Sta 4 (2)

JUL 20 1998 **ENGINEERING DATA TRANSMITTAL**

1. EDT 625051

2. To: (Receiving Organization) SST RETRIEVAL PROJECTS	3. From: (Originating Organization) SST RETRIEVAL PROJECTS	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: W320/8C452	6. Design Authority/ Design Agent/Cog. Engr.: JW BAILEY/JR BELLOMY	7. Purchase Order No.: N/A
8. Originator Remarks: N/A		9. Equip./Component No.: W320, C-106 TANK VENTILATION
		10. System/Bldg./Facility: 241-C-106
11. Receiver Remarks: 11A. Design Baseline Document? [] Yes [X] No		12. Major Assm. Dwg. No.: H-2-818468
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: N/A

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	HNF-SD-W320-ATR-012	ALL	0	C-106 TANK PROCESS VENTILATION TEST	SQ	1	N/A	N/A

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp	(J) Name	(K) Signature	(L) Date	(M) MSIN
1	1	Design Authority: JW BAILEY	[signature]	7/17/98	S2-48
		Design Agent:			
1	1	Cog.Eng.: J. JONES	[signature]	07-17-98	S5-13
1	1	Cog. Mgr.: D. BAIDE	[signature] for	7-17-98	S5-05
1	1	QA: K. CONRAD	[signature]	7-17-98	S2-48
1	1	Safety: S.U. ZAMAN	[signature]	7/16/98	S5-12
		Env.			
1	1	RR BEVINS	[signature]	7/9/98	S2-48
1	1	JR BELLOMY	[signature]	7/9/98	S2-48
1	1	JW LENTSCH	[signature]	7/9/98	S2-48
3	1	PROJECT FILES			R1-29

18.	19.	20.	21. DOE APPROVAL (if required)
D.M. STENKAMP [signature] 7/9/98 Signature of EDT Originator Date	N/A Authorized Representative for Receiving Organization Date	JW BAILEY [signature] 7/17/98 Design Authority/ Cognizant Manager Date	Ctrl. No. [] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172-2 (05/96) GEF097

HNF-SD-W320-ATR-012, Rev. 0

C-106 Tank Process Ventilation Test

John W. Bailey
Numatec Hanford Co., Richland, WA 99352
U.S. Department of Energy Contract DE-AC09-96RL13200

EDT/ECN: 625051 UC: 506
Org Code: 8C452 Charge Code: D2991/HANA0600
B&R Code: EW3130010 Total Pages: 305

Key Words: Project W-320, Sluicing, Tank 241-C-106, 296-C-006, Ventilation.

Abstract: Project W-320 Acceptance Test Report for tank 241-C-106, 296-C-006 Ventilation System

DATE: HANFORD RELEASE ID: 2
STA: 4
JUL 20 1998

Release Stamp

Kara [signature] 7/20/98

Release Approval Date

Approved for Public Release

HNF-SD-W320-ATP-012 TEST SUMMARY

Acceptance Test Procedure (ATP) HNF-SD-W320-012, C-106 Tank Process Ventilation Test, was an in depth test of the 296-C-006 ventilation system and ventilation support systems required to perform the sluicing of tank C-106. Systems involved included electrical, instrumentation, chiller and HVAC. Tests began at component level, moved to loop level, up to system level and finally to an integrated systems level test.

One criteria was to perform the test with the least amount of risk from a radioactive contamination potential stand point. To accomplish this a temporary configuration was designed that would simulate operation of the systems, without being connected directly to the waste tank air space. This was done by blanking off ducting to the tank and connecting temporary ducting and an inlet air filter and housing to the recirculation system. This configuration would eventually become the possible cause of exceptions.

During the performance of the test, there were points where the equipment did not function per the directions listed in the ATP. These events fell into several different categories. The first and easiest problems were field configurations that did not match the design documentation. This was corrected by modifying the field configuration to meet design documentation and re-performing the applicable sections of the ATP. A second type of problem encountered was associated with equipment which did not operate correctly, at which point an exception was written against the ATP, to be resolved later. A third type of problem was with equipment that actually operated correctly but the directions in the ATP were in error. These were corrected by generating an Engineering Change Notice (ECN) against the ATP. The ATP with corrected directions was then re-performed. A fourth type of problem was where the directions in the ATP were as the equipment should operate, but the design of the equipment was not correct for that type of operation. To correct this problem an ECN was generated against the design documents, the equipment modified accordingly, and the ATP re-performed. The last type of problem was where the equipment operated per the directions in the ATP, agreed with the design documents, yet violated requirements of the Basis of Interim Operation (BIO). In this instance a Non Conformance Report (NCR) was generated. To correct problems documented on an NCR, an ECN was generated to modify the design and field work performed, followed by retesting to verify modifications corrected noted deficiencies.

To expedite the completion of testing and maintain project schedules, testing was performed concurrent with construction, calibrations and the performance of other ATP's. The number of tasks and teams competing for the same resources, equipment and even floor space became somewhat confusing at times. Adding to this confusion is the fact that the ATP was started and had sections 8, 9, 10.1, 10.2, 10.4 And 10.7.1 Completed in 1996 and then put on hold for 2 years.

There were six exceptions written against the ATP, they are as follows:

1. On step 8.3.5 And 8.3.6 The initial measurement of supply voltages were over range. The phase voltage requirement was 456 to 504 VAC. Measured voltages ranged from 507 to 509 VAC. These were measured again later after additional loads came on line and the voltages were then within range.

2. On step 11.2.10 The expected flow rate through the recirculation fan ducting was stated as 2475 +/- 50 ft/min and measured at 3151 ft/min. This was caused by a combination of the test configuration and lack of exhaust fan flow. In the normal operational configuration and with the exhaust fan running, only 80% of the total air flow is through that ducting. 3151 X 80% = 2520, within the expected range of 2475 +/- 50.

3. An exception was written against step 7.1.2, as far as the verification of system and component tags being correct as shown on the P & ID drawings. Not only was there a significant amount of component and system tags to verify, but they were continually changing. The exception was written to allow an existing field verification project to be used to verify the tagging. With an inspector performing spot checks on the projects completed documentation.

4. Step 10.5.2.23 (a) & (b) of the process building radiation monitor test could not be performed as written. These were eventually deleted from the ATP via ECN W-320-801. The original ATP steps assumed that the radiation monitor needed to be manually reset after alarming. The monitor actually has an auto reset function so those steps were not needed.

5. An exception was written for section 11.4, the testing of the radiation monitor cabinet on the exhaust skid. During this test a radiation monitor trouble alarm was tested for several components. The alarm went off intermittently when not expected. It was determined that the heat trace temperature controllers were causing the alarm. These controller contacts were jumpered out to permit testing of the other components. These controllers were later rewired, reconfigured and retested per ECN 647833.

6. A second exception was written against section 11.4. Per a requirement of section 4. The requirement states that the ATP must be stopped when changes are required. The ATP was stopped awaiting changes. A draft of the changed section was generated and performed as a pre-test to verify correctness. The draft was then incorporated into the ATP via ECN W-320-801. The pre-test performed per the draft was found acceptable with no retesting required.

There was one NCR generated as a result of the performance of the ATP. The condition which occurred was not specifically referenced in the ATP, so no exception was written. The BIO requires that water used as a seal/boundary be present when the system is operating. During the performance of the ATP the seal water in the floor drain was forced up, out of the floor drain when the HMF-1361 filter was flushed. ECN 647982 and 647830 were generated to add a check valve and warning indicator to correct that condition. During operation of the recirculation fan, FN-1361, water was forced out of the seal pot. This condition was mainly contributed to the unexpected operating pressures caused by the test configuration and are not expected during normal operation. ECN 647982 and 647830 also added check valves to seal pot drain lines to prevent the recurrence of this problem. A functional check of the floor drain trap will be tested when HMF-1361 is blown down during performance of Operational Test Procedure OTP-W320-004. Testing of the seal pot problem will occur when the system is tested after being returned to normal configuration, and operated under OTP-320-011.

In addition to the modifications and retesting required as a result of ATP exceptions and the NCR, there were some modifications and retest performed at the request of operations. Five (5) indicating lights on the C-106 exhaust skid were replaced with brighter, press to test, outdoor rated indicating lights. These were retested as part of a post-modification functional test that was basically copied from the corresponding sections of the ATP. The radiation detector for the process building radiation monitor was relocated and retested in the same manner. It was determined that the level monitoring systems for the seal pot and process building floor drain trap had to be intrinsically safe. These systems were modified to be intrinsic systems and tested by a post-modification functional test similar to ATP testing.

Through the process of acceptance testing, modification and re-testing, design calculations have either been proven or corrected. A large amount of documentation has been gathered to substantiate the path to the current configuration. The resulting equipment is such that operations should be able to perform the related Operational Test Procedure with confidence in how the systems are supposed to function, and that they indeed will function as intended.

C-106 Tank Process Ventilation Test

J. R. Bellomy
SGN Eurisys Services Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: ECN W-320-757 UC: 510
Org Code: 08E00 Charge Code: D2MP6
B&R Code: EW3130010 Total Pages: ~~85~~ 87 KMB 2/25/98

Key Words: 241-C-106, Project W-320, Sluicing, 296-C-006, Ventilation

Abstract: Revision 1 of Project W-320 Acceptance Test Procedure for tank 241-C-106, 296-C-006 Ventilation System

ECN-760
ECN-765
ECN-789
ECN-801

DATE: HANFORD RELEASE ID: 2
STA: 4
FEB 25 1998

Kara M. Broz 2/25/98
Release Approval Date Release Stamp

Approved for Public Release

RECORD OF REVISION

(2) Title
C-106 Tank Process Ventilation Test

CHANGE CONTROL RECORD		Authorized for Release	
(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initial Release EDT-610538	JR Bellomy	JW Bailey
1 RS	ECN W-320-757, Direct Revision to incorporate ECNs W-320-480, W-320-506, W-320-512, W-320-522, W-320-542, and W-320-543 and update test procedure to address recent equipment modifications.	JR Bellomy JR Bellomy 24-FEB-98	JW Bailey John W. Bailey 2/24/98

ACCEPTANCE TEST PROCEDURE HNF-SD-W320-ATP-012

TEST TITLE C-106 Tank Process Ventilation System

LOCATION C-Farm

PROJECT NUMBER W-320 TASK ORDER N-09

PROJECT TITLE TANK 241-C-106 SLUICING

Prepared By
Fluor Daniel Northwest
Richland, Washington

For Numatec Hanford Corporation

PROCEDURE APPROVAL

Fluor Daniel Northwest (FDNW)

[signature] Author	2/20/98 Date	[signature] Technical Documents	2-20-98 Date
[signature] Checker	2/20/98 Date	N/A Safety	— Date
[signature] Environmental	2/23/98 Date	N/A Quality Engineering	— Date
[signature] Project Management	02/23/98 Date		

Numatec Hanford Corporation (NHC)

[signature] Projects Department	2-23-98 Date	[signature] Quality Assurance	2-23-98 Date
[signature] Safety	2-23-98 Date	[signature] Operations	2-24-98 Date

EXECUTION AND TEST APPROVAL

EXECUTED BY

[signature] / HKC FDNW
D.M. Stenkamp / ~~LMH~~ — 3-3-98
Test Director/Organization — 05/07/98 — Date

AL Almquist FDNW — 3/20/98
Test Operator/Organization — Date

F.L. Snyder — 3-3-98
RG Dykeman Title III, FDH — 3-20-98
Recorder/Organization — Date
[signature]

WITNESSES

N/A
Witness/Organization — Date

[signature]
F.L. Snyder — 3-3-98
R.G. Dykeman — 3-20-98
Title III Inspector — Date

[signature] — 5/7/98
Witness/Organization — Date

N/A
Witness/Organization — Date

A-E APPROVAL

Fluor Daniel Northwest (FDNW)

Without exceptions ___ With exceptions resolved ✓ With exceptions outstanding ___

[signature] — 5/7/98
Acceptance Inspection — Date

[signature] — 5/7/98
Design Engineer — Date

[signature] — 05/07/98
Project Manager — Date

TEST APPROVAL AND ACCEPTANCE

Numatec Hanford Corporation

Without exceptions ___ With exceptions resolved ✓ With exceptions outstanding ___

[signature] 6/30/98
Title or Department — Date
W-320 PROJ ENGINEER

[signature] — 6-24-98
Title or Department — Date

Keith Conrad — 6-30-98
Title or Department — Date
W-320 QUALITY ASSURANCE

[signature] — 6-30-98
Title or Department — Date
W-320 PROJECT MGR.

R R Bevins — 6/30/98
W-320 START-UP MGR — DATE

TABLE OF CONTENTS

NOTE: At completion of test, enter pages added during performance of test to this Table of Contents.

1 PURPOSE

This Acceptance Test Procedure (ATP) has been prepared to demonstrate that the Electrical/HVAC/Instrumentation systems of C-106 Tank Process Ventilation System functions as required by project criteria.

This ATP has been revised to incorporate ECNs W320-480, -506, -512, -522, and -542, and to incorporate changes due to equipment modifications in accordance with LOI 97-03.

NOTE: Sections 8, 9, 10.1, 10.2, 10.4, and 10.7.1 were completed during ATP Rev 0 and have already been signed off. These sections will not be tested during ATP Rev 1, and signatures pertinent to sections will be transferred to this ATP, Rev 1.

2 REFERENCES

2.1 DRAWINGS

H-2-818468, Sh 1, Rev 0	HVAC Overall Flow Diagram
H-2-818480, Sh 1, Rev 1	HVAC Process Building Plan & Sections
H-2-818480, Sh 2, Rev 1	HVAC Process Building Sections & Details
H-2-818480, Sh 3, Rev 1	HVAC Process Building Details
H-2-818480, Sh 4, Rev 1	HVAC Process Building Instrument Connections
H-2-818481, Sh 1, Rev 2	Piping Process Bldg Skid Plan
H-2-818481, Sh 2, Rev 2	Piping Process Bldg Skid Section
H-2-818481, Sh 3, Rev 2	Piping Process Bldg Skid Plans
H-2-818481, Sh 4, Rev 2	Piping Process Bldg Skid Sections
H-2-818558, Sh 3, Rev 1	Project W-320 P&ID Details
H-2-818558, Sh 4, Rev 1	Project W-320 P&ID Interlock Schedule
H-2-818559, Sh 2&4, Rev 3	Project W-320 P&ID Tk 241-C-106
H-2-818561, Sh 1, Rev 4	Project W-320 P&ID Tk 241-C-106 HVAC
H-2-818561, Sh 2-7, Rev 3	Project W-320 P&ID Tk 241-C-106 HVAC
H-2-818569, Sh 1, Rev 1	Instrument Location Plan Tank 241-C-106
H-2-818569, Sh 2, Rev 1	Instrument Location Plan Sections & Details
H-2-818571, Sh 1, Rev 0	Instrumentation Process Building Plan
H-2-818571, Sh 2, Rev 1	Instrumentation Process Building Section & Detail

H-2-818575, Sh 1, Rev 1	Instrumentation Leak Detector Elements Assembly & Installation
H-2-818577, Sh 1, Rev 0	Instrumentation Tank C-106 Purgemeter Installation and Details
H-2-818585, Sh 1, Rev 1	Instrumentation Exh Stack Rad Mon Installation Detail
H-2-818585, Sh 2, Rev 1	Instrumentation Exh Stack Rad Mon Arrangement
H-2-818585, Sh 3, Rev 1	Instrumentation Exh Stack Rad Mon Connection Diagram
H-2-818586, Sh 1, Rev 1	Instrumentation Instrument Rack IR-1361 Detail
H-2-818586, Sh 2, Rev 1	Instrumentation Instrument Rack IR-1361 Sections & Details
H-2-818586, Sh 3, Rev 1	Instrumentation Instrument Rack IR-1361 Connection Diagram
H-2-818587, Sh 1, Rev 1	Instrumentation Process Building Skid Plan
H-2-818587, Sh 2, Rev 1	Instrumentation Process Building Skid Elevations & Section
H-2-818587, Sh 3, Rev 1	Instrumentation Process Building Skid Sections & Details
H-2-818588, Sh 1, Rev 0	Instrumentation Instr Enclosure IE-1361 Assembly
H-2-818588, Sh 2, Rev 0	Instrumentation Instr Enclosure IE-1361 Section & Details
H-2-818588, Sh 3-6, Rev 0	Instrumentation Instr Enclosure IE-1361 Connection Diagram
H-2-818590, Sh 1, Rev 0	Instrumentation Operator Control Station
H-2-818596, Sh 1, Rev 0	Instrumentation Instrument Cabinet CP-01 Assembly
H-2-818596, Sh 3-5, Rev 0	Instrumentation Instrument Cabinet CP-01 Connection Diagram
H-2-818601, Sh 2, Rev 0	Instrumentation Loop Diagram Tank Press & Slurry Winch
H-2-818601, Sh 5, Rev 0	Instrumentation Loop Diagram Slurry Pres/Flo & Bldg HVAC
H-2-818601, Sh 7, Rev 1	Instrumentation Loop Diagram Chilled Water System
H-2-818601, Sh 8, Rev 0	Instrumentation Loop Diagram Pump Pit LD & Exh Skid Temp

H-2-818601, Sh 9, Rev 0	Instrumentation Loop Diagram HEPA Filter Press Diff
H-2-818601, Sh 10, Rev 0	Instrumentation Loop Diagram Exhaust Stack Rad Monitor
H-2-818601, Sh 13, Rev 0	Instrumentation Loop Diagram Valve HV-13638/13669 Psn
H-2-818601, Sh 14, Rev 0	Instrumentation Loop Diagram Common Alarms/TMACS Comm
H-2-818603, Sh 1-6, Rev 0	Instrumentation Loop Diagram Process Bldg 241-C-91
H-2-818674, Sh 1-3, Rev 1	Electrical C-Farm Conduit Plan
H-2-818674, Sh 4, Rev 0	Electrical C-Farm Misc Details
H-2-818675, Sh 2, Rev 0	Electrical C-Farm Elem Diagrams HC-1361 & HC-1362
H-2-818675, Sh 3, Rev 0	Electrical C-Farm Elem Diagrams FN-1361, ANN at MO-211
H-2-818675, Sh 4, Rev 0	Electrical C-Farm Elem Diagrams FN-1362, Exh Skid/HVAC ANN
H-2-818675, Sh 5, Rev 0	Electrical C-Farm Elem Diagrams Service Bldg/Chiller Skid
H-2-818675, Sh 6, Rev 0	Electrical C-Farm Elem Diagrams Prcs Bldg ANN & Rad Alms
H-2-818675, Sh 8, Rev 0	Electrical C-Farm Elem Diagrams Valve Cont/Slurry Pmp ANN
H-2-818678, Sh 1-3, Rev 1	Electrical Process Bldg Plan & Details
H-2-818678, Sh 4, Rev 2	Electrical C-Farm Proc Bldg Skid/Wire Run List
H-2-818678, Sh 5, Rev 1	Electrical Process Bldg Plan & Details
H-2-818680, Sh 1, Rev 0	Electrical C-Farm One-Line Diagram
H-2-818681, Sh 1&2, Rev 0	Electrical C-Farm Elect Equip Skid Details

2.2 SPECIFICATIONS

W-320-C5, Rev 0, Construction Specification "C Tank Farm"
W-320-C6, Rev 0, Construction Specification "Process Building Skid"

2.3 ENGINEERING CHANGE NOTICES (ECN)

Prior to final test approval, mark up the controlled copy of this ATP with all of the ECNs written against it.

2.4 VENDOR INFORMATION

No. 22668

PO 82295	Pressure Differential Switch (PDISH-13614/PDISH-13615)
PO 82296	Pressure Gage (PI-13629/PI-13630/PI-13631)
PO 82297	Gamma Radiation Element Radiation Indicator (RE-1361/RIT-1361)
PO 82298	Resistance Temp Sensor (TE-13620/TE-13621/TE-13622/TE-13625)
PO 82299	Pressure Regulator (PCV-13628/PCV-13629/PCV-1367)
PO 82300	Pressure Safety Valve (PSV-13629)
PO 82301	Temp Switch High/Low (TE-TSHL-13623/TE-TSHL-13624)
PO 82303	Control Valve/Solenoid Valve (HV-13638/HV-13669)
PO 82304	Flow Integrator Indicator (FQI-13629)
PO 82307	Pressure Differential Xmtr (PDT-13611/PDT-13612/PDT-13613)
PO 82307	Pressure Indicator Xmtr (PIT-1361/PIT-13616)
PO 82307	Pressure Transmitter (PT-13611)
PO 82407	Leak Detection Relay
PO 82408	Leak Detection System
PO 82417	Single Loop Controller (PIC-1361)
PO 82418	Annunciator (ANN-1361)
PO 82418	Annunciator (ANN-1362)
PO 10050-7 -GINR	Exhaust Stack Vacuum Pumps Enclosure (P-1366/P-1367) (W-320-P41)
PO WAT-XXD K27208-3	Chromalox Heater Control Panels (Intrinsically Safe) for Heating Coils HC-1361/HC-1362.

3 RESPONSIBILITIES

3.1 GENERAL

Each company or organization participating in this ATP will designate personnel to assume the responsibilities and duties as defined herein for their respective roles. The designees shall become familiar with this ATP and the systems involved to the extent that they can perform their assigned duties.

3.2 NHC PROJECT ENGINEER

3.2.1 Signs Execution and Test Approval page when test is complete and accepted.

3.2.2 Provides a distribution list for the approved and accepted ATP.

3.3 FDNW PROJECT MANAGER

3.3.1 Designates a Test Director.

3.3.2 Signs Execution and Test Approval page when test is complete and accepted.

3.3.3 Signs exception form when all exceptions have been resolved.

3.4 TEST DIRECTOR

3.4.1 Coordinates and directs acceptance testing.

3.4.2 Coordinates testing with FDNW Utilities.

3.4.3 Coordinates testing with FDNW Craft.

3.4.4 Before start of test, obtains all outstanding ECNs against referenced documents of Section 2 and distributes the approved testing schedule to FDNW Project Manager and NHC Project Engineer.

3.4.5 Notifies concerned parties (includes FDNW Project Manager, FDNW Principal Lead Engineer, and NHC Project Engineer) when a change is made in the testing schedule.

3.4.6 Schedules and conducts a pretest kickoff meeting with test participants when necessary.

3.4.7 Confirms that field testing and inspection of the system or portion of the system to be tested has been completed.

3.4.8 Stops any test which, in his or her judgment, may cause damage to the system until the problem has been resolved.

3.4.9 After verifying there is no adverse impact, may alter the sequence in which systems or subsystems are tested.

3.4.10 If a test is to be suspended for a period of time, ensures that the system is left in a safe mode.

3.4.11 Before restarting suspended test, reverifies the test prerequisites.

3.4.12 Initiates ECNs to document required changes to the ATP.

3.4.13 Reviews recorded data, discrepancies, and exceptions.

3.4.14 Signs Execution and Test Approval page when test has been performed.

3.4.15 Takes necessary actions to clear exceptions to the test, and signs exception form when exceptions have been resolved.

3.4.16 Obtains required signatures on the ATP Master prior to reproduction and distribution.

3.5 WITNESSES (Provided by Participating Organizations. One witness shall be a Title III acceptance inspector.)

3.5.1 Witness the tests.

3.5.2 ReView results of testing.

3.5.3 Assist the Test Director when requested.

3.5.4 Sign Execution and Test Approval page when test has been performed.

3.5.5 Sign exception form when exception has been resolved.

3.6 RECORDER (Provided by FDNW)

3.6.1 Prepares a Field copy from the ATP Master.

3.6.2 Records names of all designated personnel on Field copy of ATP prior to start of testing.

3.6.3 Records test instrument identification numbers and calibration expiration dates, as required.

3.6.4 Initials and dates every test step on the Field copy as it is completed next to the step number or on a data sheet, when provided. Records test data. On data sheets where there is not room for both the initial and date, date may be entered at bottom of column.

3.6.5 Records exceptions on an exception form. Uses additional exception forms as needed. Notifies the Test Director at time the exceptions is made.

3.6.6 Signs Execution and Test Approval page when test has been performed.

3.6.7 After test is finished, assigns alpha numeric page numbers to added data sheets and exception forms. Records page numbers in the Table of Contents.

3.6.8 Transfers Field copy entries for each step to the Master in ink or type; signs, and dates. Transmits the completed Master to the Test Director for approval signature routing. Transmits the Field copy to Construction Document Control for inclusion in the official project file.

3.6.9 Signs exception form when exception has been resolved and transmits to Test Director.

3.7 TEST OPERATOR

3.7.1 Performs test under direction of the Test Director.

3.7.2 Provides labor, equipment, and test instruments required for performing tests that have not been designated as being provided by others.

3.7.3 Confirms that all equipment required for performing test will be available at the start of testing.

3.7.4 Signs the Execution and Test Approval page.

3.7.5 After the performance of the test, recycles the clean glycol solution, collected in containers, back into the C-106 Supply Air Chiller System or to the recycle center.

3.8 A-E ACCEPTANCE INSPECTION, DESIGN ENGINEER, AND PROJECT MANAGER

3.8.1 Evaluate results.

3.8.2 Sign for A-E Approval on Execution and Test Approval page.

4 CHANGE CONTROL

If a need for change is discovered in the course of running the test, the test shall be stopped. Required changes to this ATP must be processed in accordance with company procedures. However, this does not prevent the running of another portion of the test unaffected by the change.

