up as many holes as possible. This data that you and Paul have provided on C-106 definately needs an internal peer review. Please correct me, but it appears from your note below that neither of you have issued a "formal report on this report" i.e., EP-0702 & WTSFG 95.13. If this is true, what is involved in getting these issued? If a peer review is conducted on yours and Paul's C-106 effort, is it possible to issue a formal report, that can be released, without releasing EP-0702 & WTSFG 95.13
?

If there are additional funds needed for the C-106 effort please advise.

John C.
376-2058

Reply Separator

Subject: C-106 screen with barometric slope
Author: James D (Dave) Hopkins at -WHC55
Date: 8/16/95 3:22 PM

John,

REFERENCES: 1) Hopkins, J. D., 1994, Criteria for Flammable Gas Watch List Tanks. WHC-EP-0702, Westinghouse Hanford Company, Richland, Washington.

2) Whitney, P. D., 1995, Screening the Hanford Tanks for Trapped Gas, WTSFG95.13, Pacific Northwest Laboratory, Richland, Washington.

Last Friday, Paul Whitney (PNL statistician) used the methodology in Reference 2 to do a re-analysis for tank 241-C-106, using surface level data obtained since the process test last year. He has faxed me his results, which show a barometric slope of -0.04 in./in. mercury at the 0.25 level. (The 0.25-level slope bounds 75% of the possible slopes. See endnote.)

I have used the slope of -0.04 to screen tank C-106 for its volume of entrapped gas. I performed the screen using the same method I used in May 1995 to screen the 58 tanks in which Whitney found significant correlation between inverse barometric pressure and surface level. Assuming the entrapped gas is 12 inches from the bottom of tank C-106, I estimated that a volume of about 530 ft³ of compressed gas is entrapped in the waste, corresponding to a void fraction of about 2%.

Assuming that 97% of the gas is H₂, and that 25% of the entrapped gas is instantly releasable, and that NH₃ amounting to 0.22 times the released gas volume is emitted from the waste surface by mass transfer, I estimated that a release could cause a flammable-gas concentration amounting to 4% of the LFL.

This is considerably less than the 25% of the LFL allowed by Reference 1. Even if 100% of the trapped gas were released, the concentration would only reach 17% of the LFL.

Although Whitney's and my methodologies have been peer reviewed, neither of us has had his work on this particular tank peer-reviewed, nor has either of us issued a formal report on this work. If you need peer reviews and formal reports for this analysis, please contact us.

END NOTE: Using the slope which bounds 75% of the possible slopes may give results which are quite conservative. For example, for tank 103-SY, even using a slope at the 0.50 level--which bounds only 50% of the possible slopes--predicts an entrapped gas volume which exceeds the upper bound estimate made recently with data obtained by inserting a void-fraction instrument into 103-SY.

This 50%-ile slope predicts a volume of 8000 scf, compared to PNL's upper-bound estimate of 5600 scf made from void fraction data.

The DETAILS of the screening are particularly relevant for this tank. I examined level/pressure data in -60 day chunks. An implicit assumption in the report was that any trend in the level data on a 60 day time scale is linear. For this tank, that assumption is false; since, the typical pattern in the level behavior after a water addition is to curve downward. The level typically decreases at an increasing rate from the time of the water addition. Thus, the existence of trapped gas in this tank could be hidden from the screening procedure used for the report. The 'fix' is simply to work on a smaller than 60-day time scale, as I have been for the recent work in support of Dave Hopkins.

The remainder of the message is organized as follows:

- I. Status and Quality of the Available Measurements
- II. Estimate of dL/dP for tank C106

I. Status and Quality of the Available Measurements

I.A. Head-space Pressure

The analyses I did for the screening report used atmospheric pressure as a proxy for tank head-space pressure. Note that while there's an in-tank head space pressure gage for tank C106, I have yet to take advantage of that information. The measurements from the gage are presented as deviations from the ambient pressure; so to make full use of this data would require getting hold of the ambient pressure outside the tank. My understanding is that this information is available. Here's a note I wrote to myself, based on a monthly report copy provided to me by Joe Brothers (PML):

June 27

There's a vapor project, headed by Steve Goheen. Check them regarding SY103 head space information. Also, they seem to have hold of some C farm outside the tank weather information. Jim Hubbe is the task leader for the pathways and probably owns the data.