5 EXECUTION

5.1 OCCUPATIONAL SAFETY AND HEALTH

Individuals shall carry out their assigned work in a safe manner to protect themselves and others from undue hazards and to prevent damage to property and environment. Facility line managers shall ensure the safety of activities within their areas to prevent injury, property damage, or interruption of operation. Performance of test activities shall always include safety and health aspects.

These tests involve working near energized equipment; all procedural requirements for working near energized equipment shall be followed, and an Energized Electrical Work Permit (A-6001-687) shall be completed.

5.2 PERFORMANCE

5.2.1 Conduct testing in accordance with FDNW Practice 134.500.8354 (Performance and Recording of Acceptance Test Procedures).

5.2.2 Perform test following the steps and requirements of this procedure.

5.2.3 As each step in Sections 7 through 11 are completed, the person completing the steps shall initial and date in the space provided. After each section is completed, initial and date in the space provided in Section 12.

5.3 RADIATION PROTECTION

Radioactive material will be used during this ATP to test the radiation detection alarm system. A Radiation Work Permit (RWP) shall be provided by the Operating Contractor. A copy of the RWP shall be included as an attachment to this ATP as part of the test data.

6 EXCEPTIONS

6.1 GENERAL

Exceptions to the required test results are sequentially numbered and recorded on individual ATP Exception Sheets (A-6002-213). This enables case-by-case resolution and approval of each exception.

Errors/exceptions in the ATP itself shall NOT be processed as test exceptions (see Section 4 CHANGE CONTROL).

6.2 RECORDING

6.2.1 Number each exception sequentially as it occurs and record it on an exception form.

6.2.2 Enter name and organization of the individual that identifies each exception.

6.2.3 Enter planned action to resolve each exception when such determination is made.

6.3 RETEST/RESOLUTION

Record the action taken to resolve each exception. Action taken may not be the same as planned action.

6.3.1 When action taken results in an acceptable retest, sign and date Retest Execution and Acceptance section of the exception form.

6.3.2 When action taken does not involve an acceptable retest, strike out the Retest Execution and Acceptance section of the exception form.

6.4 APPROVAL AND ACCEPTANCE

The Test Director provides final approval and acceptance of exceptions by checking one of the following on exception form:

6.4.1 Retest Approved and Accepted: Applicable when Retest Execution and Acceptance section is completed.

6.4.2 Exception Accepted-As-Is: Requires detailed explanation.

6.4.3 Other: Requires detailed explanation.

The Test Director signs and dates the exception form and obtains other approvals, if required.

6.5 DISTRIBUTION

A copy of the approved exception form is distributed to each participant. The signed original is attached to the ATP Master.

7 PREREQUISITES, EQUIPMENT/INSTRUMENTS, ABBREVIATIONS, GLOSSARY, AND ANNUNCIATORS

7.1 PREREQUISITES

The following conditions as applicable shall exist at start of testing for that portion of the system being tested.

3/13/98 7.1.1 NHC Project Engineer has been notified a minimum of 24 hours prior to start of the testing.

Exc #3	7.1.2	Systems and components have tag identification number in accordance with Drawings H-2-818559, Sh 2 and 4; and H-2-818561, Sh 1-7 (except for Exhaust Fan FN-1362 VSD operator panel control switches and status lights); and inspected for compliance with construction documents and vendor documents.
3/3/98	7.1.3	Reference documents (including this ATP) have been verified for correct revision number and outstanding ECNs.
3/3/98	7.1.4	A Prejob Safety Analysis has been prepared and a Prejob Safety Meeting has been conducted.
4/1/98	7.1.5	Instruments listed in Data Sheet 7.1.5 are in current calibration.
3/3/98	7.1.6	Verify the circuit breakers feeding power to the Exhaust Skid are labeled in accordance with Drawing H-2-818680.
3/3/98	7.1.7	Grounding of the Process Building 241-C-91 and the Exhaust Skid have been visually inspected and continuity tested.
3/3/98	7.1.8	The Exhaust Skid Main Disconnect switch is open (OFF position), and the Exhaust Fan FN-1362 Local Disconnect switch at Exhaust Skid is open (OFF position).
3/3/98	7.1.9	Exhaust Skid circuit breakers in C106-PP5 at Exhaust Skid, and disconnect switches, have been continuity tested.
3/3/98	7.1.10	Wiring from Exhaust Skid to MCC-N1 and wiring installed by FDNW on the Exhaust Skid and radiation monitor has been continuity tested and meggered as applicable.
3/3/98	7.1.11	The 120/240 V power panel breakers at power panel C106-PP5 at the Exhaust Skid are open (OFF position).
3/3/98	7.1.12	The supply circuit breaker to the Exhaust Skid from MCC-N1/2FMR is open (OFF position).
3/3/98	7.1.13	The supply circuit breaker to the Exhaust Fan VSD from MCC-N1/2FML, is open (OFF position).
3/3/98	7.1.14	MCC-N1 is energized.
3/3/98	7.1.15	Notify occupants in the 241-C-Farm that an evacuation horn/siren PAL-1361C will be tested and will be audible within 24 hours. Evacuation will not be required.
3/3/98	7.1.16	Verify the C-106 Supply Air Chiller system has been tested in accordance with acceptance test procedure WHC-SD-W320-ATP-006 and is ready for operation.
3/3/98	7.1.17	Annunciator wiring to the Chiller Skid has been continuity tested.
3/3/98	7.1.18	All worker safety equipment required to perform test is readily available.

✓ 3/3/98 7.1.19 Voice communications are available between Chiller Skid, Exhaust Skid, Process Building 241-C-91, Electrical Equipment Skid (EES) 241-C-51, and Operations Trailer MO-211.

✓ 3/3/98 7.1.20 Personnel and support staff responsible for directing the test described in this ATP understand the vendor information (VI) and are qualified to perform the test.

✓ 3/3/98 7.1.21 Methods of water disposal into Tank 241-C-106 have been approved by Facilities Management.

✓ 3/3/98 7.1.22 Acceptance test procedure WHC-SD-W320-ATP-011 for C-Farm Instrumentation has been completed.

✓ 3/3/98 7.1.23 Power is available to panels CB-01, CP-01, and IE-1363 at MO-211 and IE-1361 at Process Building 241-C-91. Annunciator ANN-1361 and ANN-1362 lights have been tested by use of the integral TEST pushbutton.

✓ 3/4/98 7.1.24 Valves have been aligned as shown in Data Sheet 7.1.24.

R 4/1/98 7.1.25 Air inlet station with HEPA filter is available for installation at the portable exhaust hookup line 8"VT-1012-M8. (Attachment B)

R ↓ 7.1.26 The air outlet line 8"VT-1022-M8 from the Recirculation Fan FN-1361 is available to HX-1361 inlet. (Attachment B)

✓ 3/5/98 7.1.27 Seal Pot and floor drain trap in Rm 1 has been filled with water.

✓ 3/4/98 7.1.28 Air Monitor Corp has been notified to have their representative present to perform Site Acceptance Test of the Exhaust Stack Air Sampling and Radiation Monitoring System Cabinet. (Reference Section 11)

✓ 3/16/98 7.1.29 Verify level gages LG-1366 and LG-1367 are approximately half full in order to prove Pressure Relief Seal Loops are functioning.

R 4/16/98 7.1.30 Backflow preventer BP-1362 has been appropriately tested.

✓ 3/16/98 7.1.31 Exhaust Skid including HEPA filter banks HEP-1361/HEP-1362 have been appropriately "in-place" tested for pressure decay leakage rate in accordance with Attachment C.

7.2 EQUIPMENT/INSTRUMENTS

Supplied by Test Operator unless otherwise noted.

7.2.1 Multimeter (MM), 4 required, consists of:

2 - 600 V ac/dc
2 wire, 0 - 10 megohms
4 mA to 20 A, adjustable
Remote clamp-on current probe, ac/dc, 200 A
Test lead set with clips

Instrument No. 1051 Expiration Date 9/16/99

Instrument No. 95/45-08-027 Expiration Date 6-16-99

Instrument No. N/A Expiration Date N/A

Instrument No. N/A Expiration Date N/A

7.2.2 Shorting Jumpers: 2 feet long, #12 AWG

7.2.3 Shorting Jumpers with ON-OFF switch: 2 feet long, #12 AWG

7.2.4 Variable Test Pressure Source (VTPS): 0 - 15" H_2O 817-35-40-019 4-22-98

7.2.5 Variable Test Vacuum Source (VTVS): 0 - (-)10" H_2O 817-35-40-018 8-15-98

7.2.6 Transmitter Calibrator/Simulator: Selectable 2-wire (loop powered by internal battery) and source, adjustable 4 - 20 mA

~~Decade Box 817-63-02-002 7-17-98~~

Instrument No. 817-13-55-026 Expiration Date 2-20-99

Dec 817-13-55-027 5-29-98

7.2.7 RTD Readout/Calibrator/Simulator: or Decade Box ECN 760 Platinum 100 ohm DIN

Decade Box 817-63-02-002 7-17-98

Instrument No. N/A Expiration Date N/A

7.2.8 Thermocouple Readout/Calibrator/Simulator: 3 required, Type K

Instrument No. N/A Expiration Date N/A

Instrument No. ↓ Expiration Date ↓

Instrument No. ↓ Expiration Date ↓

7.2.9 Portable Anemometer, electronic, with remote probe: 0 -20" H_2O, 0 - 3,000 ft/min

Instrument No. 799-28-01-007 Expiration Date 2/4/99

7.2.10 Thermometer, electronic, with remote and immersible probe: For air/gas, 0 to 500 °F (nominal)

Instrument No. N/A Expiration Date N/A

7.2.11 Radiation Test Sources: Provide with uniform gamma radiation field up ~~to 10~~ MIN 20 mR/hr supplied and handled by Operating Contractor. ECO 265

Source ID No. C-830 Expiration Date 7/15/98

7.2.12 Container (bucket to hold glycol solution): 5 gal (nominal), quantity as required to catch possible leak points.

7.2.13 Phase rotation meter: No. I.D- N/A , Calibration Date N/A

7.3 ABBREVIATIONS AND GLOSSARY OF TERMS

7.3.1 Abbreviations

A	A phase voltage or current
B	B phase voltage or current
C	C phase voltage or current
CB	Circuit Breaker
DR	Drain line
ECN	Engineering Change Notice
EES	Electrical Equipment Skid
ER	Electrical Rack
FN	Fan or Blower
FW	Filtered Water line
HS	Handswitch
IA	Instrument Air
L	120 V Hot Leg
LEL	Lower Explosion Limit
MM	Multimeter
N	Neutral
P	Pump
PDP	Power Distribution Panel
RAW	Raw water line
RTD	Resistance Temperature Detector
RTS	Radiation Test Source
RWP	Radiation Work Permit
SWP	Special Work Procedure
TB	Terminal Board
TE	Temperature Element
TMACS	Tank Monitoring and Control System
VC	VSD Cabinet
VOM	Volt-ohmmeter

VRB Variable Resistance Box

VSD Variable Speed Drive

VT Ventilation Train

VTPS Variable Test Pressure Source

VTVS Variable Test Vacuum Source

7.3.2 Glossary of terms for annunciators used in this text:

a. Acknowledge - Depress acknowledge pushbutton, and verify the status of the annunciator has changed from flashing to a status in accordance with Step 7.4.2.

b. Reset - Depress reset pushbutton and verify the status of the annunciator has changed from steady on to a status in accordance with Step 7.4.2

c. Test - Depress test pushbutton and verify the status of the annunciator has changed to a status in accordance with Step 7.4.2

d. Alert - A significant change of condition to an off-normal condition has taken place by sounding a horn and by flashing the annunciator window in accordance with Step 7.4.2.

7.4 ANNUNCIATORS

7.4.1 Tagging:

TAGGING		LOCATION
1.	ANN-1361	Operator's Station MO-211, "CP-01"
2.	ANN-1362	Process Building 241-C-91, "IE-1361"
3.	PAL-1361C**	Process Building 241-C-91
4.	RLH-1361**	Process Building 241-C-91

** For Evacuation Alarm and Red Strobe Light, sequence as listed below does not apply

7.4.2 Sequence: ISA Sequence Number M (ISA S18.1)

STAGE	VISUAL SIGNAL	AUDIBLE SIGNAL
Normal	OFF	OFF
Alert	Flashing	ON
Acknowledge	Steady On	OFF
Return to Normal	Steady On	OFF
Reset	OFF	OFF
Test	Flashing	ON

DATA SHEET 7.1.5

TAG NUMBER	VERIFY CALIBRATION	
	CALIBRATED	EXPIRATION DATE
IISH-13635	3/9/98	3/9/01
IT-13635	3/24/98	3/24/01
PDISH-13611	3/12/98	3/12/01
PDISH-13612	3/12/98	3/12/01
PDISH-13613	3/12/98	3/12/01
PDISH-13614 Removed from SERVICE	N/A	N/A
PDISH-13615	3/24/98	3/24/01
PDISH-13618 (1)	3/9/98	3/9/01
PDISH-13619 (1)	3/9/98	3/9/01
PDISH-13620 (2)	3/9/98	3/9/01
PDT-13611	2/20/98	2/20/01
PDT-13612	2/18/98	2/18/01
PDT-13613	2/18/98	2/~~4~~ 18/01 (initialed)
PI-13611	2/20/98	2/20/01
PI-13629 } DELETE PER ECN# 801 (initialed) 5/5/98	9/4/96	9/4/97
PI-13630 }	9/4/96	9/4/97
PI-13631 }	9/4/96	9/4/97
PIC/PSH/PSL-1361 (3)	2/25/98	2/25/01
PIT-1361	2-27-98	2-27-01
PT-13611	2-20-98	2-20-2001
TIC-13622 (3)	2-20-98	2/20/01

DATA SHEET 7.1.5

TAG NUMBER	VERIFY CALIBRATION	
	CALIBRATED	EXPIRATION DATE
TIC-13629 (3)	2/20/98	2/20/01
TISH-13610A, ~~B, C~~	2/20/98	2/20/01
TISH-13620	2/17/98	2/17/99
TISH-13621	2/17/98	2/17/99
TISH-13634A, ~~B, C~~	2/20/98	2/20/01
TISH-13625	2/17/98	2/17/99
TSH-13626	9/9/98	3/9/01
TSH-13635	9/10/96	3/9/01
TIT-13626	1-3-97	1-3-00
TIT-13629	2/20/98	2/20/01
TIT-13635	1-3-97	1-3-00

NOTE:
(1) Verify switch PDISH-13618 is set at 5.0" H_2O and PDISH-13619 is set at 4.0". Verify that output contacts of both PDISH-13618 and PDISH-13619 CLOSE on increasing pressure.
(2) Verify switch PDISH-13620 is set at 5.9" H_2O and output contact CLOSE on increasing pressure.
(3) Initial tuning for controller has been completed. Final tuning will be done during this ATP.

TISH-13610 B	2/20/98	2/20/01
TISH-13610 C	2/20/98	2/20/01
TISH-13634 B	2/20/98	2/20/01
TISH-13634C	2/20/98	2/20/01
PSV-13629	3/4/98	3/4/01
TI/TSH-13622	3/23/98	3/23/01

DATA SHEET 7.1.24

Initial/Date	Valve	Line/Position
[initials] 3/4/98	HV-1365	DR/CLOSED
[initials] 3/4/98	HV-1369	IA/CLOSED
[initials] 3/4/98	HV-13610	IA/OPEN
[initials] 3/3/98	HV-13613	IA/CLOSED
[initials] 3/4/98	HV-13631	IA/OPEN
[initials] 3/4/98	HV-13635	CWR/OPEN
[initials] 3/4/98	HV-13636	CWS/OPEN
[initials] 3/4/98	HV-13637	FW/CLOSED
[initials] 3/4/98	HV-13639	VT/OPEN
[initials] 3/4/98	HV-13641	I/OPEN
[initials] 3/4/98	HV-13642	I/CLOSED
DELETE ECN 760	~~HV-13643~~	~~VT/OPEN~~
[initials] 3/4/98	HV-13644	VT/CLOSED
[initials] 3/4/98	HV-13645	VT/CLOSED
[initials] 3/4/98	HV-13646	VT/OPEN
[initials] 3/4/98	HV-13647	VT/OPEN
[initials]	HV-13648	VT/OPEN
[initials]	HV-13649	VT/CLOSED
[initials]	HV-13650	I/OPEN
[initials]	HV-13651	I/OPEN
[initials]	HV-13652	I/OPEN
[initials]	HV-13653	I/OPEN
[initials]	HV-13654	VT/CLOSED
[initials]	HV-13655	VT/CLOSED
[initials] 3/3/98	HV-13656	IA/OPEN
[initials] 3/4/98	HV-13658	FW/CLOSED
[initials] 3/3/98	HV-13659	RAW/OPEN
[initials] 3/4/98	HV-13660	RAW/OPEN
[initials]	HV-13661	RAW/OPEN
[initials]	HV-13663	RAW/CLOSED
[initials]	HV-13664	FW/CLOSED
[initials]	HV-13665	FW/CLOSED
[initials]	HV-13666	FW/CLOSED
[initials]	HV-13667	FW/OPEN
[initials] 3/4/98	HV-13668	FW/CLOSED
DELETE ECN 760	~~HV-13670~~	~~I/CLOSED~~
[initials] 3/4/98	HV-13671	IA/CLOSED
[initials] 3/4/98	HV-13673	IA/CLOSED
[initials] 3/4/98	HV-13678	IA/CLOSED

DATA SHEET 7.1.24		
Initial/Date	Valve	Line/Position
[initials] 3/4/98	HV-13681	IA/CLOSED
[initials]	HV-13682	IA/CLOSED
[initials]	HV-13684	IA/OPEN
[initials]	HV-13687	IA/CLOSED
[initials]	HV-13688	IA/CLOSED
[initials]	HV-13689	IA/CLOSED
[initials]	HV-13690	RAW/OPEN
[initials]	HV-13691	RAW/OPEN
[initials]	HV-13692	RAW/OPEN
[initials] 3/4/98	HV-13693	RAW/OPEN
[initials] 3/3/98	HV-13694	RAW/CLOSED
[initials] 3/4/98	HV-13696	I/OPEN
[initials] 3/4/98	HV-13697	I/OPEN
[initials] 3/4/98	HV-13698	I/OPEN
[initials] 3/4/98	HV-13699	I/OPEN
[initials] 3/3/98	HV-136100	I/OPEN
[initials] 3/3/98	HV-136101	RAW/CLOSED
[initials] 3/4/98	HV-136102	RAW/CLOSED
[initials] 3/4/98	HV-136103	RAW/CLOSED
[initials] 3/3/98	HV-136104	I/OPEN
[initials] 3/3/98	HV-136105	I/OPEN
[initials] 3/3/98	HV-136106	RAW/CLOSED
[initials] 3/4/98	HV-136108	FW/CLOSED
[initials]	HV-136113	FL/CLOSED
[initials]	HV-136114	FL/CLOSED
[initials]	* HV-136117	DR/OPEN
[initials]	* HV-136118	DR/OPEN
[initials]	* HV-136119	DR/OPEN
[initials]	HV-136120	DR/OPEN
[initials]	* HV-136121	DR/OPEN
[initials]	HV-136122	DR/CLOSED
[initials]	HV-136123	DR/OPEN
[initials]	HV-136124	DR/OPEN
[initials]	HV-136125	DR/CLOSED
[initials]	HV-136126	DR/OPEN
[initials]	HV-136127	DR/CLOSED
[initials]	HV-136129	DR/CLOSED
[initials] 3/4/98	HV-136130	DR/OPEN
[initials] 3/5/98	HV-136131	DR/CLOSED

* = SEE ECN's # 789 and 801 RGD 5/7/98

DATA SHEET 7.1.24		
Initial/Date	Valve	Line/Position
[initials] 3/4/98	HV-136132	DR/CLOSED
[initials]	HV-136134	DR/OPEN
[initials]	HV-136135	DR/OPEN
[initials]	HV-136136	DR/CLOSED
[initials]	HV-136143	VT/CLOSED
[initials]	HV-136144	VT/CLOSED
[initials]	HV-136150	VT/CLOSED
[initials]	HV-136151	VT/CLOSED
[initials]	HV-136152	CWS/CLOSED
[initials]	HV-136158	IA/CLOSED
[initials]	HV-136200	CWS/OPEN TO COOLING COIL
[initials] 3/4/98	HV-136210	CWR/CLOSED

END OF SECTION 7

8 C-FARM TANK PROCESS VENTILATION SYSTEM ELECTRICAL CHECK

The following will check the electrical feeder connections and services to equipment associated with the C-Farm Tank Process Ventilation System.

8.1 PREPARATION

TRANSFER FROM REV 0

✓ 9/25/96 8.1.1 Verify applicable prerequisites of 7.1 have been met.

8.2 BUILDING HEATING AND VENTILATION SYSTEM

✓ 9/25/96 8.2.1 In Process Building 241-C-91, Rm 2, with the portable thermometer, measure and record room ambient temperature: 68.4 °F

✓ 8.2.2 Set the Process Building Exhaust Fan FN-1364 thermostat control TC-13638 to below room ambient temperature recorded on the previous step.

✓ 8.2.3 Close the Process Building Exhaust Fan FN-1364 feeder breaker C106-PP1/#3 (ON position).

✓ 8.2.4 Verify that the Process Building Exhaust Fan FN-1364 is running.

✓ 8.2.5 Set the Process Building Exhaust Fan FN-1364 thermostat control to above building ambient temperature recorded previously.

✓ 8.2.6 Verify that the Process Building Exhaust Fan FN-1364 shuts down.

✓ 8.2.7 Set the Process Building Exhaust Fan FN-1364 thermostat control to approximately 80 °F.

✓ 8.2.8 Adjust thermostat TE-13630/TC-13630 for Unit Heater UH-1361 to above building ambient temperature recorded previously.

✓ 8.2.9 Close the UH-1361 480 V disconnect switch DS-5 at rack ER-1361 (ON position).

✓ 8.2.10 Verify that the Unit Heater UH-1361 is operating (fan running and warm air coming out of the heater).

✓ 8.2.11 Adjust the thermostat TE-13630/TC-13630 to below building ambient temperature recorded previously.

✓ 8.2.12 Verify that the Unit Heater UH-1361 shuts down.

✓ 8.2.13 Adjust thermostat TE-13611/TC-13611 for the Unit Heater UH-1362 to above building ambient temperature recorded previously.

✓ 8.2.14 Close the UH-1362 480 V disconnect switch DS-2 at rack ER-1361 (ON position).

✓ 8.2.15 Verify that the Unit Heater UH-1362 is operating (fan running and warm air coming out of the heater).

✓ 9/25/96 8.2.16 Adjust the thermostat to below building ambient temperature recorded previously.

✓ 9/25/96 8.2.17 Verify that the Unit Heater UH-1362 shuts down.

✓ 9/25/96 8.2.18 Adjust both thermostats TE-13611/TC-13611 and TE-13630/TC-13630 to 60 °F.

8.3 ELECTRICAL CHECK - EXHAUST SKID

CAUTION: Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.

TRANSFERRED FROM REV 0 BY F.L. SNYDER FOR CLIFF LARSON

10/1/96 8.3.1 At the Exhaust Skid, connect the phase rotation meter on the load side of the Exhaust Skid Main Disconnect Switch.

8.3.2 In EES 241-C-51, CLOSE the Exhaust Skid feeder breaker MCC-N1/2FMR (ON position).

8.3.3 Close the Exhaust Skid Main Disconnect Switch located at Exhaust Skid (ON position).

8.3.4 Using the phase rotation meter, verify that the phase rotation is clockwise (for A,B,C).

8.3.5 Using the MM, measure all 3 phase-to-phase voltages on the load side of the Exhaust Skid Main Disconnect Switch. Record the values of V_{AB}, V_{BC}, and V_{CA} below.

V_{AB} = 509 volts FLUKE 80243

V_{BC} = 508 volts ID 953-65-08-012

V_{CA} = 509 volts CAL DUE 1-22-97

EXCEPTION #1

8.3.6 Verify that the voltages measured in the previous step are in the range of 456 to 504 V ac.

8.3.7 Open the Exhaust Skid Main Disconnect Switch. (OFF position).

8.3.8 Disconnect and remove the phase rotation meter.

8.3.9 Close the Exhaust Skid Main Disconnect Switch (ON position).

8.3.10 Close the panelboard C106-PP5 MAIN breaker (ON position).

8.3.11 Close the panelboard C106-PP5 SECONDARY MAIN breaker (ON position).

10/1/96 8.3.12 Using the MM, measure the line-to-line voltage and both line-to-neutral voltages in the panelboard. Record the values of V_{LL}, V_{L1N}, and V_{L2N} below.

V_{LL} = 257 volts

V_{L1N} = 125 volts

V_{L2N} = 124 volts

1Q 10/1/96 8.3.13 Verify that the panelboard line-to-line voltage is in the range of 228 to 252 V ac and that the panelboard line-to-neutral voltages are in the range of 114 to 126 V ac.

8.3.14 Close panelboard breaker for Exhaust Skid lighting C106-PP5/#4 (ON position).

8.3.15 Verify that the Exhaust Skid light fixtures function properly using the vendor-supplied toggle switch.

8.3.16 Close panelboard breaker for Exhaust Skid receptacles C106-PP5/#3 (ON position).

8.3.17 Using the VOM, measure and verify that the voltage at both Exhaust Skid receptacles is in the range of 114 to 126 V ac. Verify that the GFCI feature of each duplex receptacle functions properly via the test and reset buttons.

8.3.18 Close panelboard breaker for Exhaust Skid Instrumentation C106-PP5/#5 (ON position). Measure the voltage at TB6 terminals 1 and 2 at the Exhaust Skid Instrument Cabinet. Verify the voltage is in the range of 114 to 126 V ac.

8.3.19 Close the Exhaust Skid heat trace feeder breakers C106-PP 5/#1 and #2 (ON position).

8.3.20 Measure the voltage ~~at the input to~~ ACCROSS EACH of ECN 760 the heat trace contactor outputs (wire numbers 261/261 and 266/266). Verify that the voltage is in the range of 114 to 126 V ac.

8.3.21 Jumper across the heat trace thermostat to simulate the action of the thermostat closing.

8.3.22 Verify that the voltage across each of the contactors for the heat trace is zero. This will indicate contactors have closed.

8.3.23 Remove the jumpers.

8.3.24 Close the Exhaust Skid circuit breaker "RMC Instm & Control" C106-PP5/#7 (ON position).

8.3.25 Verify that the voltage across TB-1 terminals 1 and 2, at the Radiation Monitoring Cabinet, is in the range of 114 to 126 V ac.

8.3.26 Close the Exhaust Skid circuit breaker "RMC PUMPS AND SAMPLE HEAT TRACE" C106-PP5/#8 (ON position).

8.3.27 Verify that the voltage across TB-1 terminals 3 and 4, at the Radiation Monitoring Cabinet, is in the range of 114 to 126 V ac.

8.3.28 Close the Exhaust Skid 30 A circuit breaker "RMC A/C & CAB HTR" C106-PP5/#6 (ON position).

1Q 10/1/96 8.3.29 Verify that the voltage across TB-1 terminals 5 and 6, at the Radiation Monitoring Cabinet, is in the range of 114 to 126 V ac.

TRANSFER FROM REV 0 BY F.L. SNYDER FOR CLIFF LARSON

1 Q 10/1/96 8.3.30 In Exhaust Fan FN-1362 VSD, add jumper to terminals TB-EXST 501 and ~~502~~. 505 ECN 760 At EES, at MCC-N1, close breaker MCC-N1/2FML.

8.3.31 Close Exhaust Fan FN-1362 local disconnect switch (ON position).

8.3.32 On Exhaust Fan FN-1362 VSD, press LOCAL membrane switch HS-13639A and verify REMOTE light on VSD is NOT LIT. Press MANUAL membrane switch HS-13639C and verify AUTO light is NOT LIT.

1 CK 10/1/96 8.3.33 To bump fan FN-1362, press START membrane switch HS-13640A and then press STOP membrane switch HS-13640B. Verify that fan rotation is in the correct direction from the fan side of motor. Restore system to original condition (Open Exhaust Fan FN-1362 local disconnect switch and breaker MCC-N1/2FML, and then remove jumper installed in Step 8.3.30).

8.4 FINAL ELECTRICAL EQUIPMENT LINEUP FOR TESTING OF EXHAUST SKID

FINAL ELECTRICAL EQUIPMENT LINEUP			
LOCATION	PERFORM/VERIFY	INITIAL	DATE
MCC-N1	MCC-N1/2FML and 2FMR Exhaust Skid: ON	1 CK	10/1/96
Exhaust Skid	Exhaust Skid Main Disconnect Switch: ON		
Exhaust Skid	Panelboard C106-PP5 480 V MAIN BREAKER: ON		
Exhaust Skid	Panelboard C106-PP5 120/240 V SECONDARY MAIN BREAKER: ON		
Exhaust Skid	C106-PP5 circuit breakers #1, #2, #3, #4, #5, #6, #7, #8: ON		
Exhaust Skid	FN-1362 Exhaust Fan Local Disconnect Switch DS1: OFF	1 CK	10/1/96

END OF SECTION 8

TRANSFER FROM REV 0 BY E.L. SNYDER FOR CLIFF LARSON

9 CHILLER SKID TROUBLE ALARM

The following will simulate the Chiller Skid Trouble to cause an alarm in the Operator Station in Construction Trailer MO-211.

9.1 CHILLER TROUBLE

CAUTION:	Under no circumstances shall the Chiller Skid operation be disturbed during the course of this test. Where requirements require access into the control panel, notify operation personnel for assistance.

TRANSFERRED FROM REV 0 BY F.L. SNYDER FOR CLIFF LARSON

4 Q 10/17/96 9.1.1 In MO-211, annunciator ANN-1361, verify XA-1366 is in NORMAL condition.

9.1.2 At the Chiller Skid, open Chiller Skid control panel, and with the multimeter (MM) set at 100 V dc, verify that 0 V exists between terminal 111 and ground. Verify that approximately 24 V exists between terminal 110 and ~~ground.~~ 111 ECN 760

9.1.3 At the Chiller Skid and with the Chiller Skid control panel open, install shorting jumper with ON-OFF switch in the OFF position between terminals 110 (ANN-1361-6-4) and 111 (ANN-1361-(+).

9.1.4 To simulate Chiller Skid Trouble Alarm XA-1366 in MO-211 construction trailer, set shorting jumper switch to ON position. Verify XA-1366 is in ALERT condition, acknowledge and verify XA-1366 is STEADY ON.

9.1.5 Set shorting jumper switch to OFF position. Reset and verify XA-1366 is in NORMAL condition.

4 Q 10/17/96 9.1.6 In Chiller Skid control panel, remove shorting jumper installed in Step 9.1.3, then close and secure control panel face.

END OF SECTION 9

10 PROCESS VENTILATION SYSTEM

The following will test the instrument monitoring and controls, and final control elements installed into the Tank 241-C-106 Process Ventilation System.

NOTE: Where the following steps indicate the use of a multimeter (MM) to verify the status of the contact, temporarily lift field wiring across this contact to verify the status. Reinstall field wiring after completion of verifications.

10.1 SEAL POT LEVEL

The following will test the seal pot level by simulating the water level.

NOTE: Verification of XA-1368 on ANN-1361 in MO-211 Operator Station will not be performed in this Section.

RGD 3/23/98 10.1.1 Verify Seal Pot has been filled. If not, open valve HV-136103 and fill seal pot.

NOTE: If LAL-1369 has been in alarm condition for long periods of time, temporarily disconnect power source to cool the LDS electronics.

RGD 10.1.2 In Process Building 241-C-91 and in Rm 2, on Instrument Enclosure IE-1361 and on ANN-1362, verify that LAL-1369 and LAH-1369 are in NORMAL condition.

RGD 10.1.3 In Rm 1 and at the Seal Pot, open the cover of LE-1369. Disconnect wire LE-1369-6. Verify LAL-1369 is in ALERT condition.

RGD 10.1.4 Reconnect wire LE-1369-6. On ANN-1362, reset and verify LAL-1369 (NORMAL).

RGD 10.1.5 At Seal Pot, connect shorting jumper to LE-1369 terminal where wiring LE-1369-1 and LE-1369-2 are terminated and the other end to terminal where LE-1369-3 and LE-1369-6 are terminated.

RGD 10.1.6 On ANN-1362, verify, acknowledge and verify LAH-1369 (STEADY ON).

RGD 10.1.7 At Seal Pot, remove shorting jumper.

RGD 10.1.8 On ANN-1362, reset and verify LAH-1369 (NORMAL).

10.2 DRAIN TRAP LEVEL

The following will test the drain trap level by simulating the absence of water.

NOTE:	Verification of XA-1368 on ANN-1361 in MO-211 Operator Station will not be performed in this section. Drain trap must be filled with water prior to start of test.

RD 3/23/98 10.2.1 At annunciator ANN-1362, verify alarm LAL-1368 is in NORMAL condition. If not, fill drain trap with water by opening valves HV-13959 and HV-13694, then close valves and reset and verify LAL-1368 (NORMAL).

RD 10.2.2 In Process Building 241-C-91 and in Rm 2, disconnect lead wire LE-1368-3 from LE-1368. On annunciator ANN-1362, verify that LAL-1368 is in ALERT condition, acknowledge and verify LAL-1368 is STEADY ON.

RD 10.2.3 Reconnect wire LE-1368-3 to LE-1368, then reset and verify LAL-1368 is in NORMAL condition.

10.3 PRESSURE MONITORING SYSTEM

The following will test the pressure monitoring system by simulating the pressure of Tank 241-C-106 vapor space, and simulating the pressure on the inlet side of the heat exchanger HX-1361.

10.3.1 TANK 241-C-106 PRESSURE MONITORING SYSTEM

NOTE 1:	The controller output function from PIC-1361 will not be tested at this time.
NOTE 2:	The evacuation alarm PAL-1361C will be tested in this section. Inform all parties in the vicinity of Tank Farm 241-C, including Shift Manager, that the evacuation alarm will sound within the allocated time and evacuation will not be required.
NOTE 3:	The tolerance for comparing the instrumentation readings between the installed instruments and test instruments will be within ±2% of calibrated span.

4 3/16/98 10.3.1.1 Remove FUSE FU-4 at TB-3 at CP-01 in MO-211.

4 3/16/98 10.3.1.2 Disconnect wires identified as PIT-1361-(+1), and PIT-1361-(COM) at TB1-3 and TB1-4 at instrument enclosure IE-1363.

4 3/16/98 10.3.1.3 Connect MM(+) terminal to TB1-3 and TB1-4 at IE-1363.

✓ 3/16/98	10.3.1.4	Verify PIT-1361 is calibrated to a range of -10" H_2O to +5" H_2O giving an output of 4-20 mA dc.
✓ 3/16/98	10.3.1.5	Open valves HV-13687, HV-136158, and HV-13688.
✓ 3/16/98	10.3.1.6	Verify PSV-13629 is set at 25 psig.
✓ 3/16/98	10.3.1.7	Adjust PCV-13629 to 20 psig as indicated on PI-13629.
✓ 3/16/98	10.3.1.8	At exhaust hatch, open valves HV-13673 ~~and HV-13670~~ (ECN 760) and adjust flow to 3 SCFH as indicated on FI-1362.
✓ 3/16/98	10.3.1.9	Close valves ~~HV-13670 and~~ (ECN 760) HV-13673.
✓ 3/16/98	10.3.1.10	In MO-211, on CP-01 panel, record the calibrated alarm switch setting of the following instruments integral with PIC-1361: PSL-1361: -0- (should be 0" H_2O) PSH-1361: -4 (should be -4" H_2O)
DELETE	~~10.3.1.11~~	~~Disconnect wire identified as PSL-1361-N at TB3-14.~~ ECN 760
✓ 3/16/98	10.3.1.12	At IR-1361, on the 2-valve manifold (2VM) HV-136164, at PIT-1361 verify block valve HV-136164-1A is CLOSED. Open the test port (TP) at valve HV-136164-1B and connect VTVS. Open valve HV-136164-1B.
MOVE TO	10.3.1.~~13~~34 (ECN 760)	Replace FUSE FU-4 at TB-3 at CP-01 in MO-211.
✓ 3/16/98	10.3.1.14	On CP-01, ANN-1361, verify that PAL-1361A is FLASHING and audible is ON.
✓ 3/16/98	10.3.1.15	Acknowledge and verify PAL-1361A is STEADY and audible is OFF. SEE PAGE 30a FOR a-c.
✓ 3/16/98	10.3.1.16	Verify PAH-1361A is OFF.
✓ 3/16/98	10.3.1.17	On IR-1361, decrease VTVS, on PIT-1361, to -1" H_2O. Verify reading on PIT-1361 agrees with reading from VTVS pressure gage.
✓ 3/16/98	10.3.1.18	Verify MM at IE-1363 reads 13.6 mA dc, which corresponds to -1" H_2O.
✓ 3/16/98	10.3.1.19	Verify reading from PIC-1361 agrees with reading from VTVS pressure gage.
✓ 3/16/98	10.3.1.20	With MM, verify closed contact across terminals TB-2-3 and TB-2-4 (Interlock 3).
✓ 3/16/98	10.3.1.21	Decrease VTVS on PIT-1361 to -2" H_2O.
✓ 3/16/98	10.3.1.22	Reset and verify PAL-1361A and PAH-1361A are NORMAL. SEE PAGE 30a FOR STEP a.
✓ 3/16/98	10.3.1.23	Decrease VTVS, on PIT-1361, to -4" H_2O. Verify reading on PIT-1361 agrees with reading from VTVS pressure gage.

Page 30, ✓ 3/16/98 ADD following steps under Step 10.3.1.15, to read as follows:

a. Verify on PIC-1361, the display indicates an alarming state HI PRESS, the red LED light is LIT, and audible is ON.

✓ 3/16/98 *b. On PIC-1361, depress the horn symbol membrane switch and verify the red LED light is NOT LIT, the display indicates a change to HPR and UNACKED, and audible is OFF.*

✓ 3/16/98 *c. Depress the ▲ membrane switch and verify that the display indicates a change to ACKED.*

Page 30, ✓ 3/16/98 ADD following steps under Step 10.3.1.22, to read as follows:

a. On PIC-1361, depress the horn symbol membrane switch and verify display indicates a change to "PIC-1361".

Page 31, ✓ 3/16/98 ADD following steps under Step 10.3.1.27, to read as follows:

a. Verify on PIC-1361, the display indicates an alarming state LO PRESS, the red LED light is LIT, and audible is ON.

✓ 3/16/98 *b. On PIC-1361, depress the horn symbol membrane switch and verify the red LED light is NOT LIT, the display indicates a change to LPR and UNACKED, and audible is OFF.*

✓ 3/16/98 *c. Depress the ▲ membrane switch and verify that the display indicates a change to ACKED.*

Page 31, ✓ 3/16/98 ADD following steps under Step 10.3.1.32, to read as follows:

a. On PIC-1361, depress the horn symbol membrane switch and verify display indicates a change to "PIC-1361".

Page 31, ✓ 3/16/98 ADD following steps under Step 10.3.1.40, to read as follows:

a. Verify on PIC-1361, the display indicates an alarming state HI PRESS, the red LED light is LIT, and audible is ON.

✓ 3/16/98 *b. On PIC-1361, depress the horn symbol membrane switch and verify the red LED light is NOT LIT, the display indicates a change to HPR and UNACKED, and audible is OFF.*

✓ 3/16/98 *c. Depress the ▲ membrane switch and verify that the display indicates a change to ACKED.*

Page 32, ✓ 3/16/98 ADD following steps under Step 10.3.1.49, to read as follows:

a. On PIC-1361, depress the horn symbol membrane switch and verify display indicates a change to "PIC-1361".

✓ 3/16/98	10.3.1.24	Verify MM at IE-1363 reads 10.4 mA dc, which corresponds to -4" H_2O.
✓ 3/16/98	10.3.1.25	Verify reading from PIC-1361 agrees with reading from VTVS pressure gage.
✓ 3/16/98	10.3.1.26	Verify PAH-1361A is FLASHING and audible is ON.
✓ 3/16/98	10.3.1.27	Acknowledge and verify PAH-1361A is STEADY ON and audible is OFF. SEE PAGE 30a FOR STEPS a-c
✓ 3/16/98	10.3.1.28	With a MM, verify an open contact across terminals TB-2-3 and TB-2-4 (Interlock 3).
✓ 3/16/98	10.3.1.29	Increase VTVS, on PIT-1361, to -3" H_2O. Verify reading on PIT-1361 agrees with reading from VTVS pressure gage.
✓ 3/16/98	10.3.1.30	Verify MM at IE-1363 reads 11.49 mA dc, which corresponds to -3" H_2O.
✓ 3/16/98	10.3.1.31	Verify reading from PIC-1361 agrees with reading from VTVS pressure gage.
✓ 3/16/98	10.3.1.32	Reset and verify PAH-1361A is NORMAL. SEE PAGE 30a FOR STEPS a
✓ 3/16/98	10.3.1.33	Verify MM across TB-2-3 and TB-2-4 indicates a closed contact.

NOTE: The following test will cause an evacuation alarm PAL-1361C to sound. Inform all parties in the vicinity of Tank Farm 241-C, including Shift Manager, that the evacuation alarm will sound and evacuation is not required.

~~DELETE~~	~~10.3.1.34~~	~~Connect wire identified as PSL-1361-N at TB3-14.~~ ECN 760
✓ 3/16/98	10.3.1.34	REPLACE FUSE FU-4 AT TB-3 AT CP-01 IN MO211
✓ 3/16/98	10.3.1.35	Relief VTVS, on PIT-1361, pressure to 0" H_2O.
✓ 3/16/98	10.3.1.36	Verify reading on PIT-1361 agrees with reading from VTVS pressure gage.
✓ 3/16/98	10.3.1.37	Verify MM at IE-1363 reads 14.70 mA dc, which corresponds to 0" H_2O.
✓ 3/16/98	10.3.1.38	Verify reading from PIC-1361 agrees with reading from VTVS pressure gage.
✓ 3/16/98	10.3.1.39	Verify PAL-1361A is FLASHING and audible is ON.
✓ 3/16/98	10.3.1.40	Acknowledge and verify PAL-1361A is STEADY ON and audible is OFF. SEE PAGE 30a FOR STEPS a-c
✓ 3/16/98	10.3.1.41	Verify Evacuation Horn is audible.
✓ 3/16/98	10.3.1.42	Depress HS-1361.

✓ 3/16/98 10.3.1.43 Verify Evacuation Horn is OFF and PAL-1361A remains STEADY ON.

✓ 3/16/98 10.3.1.44 Release HS-1361 and verify Evacuation Horn is ON.

✓ 3/16/98 10.3.1.~~45~~47 On the 2VM for PIT-1361, CLOSE valve HV-136164-1B, disconnect VTVS, plug TP, and OPEN block valve HV-136164-1A.

ECN 760

✓ 3/16/98 10.3.1.~~46~~46 Disconnect MM and reconnect wires to TB1-3 and TB1-4.

✓ 3/16/98 10.3.1.~~47~~45 Remove FUSE FU-4 at TB-3 at CP-01 in MO-211.

✓ 3/16/98 10.3.1.~~48~~46 Verify evacuation horn is OFF.

✓ 3/16/98 10.3.1.49 Reset and verify annunciator window PAL-1361A is NORMAL.

See sheet 30a for step a

10.3.2 HEAT EXCHANGER HX-1361 PRESSURE MONITORING SYSTEM

10.3.2.1 In Process Building 241-C-91, Rm 2, on IR-1361 and at PT-13611, 2 valve manifold (2VM) HV-13163:

✓ 3/7/98 a. Close block valve HV-136163-1A.

✓ 3/7/98 b. Open the test port (TP) at valve HV-136163-1B and connect VTPS.

✓ 3/7/98 c. Open valve HV-136163-1B.

✓ 3/7/98 10.3.2.2 On Instrument Enclosure IE-1361, verify PI-13611 reading is 0" H_2O.

✓ 3/7/98 10.3.2.3 Decrease VTVS to -1" H_2O. On IE-1361, verify PI-13611 reading is -1" H_2O.

✓ 3/7/98 10.3.2.4 Decrease VTVS to -5" H_2O. Verify PI-13611 reading is -5" H_2O.

✓ 3/7/98 10.3.2.5 Increase VTVS to 3" H_2O. Verify PI-13611 reading is 3" H_2O.

✓ 3/7/98 10.3.2.6 Relief VTVS to 0" H_2O. Verify PI-13611 reading is 0" H_2O.

✓ 3/7/98 10.3.2.7 Close valve HV-136163-1B, disconnect VTVS, plug TP, and OPEN block valve HV-136163-1A.

10.4 PRESSURE DIFFERENTIAL MONITORING SYSTEM

The following will test by simulating the Heat Exchanger/Condenser HX-1361, High Efficiency Mist Eliminator HME-1361 and High Efficiency Metal Filter HMF-1361 pressure differential to ascertain that the transmitter and panel-mounted instrument functions, and alarms locally.

NOTE 1: Verification of XA-1368 on ANN-1361 in MO-211 Operator Station will not be performed in this section.

NOTE 2: The following steps in this section are generic test procedure to be performed for the instruments listed in Data Sheet 10.4. Use 13611, 13612, and 13613, except where otherwise noted, in lieu of asterisk (*) for each instrument, and use 136162, 136161, and 136160 in lieu of diamond (♦) for each valve as shown in Data Sheet.

TRANSFER FROM REV 0

✓ 10/2/96 10.4.1 In Process Building 241-C-91, on Instrument Enclosure IE-1361, record the reading from PDISH-*: -0-; verify that the reading from PDISH-13611 recorded is below 11" H_2O, and readings from PDISH-13612 / PDISH-13613 recorded is below 10" H_2O.

✓ 10/2/96 10.4.2 On ANN-1362, verify that PDAH-* is in NORMAL condition.

✓ 10/2/96 10.4.3 At PDT-*, on the 5-valve manifold (5VM) HV-♦, open by-pass valves HV-♦-1D and HV-♦-1E, and close low-pressure and high-pressure block valves HV-♦-1A and HV-♦-1B.

✓ 10/2/96 10.4.4 On the 5VM for PDT-*, at the vent port of valve HV-♦-1C, connect VTPS, then open vent valve HV-♦-1C and close by-pass valve HV-♦-1D.

NOTE: Step 10.4.5 applies only to PDT-13611 and PDAH-13611. For Step 10.4.6, use 13612 and 13613 in lieu of asterisk (*) for each instrument as shown in Data Sheet 10.4.

✓ 10/2/96 10.4.5 Increase VTPS, on PDT-13611, to 11" H_2O. Verify PDAH-13611, on ANN-1362, is in ALERT condition, then acknowledge and verify PDAH-13611 is STEADY ON.

✓ 10/2/96 10.4.6 Increase VTPS, on PDT-*, to 10" H_2O. Verify PDAH-*, on ANN-1362, is in ALERT condition, then acknowledge and verify PDAH-* is STEADY ON.

✓ 10/2/96 10.4.7 Verify reading from PDISH-* is the same as that on VTPS.

✓ 10/2/96 10.4.8 Decrease VTPS, on PDT-*, to 0 psi.

✓ 10/2/96 10.4.9 Reset and verify that PDAH-*, on annunciator ANN-1362, is OFF.

✓ 10/2/96 10.4.10 Verify reading from PDISH-* is the same as that on VTPS.

✓ 10/2/96 10.4.11 On the 5VM for PDT-*, open HV-♦-1D, close vent valve HV-♦-1C, disconnect VTPS from the vent port, then open block valves HV-♦-1A and HV-♦-1B. close HV-♦-1D and HV-♦-1E.

✓ 10/2/96 10.4.12 Verify PDISH-* reading is approximately the same as that recorded in Step 10.4.1.

DATA SHEET 10.4							
STEP	PERFORM/VERIFY	PDT-*/PDISH-*/HV-♦					
		13611	136162	13612	136161	13613	136160
10.4.1	Record reading from PDISH-*. Verify reading is below alarm setpoint of ? H_2O	11 ✓		10 ✓		10 ✓	
10.4.2	Verify PDAH-* is in NORMAL condition	✓		✓		✓	
10.4.3	Open HV-♦-1D & HV-♦-1E. Close HV-♦-1A and HV-♦-1B.		✓		✓		✓
10.4.4	Connect VTPS, open HV-♦-1C and close HV-♦-1D		✓		✓		✓
10.4.6	Increase VTPS to 10" H_2O. Verify, acknowledge and verify PDAH-*			✓		✓	
10.4.7	Verify reading from PDISH-* is 10" H_2O	✓		✓		✓	
10.4.8	Decrease VTPS to 0" H_2O		✓		✓		✓
10.4.9	Reset and verify PDAH-*	✓		✓		✓	
10.4.10	Verify reading from PDISH-* is 0" H_2O	✓		✓		✓	
10.4.11	Open HV-♦-1D, close HV-♦-1C, disconnect VTPS, then open HV-♦-1A and HV-♦-1B. Close HV-♦-1D and HV-♦-1E.		✓		✓		✓
10.4.12	Verify reading from PDISH-* is the same as that recorded in Step 10.4.1	✓		✓		✓	
	Test completed by/date:	✓ 10/2/96	✓ 10/2/96	✓ 10/2/96	✓ 10/2/96	✓ 10/2/96	✓ 10/2/96

Transfer from Rev 0

10.5 HME-1361/HMF-1361 RADIATION MONITOR

ECN 765

The following will verify the operation of the radiation monitoring of the HME-1361/HMF-1361 by use of radiation source to simulate activities, and to ascertain that the local and remote alarms functions. The following will also verify the operation of the radiation monitoring system by disconnecting the detector to simulate system failure, and to ascertain that the local and remote alarms functions.

CAUTION: A radiation source will be present during the course of this test procedure. Only the HPT will handle the radiation source; they shall receive directions from this test procedure.

10.5.1 PREPARATION

R 10.5.1.1 Verify that the applicable steps in Sections 7 and 8 have been completed. 3/24/98

R 10.5.1.2 Power is available to RIT-1361/RSH-1361/RXS-1361 located on rack IR-1361 and enclosure IE-1361.

R 10.5.1.3 Familiarize with "indicators and Alarms" section of vendor (Nuclear Research Corporation) Operations and maintenance manual. Reference to CVI No. 22668. Supplement No. 133.)

R 10.5.1.4 In 241-C-91 and on IE-1361 (ANN-1362), depress Reset pushbutton and verify annunciator windows RAH-1361 and RXA-1361 are NORMAL.

R 10.5.1.5 In MO-211 and on CP-01 (ANN-1361), depress Reset pushbutton and verify annunciator windows RAH-1361A and XA-1368 are NORMAL.