Note that while this data has obvious value to the task at hand; the problems with the surface level data (noted in the next subsection) suggest that obtaining this more detailed data will only be a priority after the problems with the level data are fixed.

I.B. Tank surface level

Tank C106 has two operating level measurement devices; an FIC and an ENRAF. Both are connected to data acquisition systems (respectively CASS and TRACS). A plot of the two showing the data for calendar year 1995 is attached. The plotting characters 'f' and 'e' are used to identify FIC and ENRAF measurements, respectively. The general trend of the two is similar; although the FIC measurements following the early April water addition are far more variable than the corresponding ENRAF measurements. Also, there are no recent 'good quality' FIC measurements.

The ENRAF for this tank is known to have been behaving unusually since its installation on this tank (almost a year ago now). The strange behavior is exhibited in an attached plot; the measured level tends to stair step down as the liquid from the tank evaporates.

From these observations I conclude:

- o The FIC measurements are suspect
- o The recent FIC measurements are 'Manual FIC' vs 'Auto FIC'; and so

C106.txt Emacs buffer

the time stamp for the measurement in the SACS database is not the time at which the measurement was taken
 There's no value in comparing the ENRAF measurements with atm pressure measurements on a finer time-resolution than one day.

Thus, the level data used will be the ENRAF data

I.C. Water addition

The screening procedure has a built-in recognizer for large changes in the level data, such as occur after a water addition. The recognized jumps were augmented by the water additions noted in the comments of the SACS database; here are the relevant dates/comments, note that there are also comments concerning the status of the PIC:

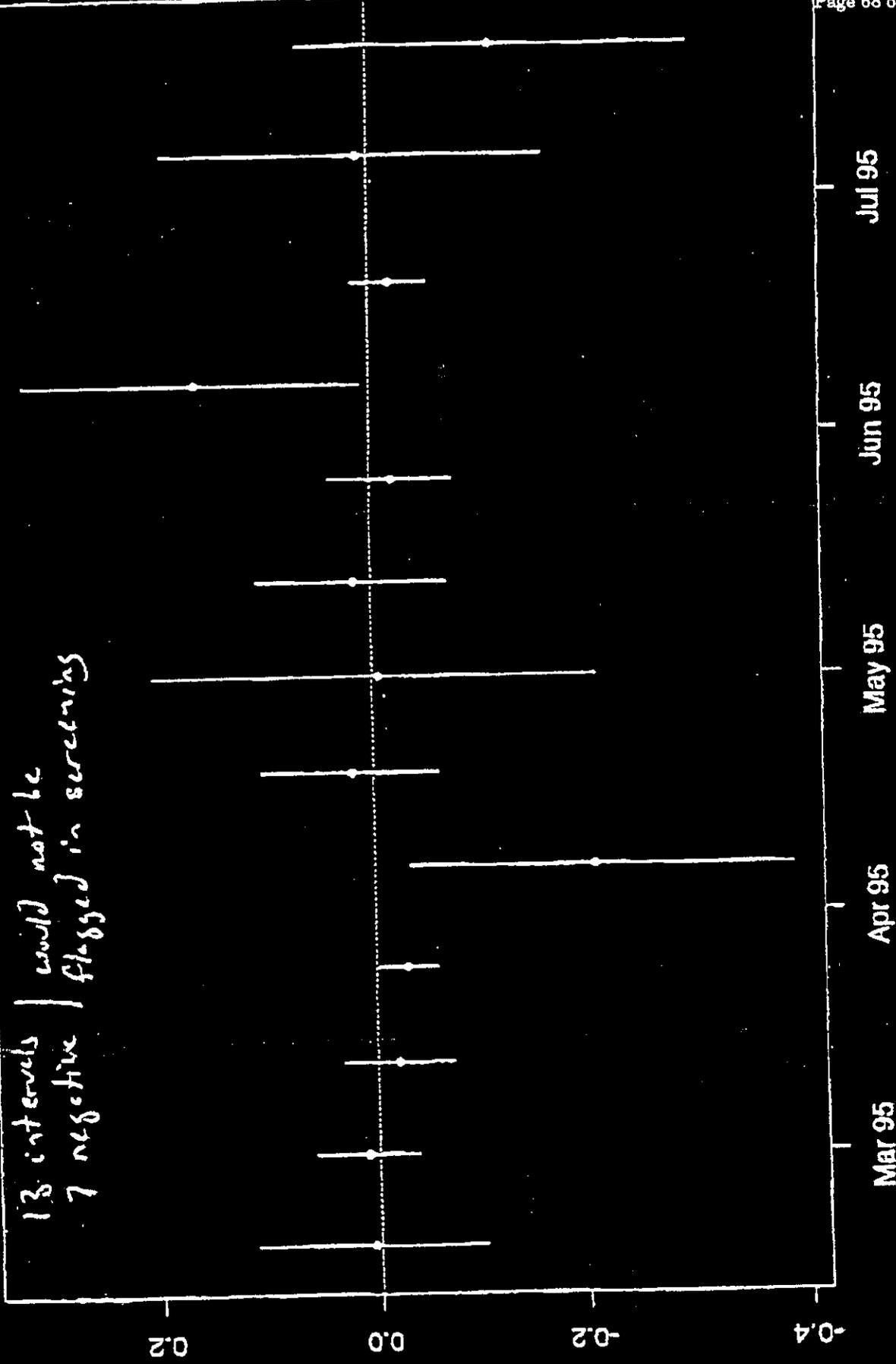
Date	Comment
Feb 12 1995 12:00PM	NR 2/11/95
Apr 9 1995 12:00PM	Readings were reversed for FIC & ENRAF
Jun 26 1995 12:00PM	Water addition 3030 GAL. on day shift
Jun 26 1995 12:00PM	3030 Gal. water add
Jun 26 1995 11:58PM	Water Add-3030 Gal. performed on day shift
Jun 27 1995 12:00PM	Water add 4000 Gal.
Jun 27 1995 11:58PM	Water add 4000 Gal.
Jun 28 1995 12:00PM	Water add-3000 Gal.
Jun 28 1995 11:59PM	Water add 3000 Gal.
Jul 7 1995 12:00PM	Will not bob or rise-J1 written
Jul 8 1995 12:00PM	Does not move
Jul 10 1995 12:00PM	Does not bob
Jul 12 1995 12:00PM	Power is on but FIC will not raise or lower
Jul 13 1995 12:00PM	FIC doesn't work
Jul 20 1995 11:59PM	36 Gal. to soaker hose used to maintain 106-C pump pit/wall dampness during pit decon work
Jul 21 1995 11:58PM	143 Gal. supply soaker hose to keep pit walls damp
Jul 24 1995 12:00PM	Does not bob
Jul 26 1995 11:58PM	35 Gal. for soaker hose
Jul 27 1995 11:58PM	45 Gal. treated water for pit decon
Jul 28 1995 11:58PM	88 Gal. Decon pump pit
Jul 29 1995 12:00PM	Not bobbing
Aug 1 1995 11:58PM	127 Gal. Pit decon
Aug 2 1995 11:58PM	830 Gal. for pit decon.
Aug 3 1995 11:58PM	70 Gal. for pump pit decon.
Aug 8 1995 11:58PM	29 Gal. pump pit decon