10.5.2 RADIATION MONITORING TESTS

CAUTION: Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.

R 10.5.2.1 On RIT-1361/RSH-1361/RXS-1361, open door and position AC power-supply switch to ON, close and secure door, then turn the key switch on the front panel to the KEYPAD position.

R 10.5.2.2 When the indicator display defaults to gamma dose rate in mR/hr, then perform the following:

R a. Record background reading from the display: .014 mR/hr. Verify background reading is below 7.50 mR/hr.

R b. Verify top mounted green lamp is LIT.

R c. Depress momentarily the CHECK SOURCE membrane switch on the front panel, record the time 8 sec. and upscale (check source) reading 6.8 mR/hr when the check source is energized. (This reading should be approximately one decade above the background reading recorded in Step a. above.

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RO d. Record the time when the upscale reading changed back to the reading recorded in Step a. above. (This time should be approximately 30 seconds, the time required for the check source to retract.)
3/24/98

10.5.2.3 On RIT-1361/RSH-1361/RXS-1361, verify the following:

RO a. The top mounted red lamp is FLASHING.

RO b. The red alert light is LIT.

RO c. The audible horn is ON.

10.5.2.4 Verify the following alarms and lights:

RO a. At IE-1361 and on ANN-1362, RAH-1361 is FLASHING and audible horn is ON.

RO b. Strobe light RLH-1361 on Bldg 241-C-91 is FLASHING.

RO c. At CP-01 and on ANN-1361, RAH-1361A and XA-1368 are FLASHING and audible horn is ON.

RO d. In 2750-E Bldg, RAH-1361B displays message at TMACS screen.

10.5.2.5 On RIT-1361/RSH-1361/RXS-1361:

RO a. Depress RESET membrane switch on front panel face.

RO b. Verify top mounted red lamp is NOT LIT.

RO c. Verify integral red alert light is NOT LIT

RO d. Verify top mounted green lamp is LIT.

RO e. Verify the audible horn is OFF

RO 10.5.2.6 3/24/98 Strobe light RLH-1361 on Bldg 241-C-91 is OFF.

RO 10.5.2.7 3/24/98 At IE-1361 and on ANN-1362, depress acknowledge and verify RAH-1361 is STEADY ON and the audible horn is OFF. Then depress RESET and verify RAH-1361 is NORMAL.

RO 10.5.2.8 3/24/98 At CP-01 and on ANN-1361, depress acknowledge and verify RAH-1361A and XA-1368 is STEADY ON and the audible horn is OFF. Then depress RESET and verify RAH-1361A and XA-1368 is NORMAL.

RO 10.5.2.9 3/24/98 In 2750-E Bldg, verify RAH-1361B does NOT display a message at TMACS screen.

RO 10.5.2.10 3/24/98 Depress and hold the TEST membrane switch on the front panel face, and verify that all Visual Displays, indicator lamps, and horn on the Radiation Monitor unit operate as designed (Refer to section 1.2 of Vendor operations and maintenance manual. Also verify the following:

RO a. The top mounted red lamp is FLASHING.

RO b. The top mounted green lamp is LIT.

RO c. The integral red alert light is LIT.

RO d. The integral yellow fail light is LIT.

RO e. The audible horn is ON.

RO f. Annunciator windows RAH-1361 and RXA-1361 on ANN-1362 are FLASHING and audible is ON.

RO g. Strobe Light RLH-1361 on the Building 241-C-91 is FLASHING.

h. 3/24/98 Annunciator windows RAH-1361A and XA-1368 on ANN-1361 at CP-01 are FLASHING and audible is ON.

i. In 2750-E Bldg, RAH-1361B displays message at TMACS screen.

10.5.2.11 Acknowledge and verify the following:

a. Annunciator windows RAH-1361 and RXA-1361 on ANN-1362 at IE-1361 is STEADY ON and audible is OFF.

b. Annunciator windows RAH-1361A and XA-1368 at MO-211 are STEADY ON and audible is OFF.

10.5.2.12 RELEASE the TEST membrane switch on the front panel and verify all visual displays, indicator lamps, and horns on the Radiation Monitor unit are OFF, except for the green stack lamp. Reset alarms listed in Step 10.5.2.11 and verify annunciator windows are NORMAL.

10.5.2.13 In 2750-E Bldg, verify RAH-1361B does NOT display a message at TMACS screen.

10.5.2.14 Turn key switch on the front panel to ON.

10.5.2.15 Record radiation test source (RTS) gamma radiation field: 112 mR/hr

10.5.2.16 In Rm 1, slowly move the RTS towards RE-1361 along the major axis perpendicular to it. During this activity, verify the following:

a. On RIT-1361, that the indicator display goes through FLASHING "A", the audible horn is ON, and the integral amber alert light is LIT, before the top mounted red lamp is FLASHING.

b. Annunciator window RAH-1361 on ANN-1362 is FLASHING and audible is ON.

c. Strobe Light RLH-1361 on the Building 241-C-91 is FLASHING.

d. Annunciator windows RAH-1361A and XA-1368 at MO-211 are FLASHING and audible is ON.

e. In 2750-E Bldg, RAH-1361B displays message at TMACS screen.

10.5.2.17 Acknowledge and verify the following:

a. Annunciator window RAH-1361 on ANN-1362 at IE-1361 is STEADY ON and audible is OFF.

b. Annunciator windows RAH-1361A and XA-1368 at MO-211 are STEADY ON and audible is OFF.

10.5.2.18 Verify that the strobe light RLH-1361 on the Building 241-C-91 is still FLASHING.

10.5.2.19 On RIT-1361/RSH-1361/RXS-1361, verify the following:

a. A flashing "H" appeared on the display.

b. The top mounted green lamp is NOT LIT.

c. The top mounted red lamp is FLASHING.

d. The integral red alert light is LIT

e. The integral horn is AUDIBLE.

10.5.2.20 On the keypad, depress RESET membrane switch and verify that a flashing "H" is still displayed, the top mounted red lamp continues to FLASH, the integral red alert light is still LIT, and the horn is SILENCED.

10.5.2.21 Verify that the strobe light RLH-1361 on the Building 241-C-91 continues FLASHING.

10.5.2.22 Record reading from RIT-1361/RSH-1361/RXS-1361 display: 32 mR/hr. Verify reading recorded is within ±10% of that recorded in Step 10.5.2.15.

3/24/98

RO 10.5.2.23 Remove RTS from the detector, then perform the following:
3/24/98

Exc #4 a. On RIT-1361/RSH-1361/RXS-1361, verify that a flashing "H" has disappeared from the display, the integral red light is LIT, the top mounted red lamp is LIT, the top mounted green lamp is LIT, and the integral yellow fail light is NOT LIT.
See ECN #801

Exc #4 b. Verify that the strobe light RLH-1361 on the Building 241-C-91 is LIT.

RO c. On RIT-1361/RSH-1361/RXS-1361, depress RESET membrane switch, then verify that the integral red light is NOT LIT, the top mounted red lamp is NOT LIT, the top mounted green lamp is LIT, and the integral yellow fail light is NOT LIT.

RO d. On ANN-1362, reset and verify RAH-1361 is in NORMAL condition.

RO e. On ANN-1361, reset and verify RAH-1361A and XA-1368 are in NORMAL condition.

RO f. In 2750-E Bldg, verify RAH-1361B does NOT display a message at TMACS screen.

RO 10.5.2.24 On RIT-1361/RSH-1361/RXS-1361, turn key switch to KEYPAD position. Verify that the upscale reading recorded in Step 10.5.2.23 changed back to the previous reading recorded on Step 10.5.2.2a.

NOTE: The reading to be recorded in the following step will be the result from the cumulative monitoring by the radiation detector to the gamma radiation field (from background and from RTS) over a period of time and will not be verified at this time.

RO 10.5.2.25 Depress MODE membrane switch until the display indicates gamma accumulated DOSE in mR, then record reading: 1.7 mR

RO 10.5.2.26 Depress MODE membrane switch until the display indicates the background gamma DOSE RATE in mR/hr.

RO 10.5.2.27 On RIT-1361/RSH-1361/RXS-1361, disconnect cable from RE-1361 connected to the connector labelled "PROBE 2 (J2)." After about 2 ½ minutes, verify the following:

RO a. The NO COUNT failure message appeared on the display

RO b. The top mounted green lamp is NOT LIT

RO c. The top mounted red lamp is NOT LIT

RO d. The integral horn is INAUDIBLE

RO e. The integral red alert light is NOT LIT

RO f. The integral yellow fail light is LIT

RO 10.5.2.28 Verify RXA-1361 on ANN-1362, and XA-1368 on ANN-1361 are FLASHING and audible is ON.

RO 10.5.2.29 Acknowledge and verify RXA-1361 on ANN-1362 at IE-1361 and XA-1368 on ANN-1361 are STEADY and audible is OFF.

RO 10.5.2.30 On RIT-1361/RSH-1361/RXS-1361, reconnect cable from RE-1361 disconnected from the connector in Step 10.5.2.28. Depress RESET membrane switch and verify the following:

RO a. The NO COUNT failure message disappeared from the display and display indicates mR/hr

RO b. The top mounted green lamp is LIT
3/24/98

RD c. 3/24/98 The top mounted red lamp is NOT LIT

RD d. The integral red alert light is NOT LIT

RD e. The integral yellow fail light is NOT LIT

RD 10.5.2.31 3/24/98 Reset and verify RXA-1361 on ANN-1362, and XA-1368 on ANN-1361 all went from STEADY ON to NORMAL condition.

10.6 HEATER CONTROL SYSTEMS

The following will check the Heating Coils HC-1361 and HC-1362 temperature controller and heating coils sheath over temperature cutout switches function as designed to limit the temperature below 80% of auto ignition temperature for Hydrogen (780 °F).

CAUTION: Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.

10.6.1 RECIRCULATION AIR HEATER HC-1361

✓ 3/12/98 10.6.1.1 Verify Disconnect DS-3 at ER-1361 and 100 A Disconnect DISC on SCP-1361 and HS-13622 are OPEN.

✓ 3/12/98 10.6.1.2 Remove FUSE FU-6 at SCP-1361.

✓ 3/12/98 10.6.1.3 Lift wires from TIC-13622 terminals 7, 8, and 9. Replace with RTD simulator.

✓ 3/12/98 ECN 460 SEE 10.6.1.11a 10.6.1.4 Record and verify setpoints on TISH-13610A,B,C (set by the vendor) are at a value less than 650 °F.

TISH-13610A: 485 TISH-13610B: 485 TISH-13610C: 485

✓ 3/12/98 10.6.1.5 In SCP-1361, install switchable Open/Close jumper at TB1-1 and TB1-2 and set in OPEN position. (This jumper will simulate FN-1361 shutdown interlock to trip heater.)

✓ 3/12/98 10.6.1.6 Replace FUSE FU-6 at SCP-1361.

✓ 3/12/98 10.6.1.7 Close Heating Coil Disconnect DS-3 at ER-1361, and disconnect DISC on SCP-1361 for the HC-1361.

✓ 3/12/98 10.6.1.8 Verify Power On light YL-13622A is LIT, and Heater On light YL-13622B is not LIT.

✓ 3/12/98 ECN 765 SEE 10.6.1.13a 10.6.1.9 Close switchable jumper at TB1-1 and TB1-2, and HS-13622 at SCP-1361.

✓ 3/12/98 10.6.1.10 Using the MM, measure and verify that all 3 phase-to-phase voltages on the line side of the HC-1361 heating coil controller, SCP-1361, are in the range of 456 to 504 V ac.

✓ 3/12/98 ~~10.6.1.11~~ 10.6.1.11 Verify TIC-13622 and TISH-13610A,B,C upper display indicates process variable and lower display indicates the set point.

✓ 3/12/98 10.6.1.11a SEE STEP 10.6.1.4 ECN 460

✓ 3/12/98 10.6.1.12 Using instructions in sections 3 and 4 of Chromalox vendor technical manual for TIC-13622, verify the following information:

✓ 3/12/98 a. From DISP page MENU verify Ramp/Soak ~~Interval number~~ STATUS display shows OFF. ECN 760

b. From CTRL page MENU verify the following:

✓ 3/12/98 Proportional Band is set at 5 °F.

✓ 3/12/98 Automatic Reset 1 is set at 0.11.

✓ 3/12/98 Rate 1 is set at 10.

3/12/98			Manual Reset is set at ZERO.
3/12/98			Fuzzy Logic is set ON.
3/12/98			Open Sensor Output Command is set at ZERO.
3/12/98			Auto/Manual Disintegration timer is set at 10.
3/12/98			Remote Setpoint Enable is set OFF.
3/12/98			Ramp/Soak is OFF.
3/12/98	10.6.1.13	On TIC-13622 front panel, set the setpoint to read 77 °F.	
3/12/98	10.6.1.13a	SEE 10.6.1.9 ECN 765	
3/12/98	10.6.1.14	With RTD simulator connected in Step 10.6.1.3, verify the following:	
3/12/98		a.	Adjust input at TIC-13622 to simulate process input temperature of 67 °F, i.e., 10 °F below the set point. Measure current output by Clamp On Ammeter at each phase of the heater.
3/12/98		b.	Record current output: A 36.3 B 36.6 C 36.7
3/12/98		c.	Verify HEATER ON light is LIT.
3/12/98		d.	Disconnect thermocouple wire at Terminal 8 ~~AND RESET~~ at TISH-13610A. Verify current output shown on Clamp On Ammeter is ZERO and HEATER ON light is NOT LIT.
3/12/98		e.	Reconnect thermocouple wire at Terminal 8 AND RESET ECN 765 at TISH-13610A. Verify current output shown on Clamp On Ammeter increases and HEATER ON light is LIT.
3/12/98		f.	Disconnect thermocouple wire at Terminal 8 at TISH-13610B. Verify current output shown on Clamp On Ammeter is ZERO and HEATER ON light is NOT LIT.
3/12/98		g.	Reconnect thermocouple wire at Terminal 8 AND RESET ECN 765 at TISH-13610B. Verify current output shown on Clamp On Ammeter increases and HEATER ON light is LIT.
3/12/98		h.	Disconnect thermocouple wire at Terminal 8 at TISH-13610C. Verify current output shown on Clamp On Ammeter is ZERO and HEATER ON light is NOT LIT.
3/12/98		i.	Reconnect thermocouple wire at Terminal 8 AND RESET ECN 765 at TISH-13610C. Verify current output shown on Clamp On Ammeter increases and HEATER ON light is LIT.
3/12/98	10.6.1.15	Open switchable jumper at TB1-1 and TB1-2 in SCP-1361 and verify curent output shown on Clamp On Ammeter is Zero.	
3/12/98	10.6.1.16	Close switchable jumper.	

3/12/98 10.6.1.17 Adjust input at TIC-13622 to simulate process input temperature to ~~74.5~~ 75 ECN 765 °F.

3/12/98 10.6.1.18 Record total duration of HEATER ON/OFF cycle: 1 SEC From this data:

3/12/98 a. Verify ~~HEATER ON~~ OUT 1 ECN 765 light on TIC-13622 is LIT for 50% of the cycle.

3/12/98 b. Verify current output shown on Clamp On Ammeter cycles ~~between ZERO amp to the value shown in Step 10.6.1.14b.~~ ECN 765

3/12/98 10.6.1.19 Adjust input at TIC-13622 to simulate process input temperature of 87 °F, i.e., 10 °F above the set point. Measure current output by Clamp On Ammeter at each phase of the heater.

a. Verify current output is ZERO. ECN 765

b. Verify ~~HEATER ON~~ OUT 1 light on TIC 13622 is NOT LIT.

3/12/98 10.6.1.20 Open the Heating Coil Disconnect DS-3 at ER-1361, HS-13622, and Disconnect DISC at SCP-1361.

3/12/98 10.6.1.21 Remove switchable jumper at TB1-1 and TB1-2 in SCP-1361.

3/12/98 10.6.1.22 Remove the MMs and RTD simulator from TIC-13622; and restore wiring to original condition.

10.6.2 EXHAUST AIR HEATER HC-1362

3/12/98 10.6.2.1 Verify 100 A Disconnect DISC on SCP-1362 and HS-13630 are OPEN.

3/12/98 10.6.2.2 Remove FUSE FU-6 at SCP-1362.

3/12/98 10.6.2.3 Lift wires from TIC-13629 Terminals 7 and 9. Replace with transmitter simulator.

SEE 10.6.2.11a 10.6.2.~~4~~ 11a ECN ~~470~~ 760 Record and verify setpoints on TISH-13634A,B,C. (set by the vendor) are at a value less than 650 °F.

TISH-13634A: 485 TISH-13634B: 485 TISH-13634C: 485

3/12/98 10.6.2.5 Install switchable Open/Close jumper in OPEN position at TB1-1 and TB1-2 in SCP-1362. (This will simulate FN-1362 shutdown interlock to trip heater.)

3/12/98 10.6.2.6 Replace FUSE FU-6 at SCP-1362.

3/12/98 10.6.2.7 Close disconnect DISC at SCP-1362.

3/12/98 10.6.2.8 Verify Power On light YL-13629A is LIT, and Heater On light YL-13629B is NOT LIT.

3/12/98 10.6.2.~~9~~ 13a ECN 765 Close HS-13630 and switchable jumper at TB1-1 and TB1-2 in SCP-1362.

✓ 3/12/98 10.6.2.10 Using the MM, measure and verify that all 3 phase-to-phase voltages on the line side of HC-1362 heating coil controller, SCP-1362 are in the range of 456 - 504 V ac.

✓ 3/12/98 10.6.2.11 Verify TIC-13629 and TISH-13634A,B,C upper display indicates process variable and lower display indicates the set point.

✓ 3/12/98 10.6.2.11a SEE STEP 10.6.2.4 ECN 760

10.6.2.12 Using instructions in sections 3 and 4 of vendor technical manual for TIC-13629, verify the following information:

✓ 3/12/98 a. From DISP page MENU verify Ramp/Soak ~~Interval number~~ STATUS ECN 760 display shows OFF.

b. From CTRL page MENU verify the following:

✓ 3/12/98 Proportional Band is set at 5 °F.

Automatic Reset 1 is set at 0.11.

Rate 1 is set at 10.

Manual Reset is set at ZERO.

Fuzzy Logic is set ON.

Open Sensor Output Command is set at ZERO.

Auto/Manual Disintegration timer is set at 10.

Remote Setpoint Enable is set OFF.

✓ 3/12/98 Ramp/Soak is OFF.

✓ 3/12/98 10.6.2.13 On TIC-13629, set the setpoint to read 53 °F.

✓ 3/12/98 10.6.2.13a SEE 10.6.2.9 ECN 765

✓ 3/12/98 10.6.2.14 Apply a 4-20 mA signal to the input to TIC-13629, and verify the following:

✓ 3/12/98 a. Adjust input at TIC-13629 to simulate process feedback input temperature of 43 °F i.e., 10 °F below the set point. Measure current output by Clamp On Ammeter at each phase of the heater.

✓ 3/12/98 b. Record current output: A 3.7 B 3.9 C 3.7

✓ 3/12/98 c. Verify Heater On light YL-13629B is LIT.

✓ 3/12/98 d. Disconnect wire at Terminal 8 at TISH-13634A. Verify current output shown on Clamp On Ammeter is ZERO and HEATER ON light is NOT LIT.

✓ 3/12/98 e. Reconnect wire at Terminal 8 And Reset ECN# 789 at TISH-13634A. Verify current output shown on Clamp On Ammeter increases and HEATER ON light is LIT.

✓ 3/12/98 f. Disconnect wire at Terminal 8 at TISH-13634B. Verify current output shown on Clamp On Ammeter is ZERO and HEATER ON light is NOT LIT.

✓ 3/12/98 g. Reconnect wire at Terminal 8 (And Reset ECN # 789) at TISH-13634B. Verify current output shown on Clamp On Ammeter increases and HEATER ON light is LIT.

✓ 3/12/98 h. Disconnect wire at Terminal 8 at TISH-13634C. Verify current output shown on Clamp On Ammeter is ZERO and HEATER ON light is NOT LIT.

✓ 3/12/98 i. Reconnect wire at Terminal 8 (And Reset ECN 789) at TISH-13634C. Verify current output shown on Clamp On Ammeter increases and HEATER ON light is LIT.

✓ 3/12/98 10.6.2.15 Open switchable jumper at TB1-1 and TB1-2 in SCP-1362, and verify current output shown on Clamp On Ammeter is ZERO.

✓ 3/12/98 10.6.2.16. Close switchable jumper.

✓ 3/12/98 10.6.2.17 Adjust input at TIC-13629 to simulate process input temperature to 50.5 °F.

✓ 3/12/98 10.6.2.18 Record total duration of HEATER ON/OFF cycle: 1 SEC. From this data:

✓ 3/12/98 a. Verify ~~HEATER ON~~ OUT 1 light (on TIC 13629 ECN 765) is LIT for 50% of the total time.

✓ 3/12/98 b. Verify current output shown on Clamp On Ammeter cycles ~~between ZERO amp to the value shown in Step 10.6.2.14b.~~ ECN765

✓ 3/12/98 10.6.2.19 Adjust input at TIC-13629 to simulate process input temperature of 63 °F, i.e., 10 °F above the set point. Measure current output by Clamp On Ammeter at each phase of the heater.

✓ 3/12/98 a. Verify current output is ZERO.

✓ 3/12/98 b. Verify ~~HEATER ON~~ OUT 1 light (on TIC 13629) is NOT LIT.

✓ 3/12/98 10.6.2.20 Open HS-13630 and Disconnect at SCP-1362.

✓ 3/12/98 10.6.2.21 Remove switchable jumper at TB1-1 and TB1-2 in SCP-1362.

✓ 3/12/98 10.6.2.22 Remove Transmitter Simulator from TIC-13629; and restore wiring to original condition.

10.7 TEMPERATURE CONTROL SYSTEM *

RD for C.L. 5/7/98 Completed Rev 0 SEE Note Page # 4

10.7.1 RECIRCULATION TEMPERATURE MONITORING AND CONTROL SYSTEM

10.7.1.1 On TISH-13620, disconnect RTD wires from TE-13620. Connect RTD simulator.

RD for C.L 5/7/98 10.7.1.2 Increase RTD temperature to 120 °F. Verify TAH-13620 is in ALERT condition, then acknowledge and verify TAH-13620 is STEADY ON.

* RD transferred signature for Curt Larsen.

RD 5/7/98 10.7.1.3 On ANN-1361, verify XA-1368 is in ALERT condition, then acknowledge and verify XA-1368 is STEADY ON.

RD ____ 10.7.1.4 Decrease RTD to 115 °F. Depress RESET pushbutton and verify alarm TAH-13620 is in NORMAL condition.

RD ____ 10.7.1.5 On ANN-1361, depress RESET pushbutton and verify alarm XA-1368 is in NORMAL condition.

RD ____ 10.7.1.6 Disconnect RTD simulator from TISH-13620 and reconnect TE-13620 RTD wires.

RD ____ 10.7.1.7 On TISH-13621, disconnect RTD wires from TE-13621. Connect RTD simulator.

RD ____ 10.7.1.8 Increase RTD simulator output to 45 °F. Verify TAH-13621 is in ALARM condition, then acknowledge and verify TAH-13621 is STEADY ON.

RD ____ 10.7.1.9 On ANN-1361, verify XA-1368 is in ALERT condition, then acknowledge and verify XA-1368 is STEADY ON.

RD ____ 10.7.1.10 Decrease RTD simulator to 43 °F. Depress RESET pushbutton and verify alarm TAH-13621 is in NORMAL condition.

RD ____ 10.7.1.11 On ANN-1361, depress RESET pushbutton and verify alarm XA-1368 is in NORMAL condition.

RD ____ 10.7.1.12 Disconnect RTD simulator from TISH-13621 and reconnect TE-13621 RTD wires.

RD ____ 10.7.1.13 On TISH-13625, disconnect RTD wires from TE-13625. Connect RTD simulator.

RD ____ 10.7.1.14 Increase RTD simulator output to 60 °F. Verify TAH-13625 is in ALARM condition, then acknowledge and verify TAH-13625 is STEADY ON.

RD ____ 10.7.1.15 On ANN-1361, verify XA-1368 is in ALERT condition, then acknowledge and verify XA-1368 is STEADY ON.

RD ____ 10.7.1.16 Decrease RTD simulator to 55 °F. Depress RESET pushbutton and verify alarm TAH-13625 is in NORMAL condition.

RD ____ 10.7.1.17 On ANN-1361, depress RESET pushbutton and verify alarm XA-1368 is in NORMAL condition.

RD ____ 10.7.1.18 Disconnect RTD simulator from TISH-13625 and reconnect TE-13625 RTD wires.

SEE Note Page #4
* RD signed for Curt Larsen 5/7/98

10.7.2 EXHAUST TEMP MONITORING

ECN 480 OR DECADE BOX

✓ 3/12/98 10.7.2.1 On TIT-13626, disconnect wires from TE-13626. Connect RTD simulator. Lift lead on Fan FN-1362 M/4 contact to simulate HVAC Trouble Alarm XA-13640.

✓ 3/12/98 10.7.2.2 Reset and verify annunciator window XA-13640 in ANN-1361 at MO-211 is NORMAL.

✓ 3/12/98 10.7.2.3 Increase RTD simulator (OR DECADE BOX ECN 480) output to 60 °F. Verify light FILTER INLET TEMP. HIGH (TLH-13626) light is LIT.

✓ 3/12/98 10.7.2.4 On ANN-1361, verify XA-13640 is FLASHING and audible is ON.

✓ 3/12/98 10.7.2.5 Acknowledge and verify XA-13640 is STEADY ON and audible is OFF.

✓ 3/12/98 10.7.2.6 Decrease RTD simulator (OR DECADE BOX ECN 480) to 50 °F. Verify TLH-13626 is NOT LIT.

✓ 3/12/98 10.7.2.7 On ANN-1361, depress RESET pushbutton and verify alarm XA-13640 is in NORMAL condition.

✓ 3/12/98 10.7.2.8 Disconnect RTD simulator (OR DECADE BOX ECN 480) from TIT-13626 and reconnect TE-13626 wires.

✓ 3/12/98 10.7.2.9 On TIT-13635, disconnect wires from TE-13635. Connect RTD simulator. (OR DECADE BOX ECN 420)

✓ 3/12/98 10.7.2.10 Increase RTD simulator (OR DECADE BOX ECN 480) output to 200 °F. Verify light "FILTER OUTLET TEMP HIGH" (TLH-13635) is LIT.

✓ 3/12/98 10.7.2.11 On ANN-1361, verify XA-13640 is FLASHING and audible is ON.

✓ 3/12/98 10.7.2.12 Acknowledge and verify XA-13640 is STEADY ON.

✓ 3/12/98 10.7.2.13 Decrease RTD simulator (OR DECADE BOX ECN 480) to 180 °F. Verify TLH-13635 is NOT LIT.

✓ 3/12/98 10.7.2.14 On ANN-1361, depress RESET pushbutton and verify alarm XA-13640 is in NORMAL condition.

✓ 3/12/98 10.7.2.15 Disconnect RTD simulator (OR DECADE BOX ECN 480) from TIT-13635 and reconnect TE-13635 wires.

✓ 3/12/98 10.7.2.16 Reconnect wire on M/4 contact lifted in Step 10.7.2.1.

10.8 RECIRCULATION FAN FN-1361 CONTROL SYSTEM

The following will test the Recirculation Fan controls.

NOTE: Verification of XA-1362A and XA-1368 on ANN-1361 in MO-211 Operator Station will not be performed in this Section

CAUTION: Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.

✓ 3/17/98	10.8.1	Disconnect wires at the output of IT-13635 and connect transmitter simulator to them. Increase transmitter simulator signal to 15.7 mA. Verify IISH-13635 indicates 11 A.
✓ 3/17/98	10.8.2	On ANN-1362 verify alarm IAH-13635 is FLASHING and audible is ON.
✓ 3/17/98	10.8.3	Acknowledge and verify IAH-13635 is STEADY ON and audible is OFF. Acknowledge and Reset ANN-1361. ECN # 789
✓ 3/17/98	10.8.4	Disconnect transmitter simulator, and reconnect output wires to IT-13635.
✓ 3/17/98	10.8.5	On ANN-1362, depress RESET pushbutton and verify alarm IAH-13635 is in NORMAL condition.
✓ 3/17/98	10.8.6	Close the Recirculation Fan circuit breaker, DS-4, (ON position).
✓ 3/17/98	10.8.7	At IE-1361, verify IISH-13635 indicates 0 A.
✓ 3/17/98	10.8.8	Start the fan using pushbutton HS-13635A on IE-1361.
✓ 3/17/98	10.8.9	Verify that fan starts and that "FAN ON" light YL-13635A on IE-1361 is LIT.
✓ 3/17/98	10.8.10	Observe the motor current on IISH-13635 at IE-1361, and verify it is between 5 and 11A.
✓ 3/17/98	10.8.11	Stop the fan using pushbutton HS-13635B on IE-1361.
✓ 3/17/98	10.8.12	Verify FAN OFF light YL-13635B is LIT and FAN ON light YL-13635A is NOT LIT.

10.9 HEME HME-1361/HEMF HMF-1361 FLUSHING TEST

10.9.1 HMF-1361 FLUSHING

> **NOTE:** Prior to starting the test for HMF-1361 Flushing, notify LMHC Tank Farm Operations that approximately 60 gallons of flush water will be drained to Tank 241-C-106.

✓ 3/12/98 10.9.1.1 Close/verify valves HV-13637, HV-13647, HV-13648, HV-13681, and HV-13682 are closed.

✓ 3/12/98 10.9.1.2 In Building 241-C-73, the Air Compressor CPR-1361 is operating, and on ANN-1364, PAL-1364 is in NORMAL condition.

✓ 3/12/98 10.9.1.3 On IE-1361, turn HS-13638 to CLOSED position and verify that HV-13638 is in CLOSED position by observing CLOSED light ZLL-13638 is LIT, and OPEN light ZLH-13638 is NOT LIT.

✓ 3/12/98 10.9.1.4 On IE-1361, verify AIR BLEED valves control switches HS-13625 and HS-13626 are in the CLOSED position.

10.9.1.5 Open the following valves sequentially:

✓ 3/12/98 a. HV-13684

✓ 3/12/98 b. HV-13681

✓ 3/12/98 c. HV-13689

✓ 3/12/98 d. HV-13687

✓ 3/12/98 e. HV-13678

✓ 3/12/98 10.9.1.6 Verify that PI-13630 is registering 100 ±5psig.

✓ 3/12/98 10.9.1.7 Record initial reading from FQI-13629 (located at process building):

-0- gal

✓ 3/12/98 10.9.1.8 Sequentially close HV-13681; then open ~~HV-13682 and~~ HV-13637. ECN 265

✓ 3/12/98 10.9.1.9 Turn HS-13625 and HS-13626 (on IE-1361) to the OPEN position.

✓ 3/12/98 10.9.1.10 Sequentially open HV-13663, HV-13664, HV-13665, and HV-13666.

✓ 3/12/98 10.9.1.11 Close HV-13666 after FQI-13629 registers approximately 60 gal in addition to that recorded in Step 10.9.1.7.

✓ 3/12/98 10.9.1.12 OPEN HV-13682, THEN ECN 265 Turn HS-13638 (on IE-1361) to the OPEN position (verify ZLH-13638 is LIT and ZLL-13638 is NOT LIT). Record time valve HV-13638 OPENED: 10:15

10.9.1.13 In Rm 1, verify valve HV-13638 opened.

10.9.1.14 Approximately 20 minutes after opening valve HV-13638, SEQUENTIALLY close valve HV-13638 by turning HS-13638 (on IE-1361) to the CLOSE position (verify ZLH-13638 is NOT LIT and ZLL-13638 is LIT), close valve HV-13637, and close valve HV-13682.

10.9.1.15 In Rm 1, verify valve HV-13638 is closed.

10.9.1.16 Open valves HV-13647 and HV-13648, and close valves opened in Step 10.9.1.5 and 10.9.1.10.

10.9.2 HEME HME-1361 MIST SPRAY

10.9.2.1 Open valves HV-13671, HV-13687, and HV-13658.

10.9.2.2 Verify timers KY-1361A/KY-1361B at IE-1361 are set for one minute and 59 minutes, respectively. If not, adjust timers as required.

10.9.2.3 Open sequentially HV-13663, HV-13664, and HV-13665.

10.9.2.4 Set HS-13669 to OPEN and verify PI-13631 indicates approximately 40 psi; if not, adjust PCV-1367.

10.9.2.5 At IE-1361 set handswitch HS-13669 to AUTO position.

10.9.2.6 After CLOSE light ZLL-13669 is LIT for approximately 59 minutes, verify valve HV-13669 opens for one minute then closes. Verify CLOSE light ZLL-13669 is LIT.

10.9.2.7 Set handswitch HS-13669 to CLOSE position and verify light ZLL-13669 is LIT.

10.9.2.8 Close valves sequentially HV-13665, HV-13664, HV-13663, HV-13671, HV-13687 and HV-13658.

10.10 EXHAUST SYSTEM/HEPA FILTER PRESSURE DIFFERENTIAL SYSTEM

This will test high differential pressure alarms across filters HEP-1361 and HEP-1362.

10.10.1 HEPA FILTER HEP-1361

10.10.1.1 To allow HVAC Trouble Alarm XA-13640 to simulate trouble alarm during test, lift lead on FN-1362 M/4 contact at fan VSD.

10.10.1.2 Verify that Skid Instrument Panel is energized; verify HV-136174-1A and HV-136174-1B are OPEN, and valves HV-136174-1C, HV-136174-1D and HV-136174-1E are CLOSED, and; record the reading from PDISH-13618: -0- ; verify that the reading recorded is below 5.0" WC.

10.10.1.3 Reset and verify that XA-13640 on ANN-1361 in MO-211 is in NORMAL condition, and verify that FILTER SECT 1 DP HIGH light PDLH-13618 is not lit.

10.10.1.4 At PDISH-13618 on the 5 valve manifold (5VM), close valves HV-136174-1A, and 1B.

10.10.1.5 At test ports attach VTPS pressure source to High side and open the Low side to atmosphere.

10.10.1.6 Increase VTPS, on PDISH-13618, to approx. 5.0" WC. Verify PDLH-13618 is LIT. Record actual pressure from PDISH-13618 alarm was caused: 4.95.

10.10.1.7 On ANN-1361 Verify that XA-13640 is in ALERT condition, then acknowledge and verify XA-13640 is STEADY ON.

10.10.1.8 Decrease VTPS, on PDISH-13618, TO 0" WC. Record actual pressure from PDISH-13618 reset is achievable: 4.66.

10.10.1.9 Verify that FILTER SECT 1 DP HIGH light PDLH-13618 is NOT LIT.

10.10.1.10 On ANN-1361 in MO-211, reset and verify that XA-13640 is in NORMAL condition.

10.10.1.11 Remove the VTPS at PDISH-13618 on the 5 valve manifold (5VM), and recap the test ports. Open HV-136174-1A, and 1B.

10.10.2 HEPA FILTER HEP-1362

10.10.2.1 Verify HV-136175-1A and HV-136175-1B are OPEN, and valves HV-136175-1C, HV-136175-1D and HV-136175-1E are CLOSED. Record the reading from PDISH-13619: - 0 -; verify that the reading recorded is below 4.0" WC.

10.10.2.2 Verify that FILTER SECT 2 DP HIGH light PDLH-13619 is NOT LIT.

10.10.2.3 At PDISH-13619 on the 5 valve manifold (5VM), close HV-136175-1A, and 1B.

10.10.2.4 At test ports attach VTPS pressure source to High side and open the Low side to atmosphere.

10.10.2.5 Increase VTPS, on PDISH-13619, To approx. 4.0" WC. Verify PDLH-13619 is LIT. Record actual pressure from PDISH-13619 alarm was caused: 3.99.

10.10.2.6 On ANN-1361 Verify that XA-13640 is in ALERT condition, then acknowledge and verify XA-13640 is STEADY ON.

10.10.2.7 Decrease VTPS, on PDISH-13619, To approximately 4.0" WC. Record actual pressure from PDISH-13619 reset is achievable: 3.72.

10.10.2.8 Verify that FILTER SECT 2 DP HIGH light PDLH-13619 is NOT LIT.

10.10.2.9 On ANN-1361 in MO-211 Reset and verify that XA-13640 is in NORMAL condition.

10.10.2.10 Remove the VTPS at PDISH-13619 on the 5 valve manifold (5VM), and recap the test ports. Open HV-136175-1A, and 1B.

10.10.2.11

10.10.3 HEPA FILTERS HEP-1361 and HEP-1362

10.10.3.1 Verify HV-136176-1A and HV-136176-1B are OPEN, and valves HV-136176-1C, HV-136176-1D and HV-136176-1E are CLOSED. Record the reading from PDISH-13620: - 0 -; verify that the reading recorded is below 5.9" WC.

10.10.3.2 Verify that FILTER OVERALL DP HIGH light PDLH-13620 is NOT LIT.

10.10.3.3 At PDISH-13620 on the 5 valve manifold (5VM), close HV-136176-1A, and 1B.

10.10.3.4 At test ports attach VTPS pressure source to High side and open the Low side to atmosphere.

4/3/12/98 10.10.3.5 At the Exhaust Skid, with MM verify across terminals TB-6-5 and TB-6-6 indicates CLOSED contact. (Interlock 3--permissive to start Exhaust Fan FN-1362.)

4/3/12/98 10.10.3.6 Increase VTPS, on PDISH-13620, To approx. 5.9" WC. Verify PDLH-13620 is LIT. Record actual pressure from PDISH-13620 alarm was caused: 6.13.

4/3/12/98 10.10.3.7 On ANN-1361, verify that XA-13640 is in ALERT condition approximately 30 seconds following step 10.10.3.6, then acknowledge and verify XA-13640 is STEADY ON.

4/3/12/98 10.10.3.8 Decrease VTPS, on PDISH-13620, TO 0" WC. Record actual pressure from PDISH-13620 reset is achievable: 5.74.

4/3/12/98 10.10.3.9 Verify that FILTER SECT 1 DP HIGH light PDLH-13620 is NOT LIT.

4/3/12/98 10.10.3.10 On ANN-1361 in MO-211, reset and verify that XA-13640 is in NORMAL condition.

4/3/12/98 10.10.3.11 Remove the VTPS at PDISH-13620 on the 5 valve manifold (5VM), and recap the test ports. Open HV-136176-1A, and 1B.

4/3/12/98 10.10.3.12 Deenergize the Skid Instrument Panel by returning disconnects to OFF position.

4/3/12/98 10.10.3.13 Reconnect lead at FN-1362 M/4 contact disconnected in step 10.10.1.1 at the fan VSD.

END OF SECTION 10

11 COLD TEST PROCESS VENTILATION SYSTEM PERFORMANCE

The following will perform cold tests for the system performance of the Heat Exchanger HX-1361, Air Recirculation Fan FN-1361 and the heater control system, Exhaust Fan FN-1362 and heater control system, and stack monitoring system.

NOTE: Sections 11.1, 11.2, and 11.3 will be performed during Chiller Operational test (ATP HNF-1831 [W320-ATP19]). Section 11.4 can be performed independent of Chiller operation.

11.1 PREPARATION

RD 3/28/98 11.1.1 Verify applicable steps specified in Sections 7, 8, and 10 have been completed.

RD 11.1.2 Place containers under the chilled water piping system at the connection points to the Process Building and the Heat Exchanger to catch possible leaks during filling and tests.

RD 11.1.3 To fill Heat Exchanger HX-1361 piping system from the Chiller Skid with glycol solution, verify makeup storage tank TK-1361 is pressurized to approximately 30 psi (PI-1367).

RD 11.1.4 Verify PI-1368 indicates 18 ±2psi, and HV-13627 is OPEN. If PI-1368 does not indicate pressure of 18 ± 2psi, open valve HV-13627 & adjust PCV-1368 to 18 psig. ECN # 789

RD 3/28/98 11.1.5 On Chiller Control Panel, verify either CWP-1 or CWP-2 is RUNNING.

RD 11.1.6 Verify FIT-1364 indicates a flow in the range of 95 to 110 gpm. If not, adjust balancing valve HV-13622/HV-13624 as required.

RD 11.1.7 ~~Verify TI-13618 and TI-13619 read approximately the same.~~ See below

RD 11.1.8 Verify/close valves HV-13636, HV-13635, and HV-136210.

RD 11.1.7 Record TI-13618 34 °F & TI-13619 40 °F. On chiller control panel, shut down chiller pumps CWP1/CWP-2. ECN # 789

RO 5/5/98 11.1.9 Valves have been aligned as shown on Data Sheet 11.1.9.

DATA SHEET 11.1.9		
Initial/Date	Valve	Position
RO 3/28/98	HV-13644	CLOSED
RO ↓	HV-13645	CLOSED
RO ↓	HV-13646	OPEN
RO ↓	HV-13647	OPEN
RO ↓	HV-13648	OPEN
RO ↓	HV-13649	OPEN
RO ↓	HV-13654	OPEN
RO ↓	HV-13655	OPEN
RO 5/5/98 ECN # 801	HV-136117	Closed ~~OPEN~~
RO ↓ 801	HV-136118	Closed ~~OPEN~~
RO ↓ 801	HV-136121	Closed ~~OPEN~~
RO ↓ 801	HV-136134	Closed ~~OPEN~~
RO 3/28/98	HV-136150	CLOSED
RO ↓	HV-136152	CLOSED

RO 3/28/98 11.1.10 Connect temporary air inlet station with HEPA filter to the portable exhaust hookup line 8"VT-1012-M8 in accordance with Attachment B, and open valve HV-136151.

RO 11.1.11 Remove HV-136142 and connect recirculation line 8"VT-1022-M8 to HX-1361 inlet in accordance with Attachment B.

RO 11.1.12 Call Hanford weather forecaster at 373-2716 and record relative humidity and outdoor air temperature.

Relative humidity = 18 % Temperature = 56 °F

RO 11.1.~~13~~ 16 ECN # 789 Turn 3-way valve HV-136200 to normally OPEN position (align to HX-1361). ON chiller control panel, start CWP-1/CWP-2. ECN # 789

RO 11.1.14 Slowly open HV-13636 and then HV-13635.

RD 3/28/98 11.1.15 Visually inspect and verify that the chilled water piping system at the connection points to the Heat Exchanger HX-1361 do not leak.

RD 11.1.~~16~~ 13 ECN #789 Open valve HV-136210. Ø

RD 11.1.17 At IE-1361, record input pressure PI-13611.

PI-13611 = 0 psi (should be 0 psi) - Per telecon with Randy Dykman. Keith Conrad/QA 7-17-98

RD 11.1.18 At IE-1361, OPEN VALVE HV-13642 AND ~~ECN 770~~, 789 record differential pressure across condenser as indicated on PDISH-13611.

PDISH-13611 = 0 psid (should be 0 psid)

RD 11.1.19 Record inlet air temperature reading as indicated on TISH-13620.

TISH-13620 = 69 °F

RD 11.1.20 Record outlet air temperature reading as indicated on TISH-13621.

TISH-13621 = 79 °F

11.2 HEAT EXCHANGER HX-1361/AIR RECIRCULATION FAN FN-1361 AND HEATER CONTROL SYSTEM

The following will perform cold tests of the Air Recirculation Fan FN-1361 and Heating Coil HC-1361 control system.

RD 3/28/98 11.2.1 Close heating coil HC-1361 Disconnect DS-3 and at ER-1361, and Disconnect DISC on SR Control Panel SCP-1361.

RD 11.2.2 Turn HS-13622 at SCP-1361 to OFF position.

RD 11.2.3 Verify Power ON light YL-13622A on SCP-1361 is LIT.

RD ~~11.2.4 On SCP-1361, set TIC-13622 to MANUAL mode.~~ DELETE ECN #789

RD 11.2.5 On SCP-1361, verify HTR ON light YL-13622B is NOT LIT.

RD 11.2.~~6~~9 On SCP-1361, manually adjust TIC-13622 setpoint to ambient and record readings from TISH-13620, TISH-13621, and TIC-13622 are approximately the same.

TISH-13620: 64 °F TISH-13621: 44° F TISH-13622: 50 °F

RD 11.2.~~7~~8 On IE-1361 and on ANN-1362, Reset And ECN #789 verify TAH-13620, TAH-13621, and TAH-13622 are in NORMAL condition.

RD 11.2.~~8~~6 On IE-1361, DEPRESS switch HS-13635A. Verify FAN ON light YL-13635A is LIT and ammeter IISH-13635 is registering a normal reading (approximately 11 A).

ECN # 789

RD 11.2.~~9~~7 On ANN-1362, Acknowledge, Reset And ECN #789 verify IAH-13635 is in NORMAL condition.

EXC #2 ______ 11.2.10 In the Process Building 241-C-91, at the Recirculation Fan FN-1361 discharge line (at HX-1361 inlet), and with a portable anemometer, measure and record discharge air flow: 3151 ft/min (should be 2475 ±50 ft/min).

RO 3/28/98 11.2.11 On SCP-1361, turn HS-13622 to ON position.

RO ______ 11.2.12 Verify HTR ON light YL-13622B is LIT.

RO ______ 11.2.13 On SCP-1361, manually adjust the setpoint to Process temperature reading as indicated on TIC-13622 and TI-13622. Gradually change the setpoint in 5 °F increments to desired value of 77 °F.

RO ______ 11.2.14 Record readings on TI-13622 at each step from 62 °F to 77 °F.

64.5 ______ 69.7 ______ 74.4 ______ 76.1 ______

RO ______ 11.2.15 After the process is stabilized, ~~switch controller~~ Record Reading on TIC-13622 ~~to~~ 77.4 ~~AUTO mode~~.

RO ______ 11.2.16 Record reading from PI-13611: 5.76 psi.

RO ______ 11.2.17 Record reading from PDISH-13611: 7.5 psid.

RO 5/5/98 11.2.18 Record and verify that the reading on TISH-13620 81 is approximately 40 °F ~~less~~ MORE than the reading on TISH-13621 40. ECN # 801

NOTE 1: The following will verify that when the Recirculation Fan FN-1361 is shut down, the interlock (Interlock 5) will cause the heating coil HC-1361 to shut down.

WARNING: If the HC-1361 does not shut down (by observing the status of HTR ON light YL-13622) when FN-1361 is shut down, then immediately turn HTR ON/OFF switch HS-13622 to OFF and notify Test Director.

RO 3/28/98 11.2.19 On IE-1361, depress HS-13635B, verify that FAN OFF light YL-13635B is LIT and FAN ON light YL-13635A is NOT LIT.

RO ______ 11.2.20 On SCP-1361, verify HTR ON light YL-13622B is NOT LIT.

RO ______ 11.2.21 On IE-1361, depress HS-13635A, verify that FAN ON light YL-13635A is LIT and FAN OFF light YL-13635B is NOT LIT.

RO ______ 11.2.22 On SCP-1361, verify HTR ON light YL-13622B is LIT.

NOTE: The Recirculation Fan FN-1361 shall be operating for the next section. If this section was completed at end of day, the Test Director may shut down Recirculation Fan FN-1361 by depressing switch HS-13635B on IE-1361. However, the Recirculation Fan FN-1361 must be restarted before proceeding to the following step.

11.3 TANK EXHAUST and HEATER CONTROL SYSTEM

The following will perform cold tests of the variable speed Exhaust Fan FN-1362, while simulating the tank pressure, and Heating Coil HC-1362 temperature control system.

RD 3/30/98 11.3.1 In CP-01, at TB-3, remove FU-4 (this disables Evacuation Horn PAL-1361C).

RD 11.3.2 At PIT-1361, on the 2-valve manifold (2VM) HV-13164, close block valve HV-136164-1A. Open the test port (TP) at valve HV-136164-1B and connect VTVS. Open valve HV-136164-1B.

RD 11.3.3 Verify that FN-1361 is operating.

RD 11.3.4 Verify final electrical equipment lineup in Step 8.4 has been completed.

RD 11.3.5 At PIT-1361, set VTVS at -10" WC and verify PIC-1361 at MO-211 indicates -10" WC.

RD 11.3.6 Verify PAH-1361A is FLASHING and audible is ON.

RD 11.3.7 Acknowledge and verify PAH-1361A is STEADY ON and audible is OFF.

RD 11.3.8 Verify on PIC-1361, the display indicates an alarming state LO PRESS, the red LED light is LIT, and audible is ON.

RD 11.3.9 On PIC-1361, depress the horn symbol membrane switch and verify the red LED light is NOT LIT, the display indicates a change to LPR and UNACKED, and audible is OFF.

RD 11.3.10 Depress the ▲ membrane switch and verify that the display indicates a change to ACKED.

RD 11.3.11 Reset and verify PAL-1361A is in NORMAL condition.

RD 11.3.12 Verify FAN OFF light YL-13640D is LIT.

RD 11.3.13 At the Exhaust Skid, close FN-1362 Exhaust Fan Disconnect Switch DS1 (ON position).

RD 11.3.14 At EES 241-C-51, on FN-1362 VSD panel face, perform the following:

RO 3/30/98 a. Depress REMOTE membrane switch HS-13639B and verify REMOTE status light YL-13639D is LIT.

RO b. Depress AUTO membrane switch HS-13639D and verify AUTO status light YL-13639E is LIT.

RO c. On the VSD Keypad, verify FAN RUN status light YL-13639A is NOT LIT.

RO d. Verify FAN RUNNING light YL-13640 is NOT LIT.

RO 11.3.15 At the Exhaust Skid, close Heating Coil HC-1362 disconnect switch (ON position).

RO 11.3.16 At Exhaust Skid, verify POWER ON light YL-13629A is LIT and the HEATER ON light YL-13629B is NOT LIT.

RO 11.3.17 At PIT-1361, increase VTVS until PIC-1361 is approximately -2.5" WC.

RO 5/5/98 a. Depress HS-13640C, verify fan FN-1362 does not start. RO 5/5/98 b. On PIC-1361 set controller to AUTO mode. ECN # 801

RO 11.3.18 At MO-211, Reset and verify PAH-1361A is in NORMAL condition.

RO 11.3.19 On PIC-1361, depress the horn symbol membrane switch and verify display indicates a change to "PIC-1361".

RO 11.3.20 At the EES, verify FAN RUNNING light YL-13640 is LIT and on the VSD Keypad the FAN RUNNING status light YL-13639A is LIT.

RO 11.3.21 At the Exhaust Skid verify Exhaust Fan FN-1362 starts.

RO 11.3.22 In MO-211, on CP-01, verify FAN ON light YL-13640C is LIT.

RO 11.3.23 At the Exhaust Fan FN-1362 discharge line, and with a portable anemometer, measure and record discharge air flow: 1150 ft/min.