Pit water must go into tank

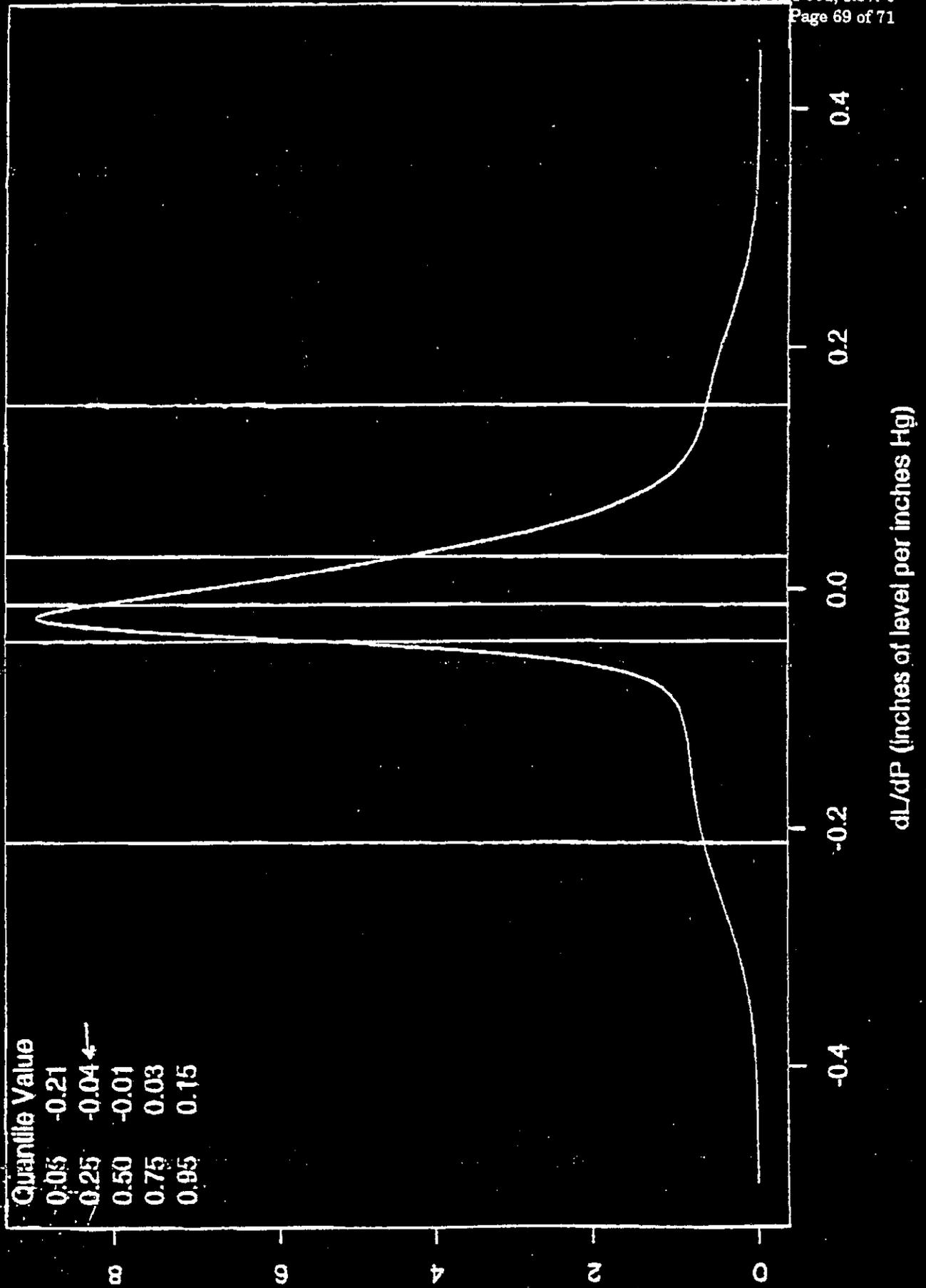
II. Level Response to Pressure

The C106 Automatic ENRAF data since Feb 11, 1995 was broken into -15 day chunks, detrended and compared with the ambient atmospheric pressure (all as described in the screening letter report). Figure 7 presents the level data, Figure 8 presents the slope (dl/dP) estimates along with 95% CI's and Figure 9 presents the distributional summary of the slopes. The final figure also has various percentiles marked. To date, Dave Hopkins has been using the 25th percentile as the input to his trapped gas calculation. This number is -0.04 inches of level per inches.Hg. Also note that the final figure summarizes the calculation which would have been used to decide whether to flag the tank (as was done in the screening report). This calculation would not lead to flagging the tank as having trapped gas.