RO 11.3.24 At PIT-1361, increase VTVS to 0" WC and, at the Exhaust Fan FN-1362 discharge line and with a portable anemometer, measure and record discharge air flow: 1560 ft/min (should be a greater flow rate than that recorded on previous step).

> SEE INSERT PAGE 56(1). ECN # 801

RO 11.3.25 Record TIT-13626 reading. 58°F Verify it is approximately the same as reading on TIT-13629. 60°F ECN # 801 RO 5/5/98

RO 11.3.26 Verify/Adjust TIC-13629 set point to 53 °F.

RO 11.3.27 At the Exhaust Skid, set the HEATER ON/OFF handswitch HS-13630 to ON position.

RO 11.3.28 Verify Heating Coil HC-1362 HEATER ON light YL-13629B is LIT.

RO 11.3.29 Record TIT-13629 reading: 60°F. Verify it is the same as the process variable temperature reading displayed on TIC-13629.

INSERT per ECN # 801

11.3.24

25/5/98 a. Verify PAL-1361A is flashing and Audible is ON.

b. Acknowledge and verify PAL-1361A is Steady ON and Audible is off.

c. Verify that PIC-1361 is Alarming and the red Led is ON.

d. Depress horn symbol membrane switch and verify Audible is off and the red LED is NOT LIT.

e. Depress Δ membrane switch and verify the display indicates a change to ACKN.

RD 3/30/98 11.3.30 Record TIT-13635 reading: 61°F.

NOTE 1:	The following will verify that when the Recirculation Fan FN-1362 is shut down, the interlock (Interlock 4) will cause the heating coil HC-1362 to shut down.
WARNING:	If the HC-1362 does not shut down (by observing the status of HTR ON light YL-13629B) when FN-1362 is shutdown, then immediately turn HTR ON/OFF switch HS-13629 to OFF and notify Test Director.

RD 3/30/98 11.3.31 At PIT-1361, decrease VTVS to -4" WC and verify:

RD a. Exhaust Fan FN-1362 STOPS.

RD b. Heating Coil HC-1362 HEATER ON light YL-13629B is NOT LIT.

RD 11.3.32 In the EES, on the VSD, the FAN RUNNING light YL-13640 is NOT LIT, and on the VSD Keypad the FAN RUN status light YL-13639A is NOT LIT.

RD 11.3.33 In MO-211, on CP-01, verify FAN OFF light YL-13640D is LIT.

RD 11.3.34 Verify PAH-1361A is FLASHING and audible is ON.

RD 11.3.35 Acknowledge and verify PAH-1361A is STEADY ON and audible is OFF.

RD 11.3.36 Verify on PIC-1361, the display indicates an alarming state LO PRESS, the red LED light is LIT, and audible is ON.

RD 11.3.37 On PIC-1361, depress the horn symbol membrane switch and verify the red LED light is NOT LIT, the display indicates a change to LPR and UNACKED, and audible is OFF.

RD 11.3.38 Depress the ▲ membrane switch and verify that the display indicates a change to ACKED.

RD 11.3.39 At PIT-1361, increase VTVS to approximately -2.5" WC, ~~verify:~~ Depress HS-1364C, then verify. ECN# 801 RD 5/5/98

RD a. Exhaust Fan FN-1362 is RUNNING.

RD b. Heating Coil HC-1362 HEATER ON light YL-13629B is LIT.

RD 11.3.40 At MO-211, Reset and verify PAH-1361A is in NORMAL condition.

RD 11.3.41 On PIC-1361, depress the horn symbol membrane switch and verify display indicates a change to "PIC-1361".

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RD 3/30/98 11.3.42 In the EES, on the VSD, the FAN RUNNING light YL-13640 is LIT and the VSD Keypad FAN RUN status light YL-13639A is LIT.

RD 11.3.43 In MO-211, on CP-01, verify FAN ON light YL-13640C is LIT, then depress STOP pushbutton HS-13640D and verify FAN OFF light YL-13640D is LIT.

RD 11.3.44 Verify PAH-1361A and PAL-1361A are in NORMAL condition.

RD 11.3.45 Verify Exhaust Fan FN-1362 STOPS.

RD 11.3.46 Verify Heating Coil HC-1362 HEATER ON light YL-13629B is NOT LIT.

RD 11.3.47 In MO-211, on CP-01, depress START pushbutton HS-13640C and verify FAN ON light YL-13640C is LIT.

RD 11.3.48 Verify PAH-1361A and PAL-1361A are in NORMAL condition.

RD 11.3.49 Verify Exhaust Fan FN-1362 is RUNNING.

RD 11.3.50 Verify Heating Coil HC-1362 HEATER ON light YL-13629B is LIT.

RD 11.3.51 Set Heating Coil HC-1362 HEATER handswitch HS-13630 to OFF position.

RD 11.3.52 Open Heating Coil HC-1362 disconnect switch (OFF position).

RD 11.3.53 In MO-211, on CP-01, depress STOP pushbutton HS-13640D and verify FAN OFF light YL-13640D is LIT.

RD 11.3.54 Verify Exhaust Fan FN-1362 STOPS.

RD 11.3.55 At PIT-1361, on the 2-valve manifold (2VM) HV-13164, close valve HV-136164-1B. Disconnect VTVS and close the test port (TP) at valve HV-136164-1B. Open block valve HV-136164-1A.

RD 3/31/98 11.3.56 Turn 3-way valve HV-136200 to normally CLOSED position (align to CC-1361).

RD 11.3.57 Close valves HV-136210, HV-13636, and HV-13635.

RD 11.3.58 In CP-01, at TB-3, install FU-4 removed on step 11.3.1.

11.4 EXHAUST STACK MONITORING SYSTEM – See Exceptions #6 And ECN# 801

The following will perform cold tests of the Exhaust Stack Monitoring System while the Exhaust Fan FN-1362 are operating. Real time tests will be performed by the vendor according to Section 5 of "Site Acceptance Test Procedure" in Attachment A to meet the requirements of 40 CFR 52 and ANSI N13.1 as a part of this ATP.

The following will verify that the system alarms locally and remotely, that Interlock 3 from the Tank Vent Exhaust Radiation Monitoring shuts down Exhaust Fan FN-1362, and that Interlock 4 from the Exhaust Fan FN-1362 does shut down the Stack Sampling Vacuum Pumps in Tank Vent Exhaust Radiation Monitoring Cabinet.

NOTE 1: The Exhaust Fan FN-1362 shall be operating for this section. If not, the Exhaust Fan FN-1362 must be restarted in accordance with 11.3 before proceeding to the following.

NOTE 2: Representative from Air Monitor Corp should be present to provide support for testing the Exhaust Stack Monitoring System.

RD 5/5/98 11.4.1 At CP-01 remove FU-4 from TB-3 (to disable evacuation alarm).

RD 11.4.2 Set valves HV-13654 and HV-13655 as required to throttle stack flow to 50 scfm.

RD 11.4.3 Verify Section 4.1 and Steps 4.2.1 through 4.2.5 of Attachment A are complete. In MO-211, on panel CP-01, depress HS-13640D to shut Exhaust Fan FN-1362 OFF. (Reference Step 4.2.6 of Attachment A) On the VSD panel face, set to MANUAL and LOCAL mode, and set speed setpoint to 676 ±30 rpm.

RD 11.4.4 Verify status light YL-13640D is LIT and status light YL-13640C is NOT LIT.

RD 11.4.5 On ANN-1361, verify XA-1362A and RXA-1365A are FLASHING and audible is ON.

RD 11.4.6 Acknowledge and verify that XA-1362A and RXA-1365A are STEADY ON.

RD 11.4.7 Before Step 4.3.1 of Attachment A, in the EES 241-C-51 and on the VSD panel face, DEPRESS the START membrane switch to start Exhaust Fan FN-1362.

RD 11.4.8 On the VSD panel face, verify RUN light YL-13639A is LIT and then the AT SPEED light YL-13639F is LIT.

See Exception #5

RD 11.4.9 On ANN-1361, DEPRESS reset button and verify XA-1362A and RXA-1365A are in NORMAL condition.

RD 11.4.10 To support Step 4.3.8 of Attachment A for 40% full scale stack flow, on the Exhaust Stack, open one of the test ports and insert the portable anemometer probe midway. On the VSD panel face, increase the speed setpoint to 1436 ±30 rpm. Verify the masstron meter (FI-13627A) reads 160 ±20 cfm.

RD 11.4.11 To support Step 4.3.8 of Attachment A for 60% full scale stack flow, Increase the VSD speed setpoint to 2103 ±30 rpm. Verify the masstron meter (FI-13627A) reads 240 ±20 cfm.

RD 11.4.12 To support Step 4.3.8 of Attachment A for 80% full scale stack flow, Increase the VSD speed setpoint to 2727 ±30 rpm. Verify the masstron meter (FI-13627A) reads 320 ±20 cfm.

RD 11.4.13 Simultaneously with Step 4.4.2 of Attachment A, on ANN-1361, verify RXA-1365A is FLASHING and audible is ON, and acknowledge and verify that RXA-1365A is STEADY ON.

5/5/98

___ 11.4.14 Following Step 4.4.7 of Attachment A, on ANN-1361, depress RESET and verify RXA-1365A is in NORMAL condition.

___ 11.4.15 Simultaneously with Step 4.4.9 of Attachment A, on ANN-1361, verify RXA-1365A is FLASHING and audible is ON, and acknowledge and verify that RXA-1365A is STEADY ON.

___ 11.4.16 Following Step 4.4.14 of Attachment A, on ANN-1361, depress RESET and verify RXA-1365A is in NORMAL condition.

___ 11.4.17 To support Step 4.5.1 of Attachment A for 50% full scale stack flow, Decrease the VSD speed setpoint to 1785 ±100 rpm. Verify the masstron meter (FI-13627A) reads 200 ±20 cfm.

___ 11.4.18 Simultaneously with Step 4.5.4 of Attachment A, on ANN-1361, verify RXA-1365A is FLASHING and audible is ON, and acknowledge and verify that RXA-1365A is STEADY ON.

___ 11.4.19 Following Step 4.5.5 of Attachment A, on ANN-1361, depress RESET and verify RXA-1365A is in NORMAL condition.

___ 11.4.20 To support Step 4.6.1 of Attachment A for stack flow of 90 ft^3/min, Decrease the VSD speed setpoint to 676 ±100 rpm. Verify the masstron meter (FI-13627A) reads 90 ±20 cfm.

___ 11.4.21 Simultaneously with Step 4.6.2 of Attachment A, on ANN-1361, verify RXA-1365A is FLASHING and audible is ON, and acknowledge and verify that RXA-1365A is STEADY ON.

___ 11.4.22 To support Step 4.6.3 of Attachment A for stack flow of 110 ft^3/min, Increase the VSD speed setpoint to 776 ±100 rpm. Verify the masstron meter (FI-13627A) reads 110 ±20 cfm. On ANN-1361, depress RESET and verify RXA-1365A is in NORMAL condition.

___ 11.4.23 Simultaneously with Step 4.7.5 of Attachment A, on ANN-1361, verify RXA-1365A is FLASHING and audible is ON, and acknowledge and verify that RXA-1365A is STEADY ON.

___ 11.4.24 Following Step 4.7.8 of Attachment A, on ANN-1361, depress RESET and verify RXA-1365A is in NORMAL condition.

___ 11.4.25 Simultaneously with Step 4.7.9 of Attachment A, on ANN-1361, verify RAH-1363A, XA-13640, XA-1362A, and RXA-1365A are FLASHING and audible is ON, and acknowledge and verify that RAH-1363A, XA-13640, XA-1362A, and RXA-1365A are STEADY ON.

___ 11.4.26 At EES 241-C-51, on the VSD panel face for Exhaust Fan FN-1362, verify FAN RUNNING light YL-13640 is NOT LIT; at MO-211, on CP-01, verify FAN ON light YL-13640C is NOT LIT and FAN OFF light YL-13640D is LIT, and; at the exhaust skid, verify Exhaust Fan FN-1362 is not running.

___ 11.4.27 Following Step 4.7.13 of Attachment A, on ANN-1361, depress RESET and verify RAH-1363A is in NORMAL condition, and verify that XA-13640, XA-1362A, and RXA-1365A are STEADY ON.

___ 11.4.28 In the Process Bldg, at PIT-1361, set the VTVS to approximately -2" H_2O. At the EES, on the VSD panel face, set to AUTO and REMOTE mode. Set VSD to display motor speed.

___ 11.4.29 In MO-211, set PIC-1361 controller to AUTO mode.

___ 11.4.30 In MO-211, on panel CP-01, depress HS-13640C, verify status light YL-13640C is LIT and status light YL-13640D is NOT LIT. On ANN-1361, depress RESET and verify that XA-13640, XA-1362A, and RXA-1365A are in NORMAL condition.

___ 11.4.31 Verify PIC-1361 controller output responded by changing the output to approximately 50%. Verify VSD responded by changing to AT SPEED. Record reading from PIC-1361: 39 % and VSD: 1730 rpm.

5/5/98 11.4.32 At the PIT-1361, set the VTVS to approximately -2.5" H_2O.

11.4.33 Verify PIC-1361 controller responded by changing the output to a lesser value than that on step 11.4.31. Verify VSD motor speed has decreased to a lesser value than that on step 11.4.31. Record reading from PIC-1361: 45 % and VSD: 1930 rpm.

11.4.34 At the PIT-1361, set the VTVS to approximately -2.0" H_2O.

11.4.35 Verify PIC-1361 controller responded by changing the output to a value equal to that on step 11.4.31. Verify VSD motor speed has increased to a value equal to that on step 11.4.31.

11.4.36 At the PIT-1361, set the VTVS to approximately -1.5" H_2O.

11.4.37 Verify PIC-1361 controller responded by changing the output to a greater value than that on step 11.4.31. Verify VSD motor speed has increased to a greater value than that on step 11.4.31. Record reading from PIC-1361: 51 % and VSD: 2100 rpm.

11.4.38 At the PIT-1361, set the VTVS to approximately -2.0" H_2O.

11.4.39 Verify PIC-1361 controller responded by changing the output to a value equal to that on step 11.4.31. Verify VSD motor speed has decreased to a value equal to that on step 11.4.31.

11.4.40 Install fuse 4 to TB-3 removed on step 11.4.1.

11.5 BETA-GAMMA CABINET COOLING

3/20/98 11.5.1 In Process Building, open instrument air valve HV-13687 and HV-13613.

11.5.2 At the Exhaust Skid, in Beta-Gamma cabinet on exhaust stack, connect shorting jumper, with ON-OFF switch, in OFF position, across temperature switch TS-1.

11.5.3 Position Switch SW-3 (in Radiation Monitoring Cabinet) to ON and jumper switch to ON position. Verify vortex cooler solenoid valve opens and cooling air is blowing into the cabinet.

11.5.4 Position jumper switch to OFF position and switch SW-3 to OFF position. Disconnect and remove shorting jumper with switch.

11.6 SYSTEM SHUTDOWN AND RESTORATION

The following will shut down and restore the Recirculation Fan FN-1361 and the Chiller System at completion of Cold Test Process Ventilation System Performance.

4/1/98 11.6.1 On IE-1361, press HS-13635B and verify that FAN OFF light YL-13635B is LIT.

11.6.2 On SCP-1361, set handswitch HS-13622 to OFF position, and verify that HTR on light is NOT LIT.

3/31/98 11.6.3 Restore Chiller System back to the inlet air Cooling Coil CC-1361 via 3-way valve HV-136200. Adjust balancing valve HV-136201 as required to achieve system flow rate of 95 to 110 gpm.

NOTE: Leave the recirculation line from FN-1361 open, and leave the temporary HEPA filter installed in Step 11.1.13.

RD 3/31/98 11.6.4 Return clean glycol solution, collected from the containers, back into the C-106 Air Chiller System or to the recycle center.

END OF SECTION 11

ORIGINAL

NONCONFORMANCE REPORT

Project No.	W.O. No.	Location (Bldg./Area)	Safety Class	NCR No.
W-320		241-C-91	SC	W320-42 (FDNW19)

Job Title

PROJECT W-320, TANK 241-C-106 SLUICING ACTIVITIES

Requirement(s) (Including source document numbers, revision, paragraph, etc.)

HNF-SD-WM-TSR-006 REV 0-D LCO 3.2.2
HNF-SD-WM-TSR-006 REV 0-J 1.1 DEFINITIONS, "OPERABLE"
HNF-SD-WM-BIO-001 REV 0-C ADDENDUM 1, 2.4.1.18 PROCESS BUILDING DRAIN AND SEAL POT

Distribution

SESG
COG/J. R. Bellomy S2-48 1,3

FDNW
A.I. Files 1,3
Q.C. Files 1,3
Records Management 3
Const Doc Control 1,2,3
Compliance Assessment 1,2,3
Quality Engrg 1,3
PM/M. A. Lane 1,2,3
CE/S. E. Carlson 1,2,3
D. L. Evans 1,2,3
D. T. Nguyen 1,2,3
QA/J. J. Huston 1,3

Description of Nonconformance:

THE PROJECT W-320, TANK 241-C-106 SLUICING ACTIVITY VENTILATION SYSTEM CAN NOT BE DEEMED OPERABLE AS REQUIRED BY DOCUMENTS REFERENCED ABOVE. SEE ATTACHED SHEET FOR DETAILED DISCRIPTION OF DISCREPANCIES.

ORIGINAL

Originator	Date	Manager	Date
Chuck Hall (signature) DANIEL M. STENKAMP	4/22/98 04/15/98	J. P. Thompson (signature) [signature] W-320 PLE	4/22/98 4/15/98

ORIGINAL

NONCONFORMANCE REPORT (continued)

Disposition	ASME Code Related	Cause Code	NCR No.
☐ Use-as-is* ☐ Reject ☒ Repair* ☐ Rework *Justification Required	☒ No ☐ Yes (ASME Code Section ______)	M1E4	~~W-320~~ W320-42

Disposition Instructions (generally not required for use-as-is and reject dispositions):

ECNs 647982 and 647830 are being implemented to resolve the flushing. ~~and fan operation problems identified~~ 4/28/98 the fan operation problem is due to the test configuration, this should not occur 4/28/98 for normal system operation.

ECN (generally required for repair and use-as-is dispositions):

☒ Yes ☐ No If yes, ECN No. 647982 & 647830

If no, provide explanation: ______

Disposition Justification (if applicable):

the ECN's will provide method to prevent water from being forced up out of the floor drain. ~~and will also prevent water~~ 4/28/98

Per DL Evans, the fan operation is due to the test configuration, the normal operating procedure ~~will~~ 4/28/98 should include precautions to maintain the seal pot full; no design change 4/28/98 required.

Approval/Concurrence:

Construction Approval

CF/CM Engineer [signature] Date 5/4/98

Field Quality Engineer N/A Date ______

Customer Projects Approval

Design Authority Engineer [signature] Date 4/29/98

QA Keith Conrad Date 4-29-98

Design Approval

Design Engineer Danny R Evans Date 4/28/98

Lead Engineer [signature] Date 4/28/98

Quality Engineer N/A Date ______

Safety Engineer C. D. Egge Date 4/29/98

Other Concurrence

FDH N/A Date ______

AI/ANI (ASME) ______ Date ______

FDNW Code Eng. ______ Date ______

Environmental T. Amstalum Date 5/1/98

Closure

☒ Disposition Completed as Directed

☐ Other (Explain) ______

Originator or Representative [signature] Date 5/22/98

Supervisor [signature] Date 5/27/98

ATP-012 DRAIN LINE PROBLEMS

HMF-1361 FLUSH

During flushing of the HMF-1361 filter, the filter is filled with 60 gallons of water and then pressurized to 100 psi using air. When the drain valve to the filter housing was opened the air pressure forced the water through the drain line to Tank C-106. This line has a wye branch, adjacent to the Sluice Pit, that runs back to the Process Building floor drain. During the flush with 100 psi air, the line to the floor drain is pressurized (approximately 3-6 psig) which then forces the seal loop fluids (approximately 1 cup ≈ 0.23 L) upward out of the floor drain trap into the Process Building.

FN-1361 RECIRC FAN OPERATION

During operation of the recirc fan with the modification of Attachment "B" in place, a problem with the drain lines was discovered. With valve HV-136151 closed (valve for the temporary Inlet Filter), the seal pot low level alarm would come on shortly after the fan was started. It would clear moments after the fan was stopped. This led us to believe that the water was being subjected to a negative pressure and was pulled up the drain lines during fan operation, and then drained back to the seal pot when the fan was stopped.

With valve HV-136151 open, the seal pot low level alarm would come on shortly after the fan was started and would stay on even after the fan was stopped. This led us to believe that with the additional air being pulled through the inlet filter, the fan was pressurizing the drain lines to the seal pot and the water in the seal pot was being drawn into Tank C-106. The drain line going to Tank C-106 is under vacuum constantly due to the 296-P-16 exhauster operation.

With the valves on all of the drain lines closed, no problem was identified during operation of the Recirculation Fan.

During the performance of ATP-012 and the associated OTP, the recirculation line is bypassed (isolated) from Tank C-106 using the modification of Attachment B. While the modification is installed, dependent on position of various valves, the seal pot will experience a range of positive and negative pressures. The seal pot will return to the design condition when the modification is removed and the recirculation ducting path is actually open to Tank C-106.

Prepared by Dan Stenkamp, and edited by Dan Evans & Tim Kasnick 4/28/98.

3.2 FLAMMABLE GAS

3.2.2 SST Ventilation Systems - Active

LCO 3.2.2 An active ventilation system shall be OPERABLE.

MODE APPLICABILITY: OPERATION and LIMITED.

PROCESS AREA APPLICABILITY: SSTs with active ventilation systems (241-C-105 except during WRSS operations, C-106, SX-101, SX-102, SX-103, SX-104, SX-105, SX-106, SX-107, SX-108, SX-109, SX-110, SX-111, SX-112, and SX-114).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Active ventilation system is inoperable.	A.1 Restore the active ventilation system to OPERABLE status.	Immediately
	<u>AND</u>	
	A.2 VERIFY concentration of flammable gas is ≤ 25% of the LFL in the affected tank.	Once per 7 days

1.1 Definitions (continued)

MODE	MODES are generally used (1) to determine SL, LCS, LCO, and AC program applicabilities, (2) to distinguish facility operational conditions, (3) to determine minimum staffing requirements, and (4) to provide an instant facility status report. The MODES defined specifically for TWRS facilities (OPERATION and LIMITED) are used to distinguish facility operational conditions and provide an instant facility status report. See also Section 1.6, "MODES." (DOE 5480.22) - annotated.
OPERABLE/OPERABILITY	A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s), and (a) setpoints are within limits, (b) operating parameters necessary for OPERABILITY are within limits, and (c) when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication, or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its safety function(s) are also capable of performing their related safety support function(s). (DOE 5480.22) - annotated.
<u>OR</u>	See Section 1.2, "Logical Connectors." (NUREG 1431)
PHYSICALLY CONNECTED	PHYSICALLY CONNECTED refers only to piping, tanks and structures and their associated instrumentation. 1) PHYSICALLY CONNECTED piping is any piping which is part of or connected to the transfer route. Piping need not be considered connected to the transfer route if it is physically disconnected by a removal of piping (i.e., air gap) or isolated with a blind flange/process blank. Note that closed valves do not physically disconnect piping. The East/West cross-site transfer line and replacement cross-site transfer lines are considered PHYSICALLY CONNECTED piping only when cross-site WASTE transfers are in progress. The East/West cross-site transfer line is the piping between 241-UX-154 diversion box and 241-ER-151

cm (4 in) R-4 riser. The HEMF is provided with a bypass to allow for maintenance. As with the HEME above, this bypass is not used for the backflushing. The liquid is returned to the tank by gravity.

2.4.1.17 Recirculation System. The 296-C-06 recirculation system removes heat from the Tank 241-C-106 vapor space, promotes visibility, and dehumidifies the recirculating air. The recirculation fan (FN-1361) provides air flow (including gases in the vapor space of the tank) in the recirculation path. The condenser (HX-1361) cools the air, condenses moisture in the airstream, and the condensate is returned to the tank. The moisture separator (MS-1361) removes moisture from the air stream. A recirculation system heating coil (HC-1361) is used to reheat the air to about 25°C (77°F) to decrease the relative humidity of the air stream and to provide some fog suppression before returning the recirculating air to the tank.

Air, at flow rates of 34.5 m^3/min (1220 ft^3/min), flows from Tank 241-C-106 through a 25 cm (10 in) combined recirculation and exhaust flow duct, circulates through the condenser, and returns to Tank 241-C-106 through a 20 cm (8 in) duct. The discharge of the recirculation fan splits into a 20 cm (8 in) recirculation pipe, with a flow rate of 24 m^3/min (860 ft^3/min), and a 15 cm (6 in) exhaust pipe, with a flow rate of 10.2 m^3/min (360 ft^3/min), 304L stainless steel. Ventilation system ducts are constructed from schedule 10, 304L stainless steel.

2.4.1.18 Process Building Drain and Seal Pot. A seal pot is provided on the process building drain line. It serves as a common collection point and seal for the condenser and other ventilation system equipment drains while preventing Tank 241-C-106 from venting into the process building. The overflow from the seal pot, which includes the HEME backwash waste water, is returned to Tank 241-C-106 via a dedicated encased drain line through the 10 cm (4 in), R-4 riser.

2.4.1.19 Chiller Skid. The chiller skid contains an air-cooled chiller and a chilled-water cooling system. The chilled-water cooling system consists of a makeup storage tank, an air separator, circulation pumps, an expansion tank, and instruments for monitoring the closed-loop cooling system. The circulating fluid (chilled water) is a 46% propylene glycol solution mixed with water circulated between the chiller and the recirculation system condenser. Chilled water may also be provided to the intake air cooling coil (CC-1361). The chilled water cooling system removes heat and dehumidifies the recirculating tank vapor by reducing the temperature of the vapor from about 35 to 4.4°C (95 to 40°F). In its alternate use with the existing ventilation system, it cools the bulk solid waste in Tank 241-C-106 to reduce (before sluicing initiation) or maintain (during intermittent sluicing outages) waste temperatures below local saturation. The chiller skid is located outside the fenced area of the C Tank Farm.

2.4.1.19.1 Air-Cooled Chiller. An air-cooled chiller (R-1361) is used to remove heat that the chilled-water system gained from the recirculation ventilation system condenser, or with the existing ventilation system, from cooling ambient inlet air to 4.4 °C (40 °F) in the intake air cooling coil (CC-1361). The chiller is a complete factory assembled package, rated at 40 tons, with reciprocating compressors, condenser, refrigerant circuits,

POST-MODIFICATION FUNCTIONAL CHECK
FOR PROCESS BLDG SEAL POT, FLOOR DRAIN TRAP
& FLOOR DRAIN WATER SEAL LEVEL SWITCHES (REF ECN 647830)

FLUOR DANIEL NORTHWEST (FDNW)

R Calvan	6/3/98	[signature]	6/3/98
Author	Date	Checker	Date

NUMATEC HANFORD COMPANY (NHC) / LOCKHEED MARTIN HANFORD COMPANY (LMHC)

DMS [signature]	6-3-98	[signature] Bailey	6/3/98
Project W-320 Eng	Date	Design Authority	Date
Joseph M Jones	06-03-98	J E Andrew	6/3/98
Cog. Eng	Date	Operations	Date
Keith Conrad	6/3/98	[signature]	6/4/98
Quality Assurance	Date	Safety	Date

R. M. 6-4-98
RM 6-4-98

NOTE: Each step shall be initialed and dated by an AI representative.

1 REFERENCES

1.1 H-2-818561, SH 3, REV 4
1.2 H-2-818588, SH 1, REV 1
1.3 H-2-818588, SH 2, REV 1
1.4 H-2-818588, SH 4, REV 1
1.5 H-2-818588, SH 5, REV 1
1.6 H-2-818588, SH 6, REV 1
1.7 H-2-818603, SH 3, REV 1
1.8 H-2-818675, SH 3, REV 1
1.9 H-2-818675, SH 6, REV 1
1.10 H-2-818680, SH 1, REV 1

2 PREREQUISITES

BB 6-4-98 2.1 Power Distribution Panel C-PDP-1 is energized and voltages V_{AB}, V_{BC}, and V_{CA} are in range of 456 to 504 V AC.

BB 2.2 MCC-N1 supply breaker C-PDP-1/11 is CLOSED/ON.

BB 2.3 MCC-N1 Incoming Supply breaker MCC-N1/1FM is CLOSED/ON.

BB 2.4 Process Building feeder breaker MCC-N1/1FDR is CLOSED/ON.

BB 6-4-98 2.5 Process Building Main Disconnect Switch DS-1 is CLOSED/ON.

BB ____ 2.6 Process Building Power Panel C106-PP1 Supply CB-01 is CLOSED/ON.

BB ____ 2.7 Panelboard C106-PP1 Primary Main breaker is ON.

BB ____ 2.8 Panelboard C106-PP1 Secondary Main breaker is ON.

BB ____ 2.9 Process Building Instrumentation power from Panelboard C106-PP1 breaker #5 is ON.

BB ____ 2.10 Fuses are installed: TB-4 Terminals/Fuse Blocks 3, 6, 7, and 8. + closed #4 BB 6-4-98 6-4-98

BB ____ 2.11 Voice communication is established between MO-211 and the Process Building 241-C-91.

BB ✓ 2.12 All worker safety equipment required to perform test is readily available.

3 EQUIPMENT/INSTRUMENTS

Supplied by Test Operator unless otherwise noted.

3.1 Shorting jumper - approximately 6 feet long.

3.2 Multimeter (MM): volt-ohmmeter rated to 600 V AC

Instrument No. 950-45-08-038 Expiration Date 3/13/99

3.3 Metal container - 5 gallon (nominal), partially filled with water.

3.4 Level Detector Test Electrode Assembly (with 2 probes - one long with two 6 feet long lead wiring, and one short with one 6 feet long lead wiring).

NOTE: If the results of any step do not agree with expectations, stop the test and NOTIFY the Test Director.

4 PROCESS BLDG LEVEL SWITCH INSTRUMENTATION SEAL POT & FLOOR DRAIN TRAP

CAUTION:	**Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.**

4.1 Process Building Seal Pot level switch high (LSH-1369) and level switch low (LSL-1369). This test will verify correct operation of the level switch system.

NOTE: The test will only check the alarm actuation on annunciator ANN-1362 on IE-1361 in the Process Building 241-C-91. The HVAC System Trouble Alarm XA-1368 (3-3) in MO-211 has already been tested by ATP-012. Therefore, ignore alarm input to window XA-1368 by depressing ACK pushbutton for every occurance.

BB 6-4-98 4.1.1 Inside IE-1361, disconnect level detector incoming wires identified by wire numbers LE-1369-1 and LE-1369-3 from terminals G and H on LSH-1369.

BB ____ 4.1.2 Disconnect level detector incoming wires identified by wire numbers LE-1369-4 and LE-1369-6 from terminals G and H on LSL-1369.

BB ____ 4.1.3 Connect the test electrode (ref. Para. 3.4) wiring (use only one wire of the two from the long probe) from each electrode to configure installed electrode wiring (long probe to LSL-1369 and short probe to LSH-1369). Then connect a shorting jumper from the 5 gallon water container to terminal G on LSL-1369, and another shorting jumper from the 5 gallon water container to terminal G on LSH-1369. Do not immerse the test electrode in water.

BB ____ 4.1.4 Verify 10K ohm resistor is installed at terminals RH and H on LSH-1369 and LSL-1369.

BB ____ 4.1.5 Apply AC power to IE-1361 by placing breaker C106-PP1/5 to ON.

BB ____ 4.1.6 On ANN-1362, Acknowledge, Reset and verify annunciator window LAH-1369 (5-2) is OFF and audible horn is OFF.

BB ✓ 4.1.7 On ANN-1362, verify annunciator window LAL-1369 (6-2) is STEADY ON.

BB 6-4-98 4.1.8 At level switch module LSH-1369:

4.1.8.1 Verify by MM, terminals 1 and 2 is energized (115 Vac power supply to the level switch module).

4.1.8.2 Verify by MM, terminals G and H show OPEN (≈11.3 Vac).

BB 4.1.9 At level switch module LSL-1369:

4.1.9.1 Verify by MM, terminals 1 and 2 is energized (115 Vac power supply to the level switch module).

4.1.9.2 Verify by MM, terminals G and H show OPEN (≈11.3 Vac).

BB 4.1.10 Immerse the low (long probe) level test electrode in the water of the 5 gallon water container.

BB 4.1.11 On ANN-1362, Reset, then Verify annunciator window LAL-1369 (6-2) is OFF.

BB 4.1.12 At TB-4 in IE-1361, LIFT/OPEN fuse block 8.

BB 4.1.13 On ANN-1362, Verify annunciator window LAL-1369 (6-2) is FLASHING and the audible horn is ON. Acknowledge and Verify LAL-1369 is STEADY ON, and the audible horn is OFF.

BB 4.1.14 At TB-4 in IE-1361, RESTORE/CLOSE fuse block 8.

BB 4.1.15 On ANN-1362, Reset and Verify annunciator window LAL-1369 (6-2) is OFF.

BB 4.1.16 Immerse both the low level test electrode and the high level test electrode in the water of the 5 gallon water container.

BB 4.1.17 On ANN-1362, Verify annunciator window LAH-1369 (5-2) is FLASHING and the audible horn is ON. Acknowledge and Verify LAH-1369 is STEADY ON and the audible horn is OFF.

BB 4.1.18 Remove the high level test electrode from 5 gallon water container, but leaving only the low level test electrode immersed in the water.

BB 4.1.19 On ANN-1362, Reset and Verify annunciator window LAH-1369 (5-2) is OFF.

BB 4.1.20 At TB-4 in IE-1361, LIFT/OPEN fuse block 7.

BB 4.1.21 On ANN-1362, Verify annunciator window LAH-1369 (5-2) is FLASHING and the audible horn is ON. Acknowledge and Verify LAH-1369 is STEADY ON and the audible horn is OFF.

BB 6-4-98 4.1.22 At TB-4 in IE-1361, RESTORE/CLOSE fuse block 7.

BB 4.1.23 On ANN-1362, Reset and Verify annunciator window LAH-1369 (5-2) is OFF.

BB 4.1.24 Remove the test electrodes from 5 gallon water container.

BB 4.1.25 On ANN-1362, Verify annunciator window LAL-1369 (6-2) is FLASHING and the audible horn is ON. Acknowledge and Verify LAL-1369 is STEADY ON and the audible horn is OFF.

BB 4.1.26 Remove AC power to IE-1361 by placing breaker C106-PP1/5 to OFF.

BB 4.1.27 Disconnect test electrode wiring and reconnect Level Detector wiring previously removed.

4.2 Process Building Floor Drain Trap Level Switch Low (LSL-1368). This test will verify correct operation of the level switch system.

BB 6-4-98 4.2.1 Verify IE-1361 is DE-ENERGIZED.

BB 4.2.2 Inside IE-1361, disconnect level detector incoming wires identified by wire numbers LE-1368-1 and LE-1368-3 from terminals G and H on LSL-1368.

BB 4.2.3 Connect the level detector test electrode (ref. Para. 3.4) wiring (use only one wire of the two from the long probe) to configure installed electrode wiring. Then connect a shorting jumper from the 5 gallon water container to terminal G on LSL-1368. Do not immerse the test electrode in water.

BB 4.2.4 Verify 10K ohm resistor is installed at terminals RH and H on LSL-1368.

BB 4.2.5 Apply AC power to IE-1361 by placing breaker C106-PP1/5 to ON.

BB 4.2.6 On ANN-1362, Verify annunciator window LAL-1368 (7-2) is FLASHING and audible horn is ON. Acknowledge and Verify LAL-1368 is STEADY ON and audible horn is OFF.

BB 4.2.7 At level switch module LSL-1368:

4.2.7.1 Verify by MM at terminals 1 and 2 is energized (115 Vac power supply to the level switch module).

4.2.7.2 Verify by MM, terminals G and H show OPEN (≈11.3 Vac).

BB 4.2.8 Immerse the long level test electrode in the water of the 5 gallon water container.

BB 4.2.9 On ANN-1362, Reset and Verify annunciator window LAL-1368 (7-2) is OFF.

BB 6-4-98 4.2.10 At TB-4 in IE-1361, LIFT/OPEN fuse block 6.

BB 4.2.11 On ANN-1362, Verify annunciator window LAL-1368 (7-2) is FLASHING and the audible horn is ON. Acknowledge and Verify LAL-1368 is STEADY ON, and the audible horn is OFF.

BB 4.2.12 At TB-4 in IE-1361, RESTORE/CLOSE fuse block 6.

BB 4.2.13 On ANN-1362, Reset and Verify annunciator window LAL-1368 (7-2) is OFF.

BB 4.2.14 Remove the test electrodes from the 5 gallon water container.

BB 4.2.15 On ANN-1362, Verify annunciator window LAL-1368 (7-2) is FLASHING and the audible horn is ON. Acknowledge and Verify LAL-1368 is STEADY ON, and the audible horn is OFF.

BB 4.2.16 Remove AC power to IE-1361 by placing breaker C106-PP1/5 to OFF.

BB ✓ 4.2.17 Disconnect test electrode wiring and reconnect Level Detector wiring previously removed.

5 LEAK DETECTION INSTRUMENTATION FLOOR DRAIN WATER SEAL

CAUTION: Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.

5.1 Process Building Floor Drain Water Seal Level Switch Low (LSL-13691). This test will verify correct operation of the level switch system.

BB 6-4-98 5.1.1 Verify IE-1361 is DE-ENERGIZED.

BB 5.1.2 Inside IE-1361, disconnect level detector incoming wires identified by wire numbers LE-13691-1, LE-13691-2 and LE-13691-3 from an UNMARKED terminal, terminals 13 and 14 on LSL-13691.

BB 5.1.3 Connect the level detector test electrode (ref. Para. 3.4) wiring (use both of the two wires form the long probe) to configure installed electrode wiring to an UNMARKED terminal and terminal 13. Then connect a shorting jumper from the 5 gallon water container to terminal 14 on LSL-13691. Do not immerse the test electrode in water.

BB ✓ 5.1.4 Verify 10K ohm resistor is installed at terminals 14 and 15 on LSL-13691.

BB 6-4-98 5.1.5 Apply AC power to IE-1361 by placing breaker C106-PP1/5 to ON.

BB 5.1.6 On IE-1361, verify YL-13691 is NOT LIT. Verify YL-13691 is functioning by depressing the "Press-to-test" lens.

BB 5.1.7 Immerse the level detector test electrode in the water of the 5 gallon water container.

BB 5.1.8 On IE-1361, verify YL-13691 is LIT.

BB 5.1.9 At TB-4 in IE-1361, LIFT/OPEN fuse block 4.

BB 5.1.10 On IE-1361, verify YL-13691 is NOT LIT.

BB 5.1.11 At TB-4 in IE-1361, RESTORE/CLOSE fuse block 4.

BB 5.1.12 Remove the test electrodes from the 5 gallon water container.

BB 5.1.13 On IE-1361, verify YL-13691 is NOT LIT.

BB 5.1.14 Remove AC power to IE-1361 by placing breaker C106-PP1/5 to OFF.

BB 5.1.15 Disconnect test electrode wiring and reconnect Level Detector wiring previously removed.

END OF TEST

Test Director Name (printed) and signature: Gerald T. Kiely [signature] 6-4-98

AI Representative Name (printed) and initial: Brian Beleu BB 6-4-98

Completed copies to: JCS 2E-98-01055
TJ Kasnick
JR Bellomy

EXCEPTION NO. 1

Project No. W-320

ATP No.

Recorded by F.L. Snyder

Organization FDH

Date Recor[ded] 3/1[illegible]

Step No. 8.3.5/8.3.6

Requirement 3 phase voltages to be within the range of 456 to 504.

Description of Problem
Voltages were Vab 509, Vbc 508, Vca 507. This exception is written to cover out-of-range voltages recorded on 10-1-96

Objector 1 (Name/Organization) F.L. Snyder FDH

Objector 2 (Name/Organization) D.M. Stenkamp/HKC ~~LMH~~ FDNW

Planned Action
Troubleshoot.

Action Taken
Retested, Voltages with-in Range.

RETEST EXECUTION AND ACCEPTANCE

Retest Installation Contractor	Date	Recorder R.G. Dykeman	Date 4/2/98
Witness 1 (Name/Organization) T.J. Kasnick FDNW	Date 4/2/98	Witness 2 (Name/Organization)	Date
Field Engineering	Date	Test Director (Name/Organization) HKC D.M. Stenkamp ~~LMH~~ FDNW	Date 4/2/98
Design Engineering (Author of ATP) [signature] Choudhury	Date 4/30/98	A-E Project Engineer	Date

APPROVAL AND ACCEPTANCE – OPERATING CONTRACTOR

☒ Retest Approved and Accepted ☐ Exception Accepted-as-is* ☐ Other*

* Explanation

Approver 1 [signature] Kasnick	Date 5/7/98	Approver 2 [signature] Stenkamp HKC	Date 5/8/98
Approver 3 [signature]	Date 6/29/98	Approver 4 Keith Conrad/QA	Date 6-30-98

KEH-428 (6-85)

EXCEPTION NO. 2	Project No. W-320	ATP N

Recorded by	Organization	Date R
R.G. Dykeman	FDH	

Step No.: 11.2.10

Requirement: Air flow should read 2475 ± 50

Description of Problem: Airflow recorded is 3151.

Objector 1 (Name/Organization): R.G. Dykeman FDH

Objector 2 (Name/Organization): D.M. Stenkamp/ ~~LMH~~ FDNW HKC

Planned Action: None

Action Taken: None

RETEST EXECUTION AND ACCEPTANCE

Retest Installation Contractor	Date	Recorder	Date
Witness 1 (Name/Organization)	**Date**	**Witness 2 (Name/Organization)**	**Date**
Field Engineering	**Date**	**Test Director (Name/Organization)**	**Date**
		D.M. Stenkamp/HKC	5/7/98
Design Engineering (Author of ATP)	**Date**	**A-E Project Engineer**	**Date**
HK Choudhury	4/30/98		

APPROVAL AND ACCEPTANCE – OPERATING CONTRACTOR

☐ Retest Approved and Accepted ☒ Exception Accepted-as-is* ☐ Other*

* Explanation: In the test configuration, recirc discharge duct was connected to HX-1361 inlet and exhaust fan was not running. As a result, recirc discharge inlet air flow recording of 3151 ft/min translates to 1100 SCFM and is correct. In the normal operation, 860 SCFM goes to tank C-106 and 230 SCFM goes to exhaust stack with a total of 1090 SCFM.

Approver 1	Date	Approver 2	Date
[signature]	5/7/98	D.M. Stenkamp/HKC	5/8/98
Approver 3	**Date**	**Approver 4**	**Date**
[signature]	6-29-98	Keith Conrad/QA	6-30-98

EXCEPTION NO. 3	Project No. W-320	ATP N
Recorded by R.G. Dykeman	Organization FDH	Date R 4

Step No. 7.1.2

Requirement: Systems and components have proper Id numbers.

Description of Problem: Components being changed during ATP. Will be verified by AI after As-builts are complete.

Objector 1 (Name/Organization)	Objector 2 (Name/Organization)
R.G. Dykeman FDH	DM Stenkamp/HKC

Planned Action: Acceptance Inspection to verify during As-built drawings completion. (spotcheck) –

Action Taken: Spotchecked Drawings # H-2-818561 Sheets # 3 thru 7. Verified components properly labeled.

RETEST EXECUTION AND ACCEPTANCE

Retest Installation Contractor	Date	Recorder	Date
Witness 1 (Name/Organization)	**Date**	**Witness 2 (Name/Organization)**	**Date**
[signature] FDH	5/6/98		
Field Engineering	**Date**	**Test Director (Name/Organization)**	**Date**
		D.M. [signature]/HKC	5/7/98
Design Engineering (Author of ATP)	**Date**	**A-E Project Engineer**	**Date**
HK Choudhury	4/30/98		

APPROVAL AND ACCEPTANCE – OPERATING CONTRACTOR

☐ Retest Approved and Accepted ☒ Exception Accepted-as-is* ☐ Other*

* Explanation

Via spotcheck by Acceptance Inspection, No Discrepancies were found.

Approver 1	Date	Approver 2	Date
[signature]	5/7/98	D.M. [signature]/HKC	5/8/98
Approver 3	**Date**	**Approver 4**	**Date**
[signature]	6-29-98	Keith Conrad/QA	6-30-98

EXCEPTION NO. 4	Project No. W-320
Recorded by R.G. Dykeman	Organization FDH
Step No. 10.5.2.23(a)(b)	Requirement Verify detector is working per ATP.

Description of Problem
Steps (a) & (b) could not be performed as written in ATP.

Objector 1 (Name/Organization)	Objector 2 (Name/Organization)
R.G. Dykeman FDH	DM Stenkamp/HKC ~~LMH~~ FDNW 05/07/98

Planned Action
~~None~~ 4/30/98 Step No 10.5.2.23 a & b are not required and have been deleted by ECN W-320-801.

Action Taken
~~None~~ 4/30/98 ECN W-320-801 issued to delete step no. 10.5.2.23 a and b.

RETEST EXECUTION AND ACCEPTANCE

Retest Installation Contractor	Date	Recorder	Date
Witness 1 (Name/Organization)	Date	Witness 2 (Name/Organization)	Date
Field Engineering	Date	Test Director (Name/Organization)	Date
		DM Stenkamp/HKC	5/7/98
Design Engineering (Author of ATP)	Date	A-E Project Engineer	Date
HK Choudhury	4/30/98		

APPROVAL AND ACCEPTANCE – OPERATING CONTRACTOR

☐ Retest Approved and Accepted ☒ Exception Accepted-as-is* ☐ Other*

* Explanation Radiation high level alarm output furnished by Vendor at Radiation Detector System is not a latching type. Since there is a latching type of annunciation at IE-1361 in the vicinity of Radiation Detector System is available, no physical change to Vendor furnished equipment is required.

Approver 1	Date	Approver 2	Date
[signature]	5/7/98	D. M. Stenkamp/HKC	5/8/98
Approver 3	Date	Approver 4	Date
[signature]	6/30/98	Keith Conrad/DA	6-30-98

KEH-428 (6-85)

EXCEPTION NO. 5	Project No. W-320	ATP
Recorded by R.G. DYKEMAN	Organization FDH	Date 4

Step No. 11.4.89 (RGD 5/5/98)

Requirement: DEPRESS reset and verify RXA-1365A in Normal.

Description of Problem: Jumper was installed to bypass TC-1, TC-2 and TC-3 at Radiation Monitoring Cabinet

Objector 1 (Name/Organization): R.G. DYKEMAN FDH

Objector 2 (Name/Organization): D.M. StenKamp/ ~~LMH~~ FDNW/HKC 05/07/98

Planned Action: HKC 4/30/98 ~~None~~ ECN 647833 rectifies the incorrect wiring for Temperature Controllers TC-1, TC-2, TC-3 (Note: Operation of TC-1, TC-2, TC-3 is not part of ATP)

Action Taken: NONE For ATP-012.

RETEST EXECUTION AND ACCEPTANCE

Retest Installation Contractor	Date	Recorder	Date
Witness 1 (Name/Organization)	**Date**	**Witness 2 (Name/Organization)**	**Date**
Field Engineering	**Date**	**Test Director (Name/Organization)**	**Date**
		D.M. Stenkamp/HKC	5/7/98
Design Engineering (Author of ATP)	**Date**	**A-E Project Engineer**	**Date**
HkChoudhry	4/30/98		

APPROVAL AND ACCEPTANCE – OPERATING CONTRACTOR

☐ Retest Approved and Accepted ☐ Exception Accepted-as-is* (HKC 5/7/98) ☒ Other*

*** Explanation:** Operation of Heat Tracing temperature controllers TC-1, TC-2 and TC-3 is not ~~of~~ part of ATP-012. After rectifying the incorrect wiring, functional check of controllers TC-1, TC-2, TC-3 will be performed via ECN 647833 WORK PACKAGE.

Approver 1	Date	Approver 2	Date
[signature]	5/7/98	D.M. Stenkamp	6/24/98
Approver 3	**Date**	**Approver 4**	**Date**
JR Bullard	6-29-98	Keith Conrad/QA	6-30-98

KEH-428 (6-85)

Post-Modification Functional Check for Rewiring CAM TC Alarm Output and Replacement of Exhaust Skid Alarm Pilot Lights (reference ECN 647833)

FLOUR DANIEL NORTHWEST (FDNW)

5/21/98	5-21-98
Author / Date	Checker / Date

NUMATEC HANFORD COMPANY (NHC) / LOCKHEED MARTIN HANFORD COMPANY (LMHC)

DMS 5/21/98	5/22/98
Project W-320 Eng / Date	Design Authority / Date
05-27-98	w/ comments 5/28/98
Cog. Eng / Date	Operations / Date
5-22-98	5/27/98
Quality Assurance / Date	Safety / Date

Note: Each step shall be initialed and dated by an AI representative.

1 **REFERENCES**

1.1 Air Monitor Corp., VI #22668 Supplement 161 (dwgs W25255CA, W25255CB, W25255CC & W25255CD)

1.2 H-2-818561, SH6, Rev 4

1.3 H-2-818561, SH7, Rev 4

1.4 H-2-818585, SH2, Rev 2

1.5 H-2-818596, SH1, Rev 1

1.6 H-2-818601, SH9, Rev 1

1.7 H-2-818675, SH3, Rev 1

1.8 H-2-818675, SH4, Rev 1

1.9 H-2-818681, SH2, Rev 1

1.10 H-2-818748, SH1, Rev 1

2 PREREQUISITES

BB 6-9-98 2.1 Power Distribution Panel C-PDP-1 is energized and voltages V_{AB}, V_{BC}, and V_{CA} are in range of 456 to 504 Vac.

BB 6-9-98 2.2 MCC-N1 supply breaker C-PDP-1/11 is CLOSED/ON.

BB 6-9-98 2.3 MCC-N1 Incoming Supply breaker MCC-N1/1FM is CLOSED/ON.

BB 6-9-98 2.4 Exhaust Fan VSD feeder breaker MCC-N1/2FML is locked and tagged OPEN/OFF.

BB 6-9-98 2.5 Exhaust Skid feeder breaker MCC-N1/2FMR is CLOSED/ON.

BB 6-9-98 2.6 Exhaust Skid incoming disconnect switch is CLOSED/ON.

BB 6-9-98 2.7 Panelboard C106-PP5 Primary Main breaker is ON.