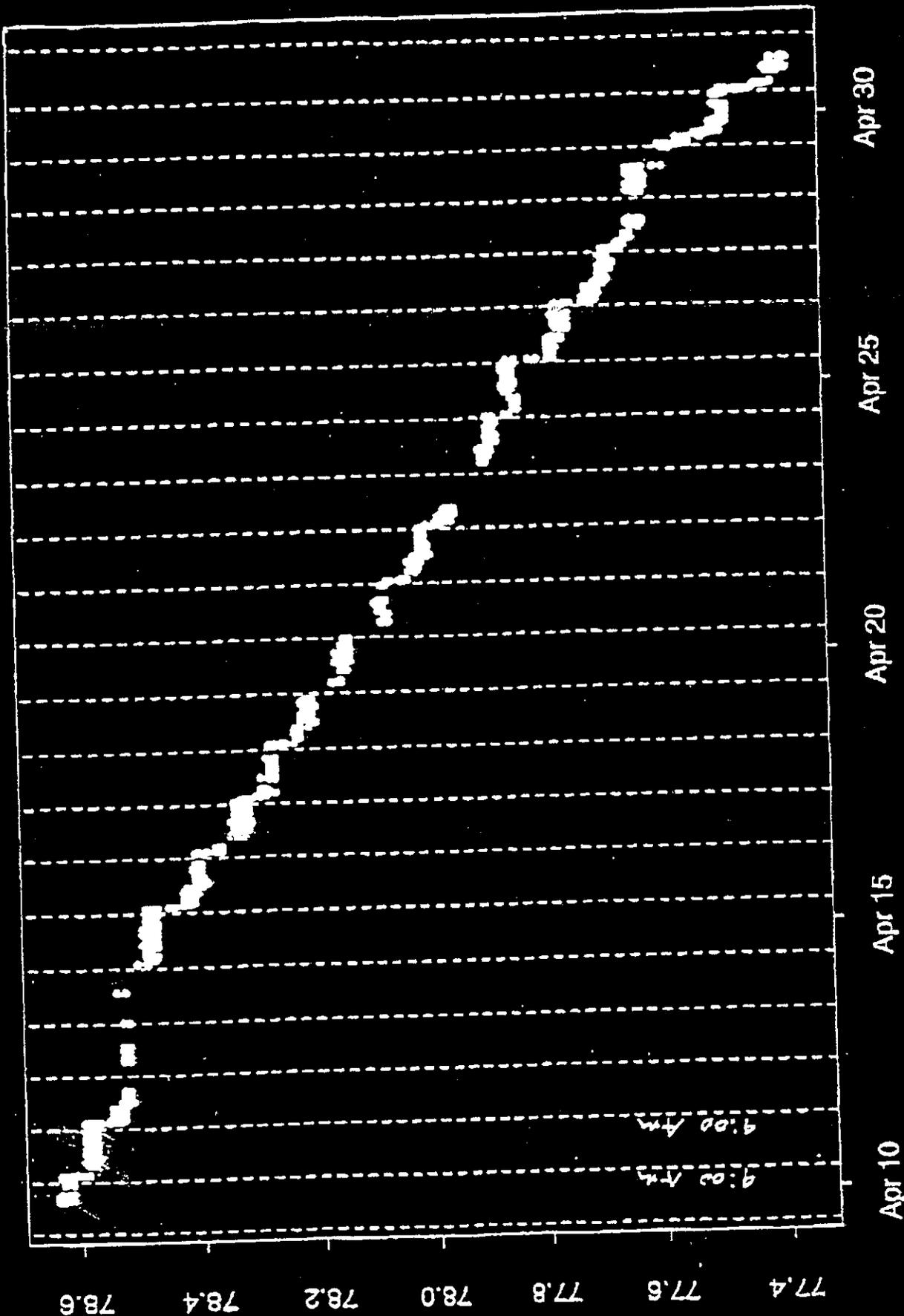
Estimated d DC / d AP for Tank C106 based on ENRAF Measurements



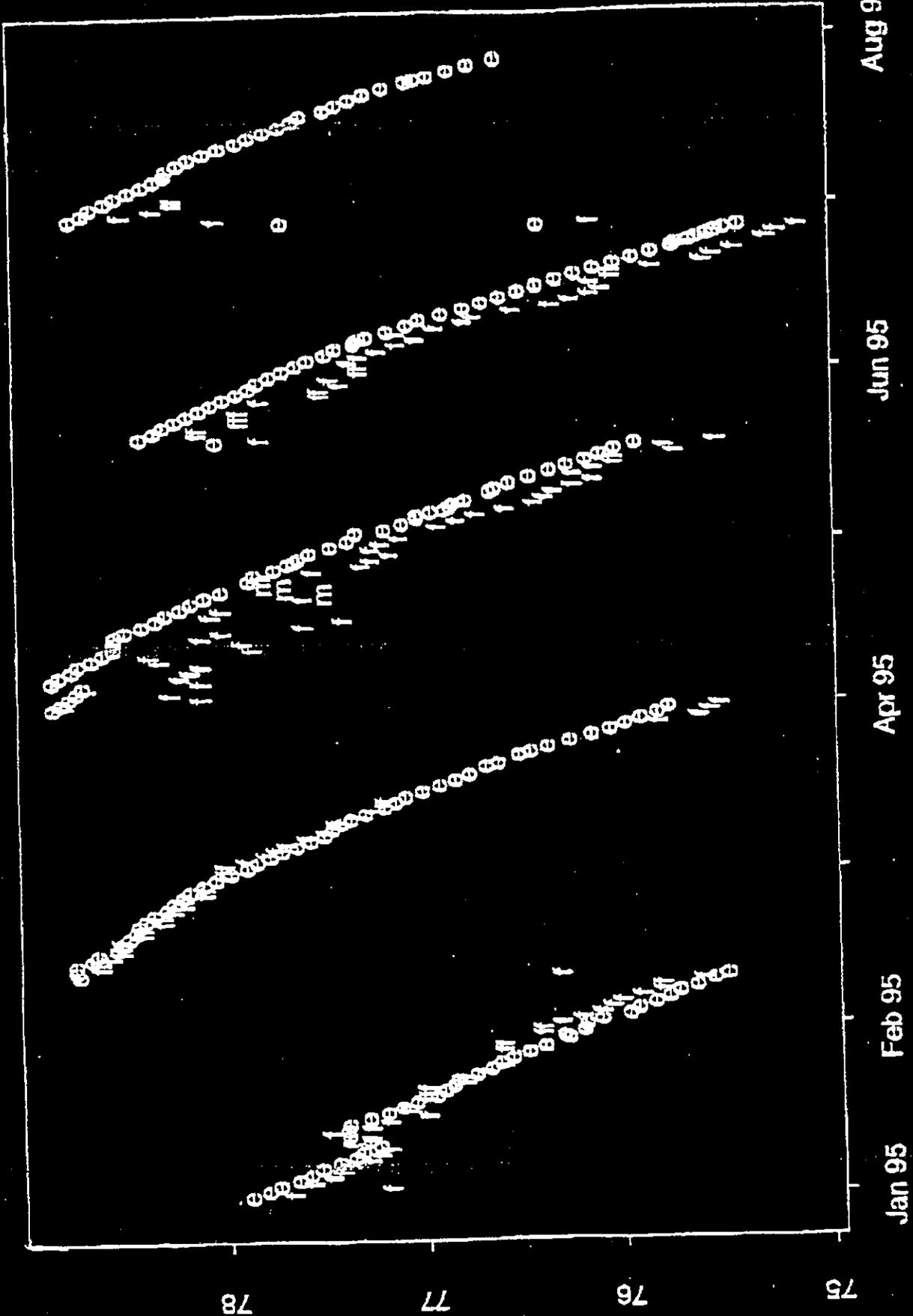
C106 $\overline{\text{NRAF}}$ lag=0



C106 ENRAF



C106 Surface Level Measurements from 1-1-95 to 7-28-95



PNL Fri Aug 11 12:30:25 PDT 1995