BB 6-9-98 2.8 Panelboard C106-PP5 Secondary Main breaker is ON.

BB 6-9-98 2.9 Exhaust Skid Instrumentation power from Panelboard C106-PP5 breaker #5 is ON.

BB 6-9-98 2.10 Radiation Monitor Instrumentation & Control power from Panelboard C106-PP5 breaker #7 is ON.

BB 6-9-98 2.11 Voice communication is established between MO-211 and the Exhaust Skid.

3 EQUIPMENT/INSTRUMENTS

3.1 Multi-meter (MM): volt-ohmmeter rated to 600 Vac
950-45-08-038 3-13-99

3.2 RTD simulators (or Decade Boxes) - 2 required: for Platinum 100 ohm DIN

Instrument ID 817-63-02-002 Expiration Date 7-17-98

Instrument ID 817-63-02-010 Expiration Date 3-4-99

3.3 Variable Test Pressure Source (VTPS): 0 - 15" H_2O

3.4 Shorting jumper, #12 AWG, 2 feet long

CAUTION: THESE TESTS INVOLVE WORKING ON OR NEAR ENERGIZED EQUIPMENT; ALL PROCEDURAL REQUIREMENTS FOR WORKING ON OR NEAR ENERGIZED EQUIPMENT SHALL BE FOLLOWED.

NOTE: If the results of any step do not agree with expectations, STOP the test and NOTIFY the Test Director.

4 TEMPERATURE CONTROLLER (TC) TEST

BB 6-19-98 4.1 Inside the Radiation Monitor Cabinet, install jumper wire from relay K5 terminal 8 to TB-6 terminal 43.

BB 6-19-98 4.2 On TC-1 inside the Radiation Monitor Cabinet, adjust AL-1 (Type 5 Alarm) and AL-2 (Type 6 Alarm) setpoint to 15° F in accordance with Yokogawa vendor manual.

BB 6-19-98 4.3 On TC-2 inside the Radiation Monitor Cabinet, adjust AL-1 (Type 5 Alarm) and AL-2 (Type 6 Alarm) setpoint to 15 °F in accordance with Yokogawa vendor manual.

BB 6-19-98 4.4 On TC-3 inside the Radiation Monitor Cabinet, adjust alarm type dip switches and settings, in accordance with Yokogawa vendor manual, as follows:

a) local alarm AL-2 (Type 10) setpoint = 40 °F,
b) temperature control operational setpoint = 50 °F,
c) no remote setpoint function or deviation alarm type.

BB 6-19-98 4.5 At stack flow transmitter (Masstron) FT-13627, record temperature indication 69.8 °F.

BB 6-19-98 4.6 At the temperature transmitter TT-13623 (TT-2), disconnect TE-13623 (RTD) wires and connect the RTD simulator. Adjust the RTD simulator until the temperature indication on FT-1365 (Record Sample Masstron) matches the FT-13627 (Stack Masstron) temperature reading (+/- 10 °F).

BB 6-19-98 4.7 Verify that strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is OFF and the horn is NOT AUDIBLE.

BB 6-19-98 4.8 In MO-211, RESET and verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in NORMAL condition.

BB 6-19-98 4.9 At TT-13623 (TT-2), increase the RTD simulator output until the strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is ON and horn (UA-13655) is AUDIBLE. Silence horn and record FT-1365 (Record Sample Masstron) temperature indication 84.8 °F.

BB 6-19-98 4.10 Verify that FT-1365 (Record Sample Masstron) temperature indication is 13 °F - 17 °F above the temperature recorded in step 4.5.

BB 6-19-98 4.11 In MO-211, verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is steady ON, and audible is OFF.

BB 6-19-98 4.12 Inside the Radiation Monitor Cabinet, verify with a MM that 120 Vac is NOT present across TB-5 terminals 31 and 32 (i.e. Record Sample heat trace is off).

BB 6-19-98 4.13 At TT-13623 (TT-2), decrease the RTD simulator output until the strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is OFF and horn is NOT AUDIBLE. Record FT-1365 (Record Sample Masstron) temperature indication ~~72.3~~ 84.8 BB 6-19-98 °F.

BB 6-19-98 4.14 Verify that FT-1365 (Record Sample Masstron) temperature indication is 10 °F - 15 °F above the temperature recorded in step 4.5.

BB 6-19-98 4.15 In MO-211, RESET and verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in NORMAL condition.

BB 6-19-98 4.16 At TT-13623 (TT-2), decrease the RTD simulator output until the strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is ON and horn is AUDIBLE. Silence horn and record FT-1365 (Record Sample Masstron) temperature indication 54.4 °F.

BB 6-19-98 4.17 Verify that FT-1365 (Record Sample Masstron) temperature indication is 13 °F - 17 °F below the temperature recorded in step 4.5.

BB 6-19-98 4.18 In MO-211, verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is steady ON, and audible is OFF.

BB 6-19-98 4.19 Inside the Radiation Monitor Cabinet, verify with a MM that 120 Vac is across TB-5 terminals 31 and 32 (i.e. Record Sample heat trace is on).

BB 6-19-98 4.20 At TT-13623 (TT-2), disconnect the RTD simulator and reconnect TE-13623 (RTD) wires.

BB 6-19-98 4.21 At the temperature transmitter TT-13624 (TT-3), disconnect TE-13624 (RTD) wires and connect the RTD simulator. Adjust the RTD simulator until the temperature indication on FT-1366 (Beta/Gamma Masstron) matches the FT-13627 (Stack Masstron) temperature reading (+/- 10 °F).

BB 6-19-98 4.22 Verify that strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is OFF and the horn is NOT AUDIBLE.

BB 6-19-98 4.23 In MO-211, RESET and verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in NORMAL condition.

BB 6-19-98 4.24 At TT-13624 (TT-3), increase the RTD simulator output until the strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is ON and horn (UA-13655) is AUDIBLE. Silence horn and record FT-1366 (Beta/Gamma Masstron) temperature indication 85.6 °F.

BB 6-19-98 4.25 Verify that FT-1366 (Beta/Gamma Masstron) temperature indication is 13 °F - 17 °F above the temperature recorded in step 4.5.

BB 6-19-98 4.26 In MO-211, verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is steady ON, and audible is OFF.

BB 6-19-98 4.27 Inside the Radiation Monitor Cabinet, verify with a MM that 120 Vac is NOT present across TB-5 terminals 33 and 34 (i.e. Beta/Gamma sample heat trace is off).

BB 6-19-98 4.28 At TT-13624 (TT-3), decrease the RTD simulator output until the strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is OFF and horn is NOT AUDIBLE. Record FT-1366 (Beta/Gamma Masstron) temperature indication 85.3 °F.

BB 6-19-98 4.29 Verify that FT-1365 (Record Sample Masstron) temperature indication is 10 °F - 15 °F above the temperature recorded in step 4.5.

BB 6-19-98 4.30 In MO-211, RESET and verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in NORMAL condition.

BB 6-19-98 4.31 At TT-13624 (TT-3), decrease the RTD simulator output until the strobe light XL-1365 mounted on the Radiation Monitoring Cabinet is ON and horn is AUDIBLE. Silence horn and record FT-1366 (Beta/Gamma Masstron) temperature indication 53.5 °F.

BB 6-19-98 4.32 Verify that FT-1365 (Record Sample Masstron) temperature indication is 13 °F - 17 °F below the temperature recorded in step 4.5.

BB 6-19-98 4.33 In MO-211, verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is steady ON, and audible is OFF.

BB 6-19-98 4.34 Inside the Radiation Monitor Cabinet, verify with a MM that 120 Vac is across TB-5 terminals 33 and 34 (i.e. Beta/Gamma sample heat trace is on).

BB 6-19-98 4.35 Inside the Radiation Monitor Cabinet, verify with a MM that 120 Vac is NOT present across TB-5 terminals 35 and 36 (i.e. Sample Exhaust heat trace is off).

BB 6-19-98 4.36 Inside the Radiation Monitor Cabinet, use MM to monitor for 120 Vac across TB-5 terminals 35 and 36. At TT-13624 (TT-3), decrease the RTD simulator output until MM indicates 120 Vac (i.e. Sample Exhaust heat trace on) and record FT-1366 (Beta/Gamma Masstron) temperature indication 48.6 °F.

BB 6-19-98 4.37 Verify that FT-1366 (Beta/Gamma Masstron) temperature indication is 50 °F ± 2 °F.

BB 6-19-98 4.38 At TT-13624 (TT-3), decrease the RTD simulator output until the RED AL-2 LED on TC-3 is LIT and record FT-1366 (Beta/Gamma Masstron) temperature indication 39.2 °F.

BB 6-19-98 4.39 Verify that FT-1366 (Beta/Gamma Masstron) temperature indication is 40 °F ± 2 °F.

BB 6-19-98 4.40 At TT-13624 (TT-3), disconnect the RTD simulator and reconnect TE-13624 (RTD) wires.

BB 6-19-98 4.41 Inside the Radiation Monitor Cabinet, disconnect jumper wire between relay K5 terminal 8 and TB-6 terminal 43 (previously installed in step 4.1).

BB 6-19-98 4.42 In MO-211, RESET and verify that TANK 241-C-106 RAD MON SYSTEM TROUBLE RXA-1365A (window 4-3 on ANN-1361) is in NORMAL condition.

6/15/98: Minor changes made to reflect restoration of TC-1 and TC-2 alarm wiring to original configuration (ECN 648245) and to reflect alarm setpoints are in °F, not %. TJKosanich 6/15/98 RG Swan 6/15/98

JRBollany 6/17/98

5 EXHAUST SKID ALARM PILOT LIGHT TEST

NOTE: Prior to steps that simulate alarms, Annunciator Panel ANN-1361 may need to be ACKNOWLEDGED and RESET to clear conditions caused by test equipment hookup and removal.

5.1 TLH-13626

BB 6-9-98 5.1.1 On Exhaust Skid Instrument Panel, verify the Push-to-Test lamp test feature for TLH-13626, TLH-13635, PDLH-13618, PDLH-13619, and PDLH-13620 functions correctly.

BB 6-9-98 5.1.2 Inside the Exhaust Fan FN-1362 VSD, lift lead ANN-1361-5-3 from TB-A terminal 4 (clears alarm input to HVAC Trouble Alarm XA-13640).

BB 6-9-98 5.1.3 At TIT-13626 on the Exhaust Skid, disconnect wires from TE-13626. Connect RTD simulator (or Decade Box) to TIT-13626. Set the RTD Simulator (or Decade Box) to 50 °F (103.9 ohms).

BB 6-9-98 5.1.4 In MO-211, reset and verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in NORMAL condition.

BB 6-9-98 5.1.5 Increase RTD simulator (or Decade Box) output until the alarm light, on the Exhaust Skid Instrument Panel, for **INLET TEMP HI TLH-13626** is LIT. Verify simulator output is 59 °F - 61 °F (105.85 - 106.28 ohms).

BB 6-9-98 5.1.6 In MO-211, verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is STEADY ON and audible is OFF.

BB 6-9-98 5.1.7 Decrease RTD simulator (or Decade Box) output until the alarm light, on the Exhaust Skid Instrument Panel, for **INLET TEMP HI TLH-13626** is NOT LIT. Verify simulator output is 49 °F - 51 °F (103.67 - 104.12 ohms).

BB 6-9-98 5.1.8 In MO-211, RESET and verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in NORMAL condition.

5.2 TLH-13635

BB 6-9-98 5.2.1 At TIT-13635 on the Exhaust Skid, disconnect wires from TE-13635. Connect RTD simulator (or Decade Box) to TIT-13635. Set the RTD Simulator (or Decade Box) to 50 °F (103.9 ohms).

BB 6-9-98 5.2.2 Increase RTD simulator (or Decade Box) output until the alarm light, on the Exhaust Skid Instrument Panel, for **OUTLET TEMP HI TLH-13635** is LIT. Verify simulator output is 199 °F - 201 °F (135.76 - 136.18 ohms).

BB 6-9-98 5.2.3 In MO-211, verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is STEADY ON and audible is OFF.

BB 6-9-98 5.2.4 Decrease RTD simulator (or Decade Box) output until the alarm light, on the Exhaust Skid Instrument Panel, for **OUTLET TEMP HI TLH-13635** is NOT LIT. Verify simulator output is 179 °F - 181 °F (131.53 - 131.95 ohms).

BB 6-9-98 5.2.5 In MO-211, RESET and verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in NORMAL condition.

BB 6-9-98 5.2.6 Disconnect RTD simulator (or Decade Box) from TIT-13635 and reconnect TE-13635 wires.

5.3 PDLH-13618

BB 6-9-98 5.3.1 On PDISH-13618, verify that the indication is less than 5.0" WC. On Exhaust Skid Instrument Panel, verify alarm light for **FILTER SECT 1 DP-HI PDLH-13618** is NOT LIT.

BB 6-9-98 5.3.2 At PDISH-13618 on the 5 valve manifold (5VM), close valves HV-136174-1A and -1B. Verify that valves HV-136174-1C, -1D, and -1E are closed.

BB 6-9-98 5.3.3 At PDISH-13618 test ports, connect a variable test pressure source (VTPS) to the High side and open the Low side to atmosphere.

BB 6-9-98 5.3.4 At PDISH-13618, increase VTPS until alarm light, on the Exhaust Skid Instrument Panel, for **FILTER SECT 1 DP-HI PDLH-13618** is LIT. Verify pressure is 5.0 ± 0.2 " WC.

BB 6-9-98 5.3.5 In MO-211, verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is STEADY ON and audible is OFF.

BB 6-9-98 5.3.6 At PDISH-13618, decrease VTPS until alarm light, on the Exhaust Skid Instrument Panel, for **FILTER SECT 1 DP-HI PDLH-13618** is NOT LIT. Verify pressure is less than 4.8 " WC.

BB 6-9-98 5.3.7 In MO-211, RESET and verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in NORMAL condition.

BB 6-9-98 5.3.8 At PDISH-13618 test ports, disconnect the VTPS and recap the test ports. Open valves HV-136174-1A and -1B.

5.4 PDLH-13619

BB 6-9-98 5.4.1 On PDISH-13619, verify that the indication is less than 4.0" WC. On Exhaust Skid Instrument Panel, verify alarm light for **FILTER SECT 2 DP-HI PDLH-13619** is NOT LIT.

BB 6-9-98 5.4.2 At PDISH-13619 on the 5 valve manifold (5VM), close valves HV-136175-1A and -1B. Verify that valves HV-136175-1C, -1D, and -1E are closed.

BB 6-9-98 5.4.3 At PDISH-13619 test ports, connect a variable test pressure source (VTPS) to the High side and open the Low side to atmosphere.

BB 6-9-98 5.4.4 At PDISH-13619, increase VTPS until alarm light, on the Exhaust Skid Instrument Panel, for **FILTER SECT 2 DP-HI PDLH-13619** is LIT. Verify pressure is 4.0 ± 0.2 " WC.

BB 6-9-98 5.4.5 In MO-211, verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is STEADY ON and audible is OFF.

BB 6-9-98 5.4.6 At PDISH-13619, increase VTPS until alarm light, on the Exhaust Skid Instrument Panel, for **FILTER SECT 2 DP-HI PDLH-13619** is NOT LIT. Verify pressure is less than 3.8 " WC.

BB 6-9-98 5.4.7 In MO-211, RESET and verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in NORMAL condition.

BB 6-9-98 5.4.8 At PDISH-13619 test ports, disconnect the VTPS and recap the test ports. Open valves HV-136175-1A and -1B.

5.5 PDLH-13620

BB 6-9-98 5.5.1 On PDISH-13620, verify that the indication is less than 5.9" WC. On Exhaust Skid Instrument Panel, verify alarm light for **FILTER OVERALL DP-HI PDLH-13620** is NOT LIT.

BB 6-9-98 5.5.2 At PDISH-13620 on the 5 valve manifold (5VM), close valves HV-136176-1A and -1B. Verify that valves HV-136176-1C, -1D, and -1E are closed.

BB 6-9-98 5.5.3 At PDISH-13620 test ports, connect a variable test pressure source (VTPS) to the High side and open the Low side to atmosphere.

BB 6-9-98 5.5.4 At PDISH-13620, increase VTPS until alarm light, on the Exhaust Skid Instrument Panel, for **FILTER OVERALL DP-HI PDLH-13620** is LIT. Verify pressure is 5.9 ± 0.2 " WC.

BB 6-9-98 5.5.5 Approximately 30 seconds following step 5.5.4, In MO-211, verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in ALERT condition and audible is ON; acknowledge and verify alarm is STEADY ON and audible is OFF.

BB 6-9-98 5.5.6 At PDISH-13620, decrease VTPS until alarm light, on the Exhaust Skid Instrument Panel, for **FILTER OVERALL DP-HI PDLH-13620** is NOT LIT. Verify pressure is less than 5.7 " WC.

BB 6-9-98 5.5.7 In MO-211, RESET and verify TANK 241-C-106 EXH SKID HVAC SYSTEM TROUBLE XA-13640 (window 5-3 on ANN-1361) is in NORMAL condition.

BB 6-9-98 5.5.8 At PDISH-13620 test ports, disconnect the VTPS and recap the test ports. Open valves HV-136176-1A and -1B.

BB 6-9-98 5.5.9 Inside the Exhaust Fan FN-1362 VSD, reconnect lead ANN-1361-5-3 (lifted in step 5.1.1) to TB-A terminal 4 (restores alarm input to HVAC Trouble Alarm XA-13640).

BB 6-9-98 5.5.10 Disconnect RTD simulator (or Decade Box) from TIT-13626 and reconnect TE-13626 wires.

Test Director Name (printed) and signature: DANIEL M. STENKAMP Daniel M. Stenkamp

AI rep Name (printed) & Initials: Brian Belew BB

Completed copies to: JCS 2E-98-00912
TJ Kasnick
JR Bellomy

EXCEPTION NO. 6	Project No. W-320	ATP N
Recorded by R.G. Dykeman	Organization FDH	Date 4

Step No. 4 (pg. 10) | Requirement: If change is discovered, the test shall be stopped.

Description of Problem
SECTION # 11.4 WAS RUN WITH A DRAFT COPY OF THE ECN. (REF. HNF-SD-W320-TP-001)

Objector 1 (Name/Organization) R.G. Dykeman FDH	Objector 2 (Name/Organization) D.M. Stenkamp/HKC ~~LMH~~ FDNW 05/07/98

Planned Action
Issue the approved ECN W-320-801.

Action Taken
ECN issued to revise Section # 11.4.

RETEST EXECUTION AND ACCEPTANCE

Retest Installation Contractor	Date	Recorder	Date
Witness 1 (Name/Organization)	Date	Witness 2 (Name/Organization)	Date
Field Engineering	Date	Test Director (Name/Organization) D.M. Stenkamp/HKC	Date 5/7/98
Design Engineering (Author of ATP) HK Choudhury	Date 4/30/98	A-E Project Engineer	Date

APPROVAL AND ACCEPTANCE – OPERATING CONTRACTOR

☐ Retest Approved and Accepted ☒ Exception Accepted-as-is* ☐ Other*

* Explanation The test was completed using the draft copy and then incorporated into the ATP via ECN W-320-801. Testing per the draft copy was successful and no retesting is required.

Approver 1 [signature]	Date 5/7/98	Approver 2 D.M. Stenkamp/HKC	Date 5/8/98
Approver 3 [signature]	Date 6-29-98	Approver 4 Keith Conrad	Date 6-30-98

KEH-428 (6-85)

POST-MODIFICATION FUNCTIONAL CHECK FOR HME-1361/HMF-1361 RADIATION MONITOR (REF ECN 647831)

FLUOR DANIEL NORTHWEST (FDNW)

Author	Date 6/16/98	Checker	Date 6/16/98

NUMATEC HANFORD COMPANY (NHC) / LOCKHEED-MARTIN HANFORD COMPANY (LMHC)

Project W-320 Eng	Date 6/16/98	Design Authority	Date 6/16/98
Cog. Eng	Date 06/17/98	Operations	Date 6/17/98
Quality Assurance	Date 6-16-98	Safety	Date 6/17/98

NOTE: The radiation monitoring system shall be retested due to the relocation of the radiation element and to ascertain that the radiation monitoring system functions.

NOTE: Each step shall be initialed and dated by an AI representative.

1 REFERENCES

1.1 H-2-818561, SH 4, REV 4
1.2 H-2-818586, SH 1, REV 2
1.3 H-2-818586, SH 3, REV 3
1.4 H-2-818587, SH 1, REV 2
1.5 H-2-818587, SH 1, REV 2
1.6 H-2-818587, SH 2, REV 2
1.7 H-2-818587, SH 3, REV 2
1.8 H-2-818588, SH 1, REV 1
1.9 H-2-818603, SH 4, REV 1
1.10 H-2-818675, SH 3, REV 1
1.11 H-2-818675, SH 6, REV 1
1.12 H-2-818678, SH 2, REV 2
1.13 H-2-818678, SH 3, REV 2
1.14 H-2-818680, SH 1, REV 1

2 PREREQUISITES

BB 6-22-98 2.1 Familiarize with "Indicators and Alarms" section of vendor (Nuclear Research Corporation). Operations and maintenance manual; Reference to CVI No. 22668. Supplement No. 133.

BB 6-22-98 2.2 Power Distribution Panel C-PDP-1 is energized and voltages V_{AB}, V_{BC}, and V_{CA} are in range of 456 to 504 V AC.

BB 6-22-98 2.3 MCC-N1 supply breaker C-PDP-1/11 is CLOSED/ON.

BB 6-22-98 2.4 MCC-N1 Incoming Supply breaker MCC-N1/1FM is CLOSED/ON.

BB 6-22-98 2.5 Process Building feeder breaker MCC-N1/1FDR is CLOSED/ON.

BB 6-22-98 2.6 Process Building Main Disconnect Switch DS-1 is CLOSED/ON.

BB 6-22-98 2.7 Process Building Power Panel C106-PP1 Supply Circuit Breaker CB-01 is CLOSED/ON.

BB 6-22-98 2.8 Panelboard C106-PP1 Primary Main breaker is ON.

BB 6-22-98 2.9 Panelboard C106-PP1 Secondary Main breaker is ON.

BB 6-22-98 2.10 Process Building Instrumentation power from Panelboard C106-PP1 breaker #5 is ON.

BB 6-22-98 2.11 On IR-1361 and in TBX-PB-1, fuses are installed: TB-2 Fuse Blocks FU-3, FU-4 and FU-5.

BB 6-22-98 2.12 Voice communication is established between MO-211, the Process Building 241-C-91, and 2750-E Bldg. (TMACS).

BB 6-22-98 2.13 All worker safety equipment required to perform tests is readily available.

3 EQUIPMENT/INSTRUMENTS

Supplied by Test Operator unless otherwise noted.

3.1 Radiation Test Sources: Provide with uniform gamma radiation field up to a minimum of 20 mR/hr supplied and handled by Operating Contractor.

Source ID No. ETVB-4 Expiration Date N/A BB 6-22-98

NOTE: If the results of any step do not agree with expectations, stop the test and NOTIFY the Test Director.

4 HME-1361/HMF-1361 RADIATION MONITOR

The following will verify the operation of the radiation monitoring of the HME-1361/HMF-1361 by use of a radiation source to simulate activities, and to ascertain that the local and remote alarms function. The following will also verify the operation of the radiation monitoring system by disconnecting the detector to simulate system failure, and to ascertain that the local and remote alarms function.

CAUTION: A radiation source will be present during the course of this test procedure. Only the HPT will handle the radiation source as required by this test procedure.

4.1 PREPARATION

BB 6-22-98 4.1.1 Power is available to RIT-1361/RSH-1361/RXS-1361 located on rack IR-1361 and enclosure IE-1361.

BB 6-22-98 4.1.2 In 241-C-91 and on IE-1361 (ANN-1362), depress Reset pushbutton and verify annunciator windows RAH-1361 and RXA-1361 are NORMAL.

BB 6-22-98 4.1.3 In MO-211 and on CP-01 (ANN-1361), depress Reset pushbutton and verify annunciator window RAH-1361A is NORMAL.

NOTE: The testing will only check the alarm actuation on annunciators ANN-1362 RAH-1361 and RXA-1361 on IE-1361 in the Process Building 241-C-91, and ANN-1361 (RAH-1361A) on CP-01. The HVAC System Trouble Alarm XA-1368 (3-3) in MO-211 has already been tested by ATP-012. Therefore, ignore alarm input to window XA-1368 by depressing ACK pushbutton for every occurance.

4.2 RADIATION MONITORING TESTS

CAUTION: Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.

BB 6-23-98 4.2.1 On RIT-1361/RSH-1361/RXS-1361, open door and position AC power-supply switch to ON, close and secure door, then turn the key switch on the front panel to the KEYPAD position.

4.2.2 When the indicator display defaults to a gamma dose rate in mR/hr, then perform the following:

BB 6-23-98 4.2.2.1 Record background reading from the display: .97-1 mR/hr. Verify background reading is below 7.50 mR/hr.

BB 6-23-98 4.2.2.2 Verify top mounted green lamp is LIT.

BB 6-23-98 4.2.2.3 Depress momentarily the CHECK SOURCE membrane switch on the front panel, record the time 8:42 AM and upscale (check source) reading 6.8 mR/hr when the check source is energized. (This reading should be approximately one decade above the background reading recorded in Step 4.2.2.1. above.)

Reading is acceptable JJKoenick 6/23/98

Per instrument tech, check source should be approximately 6 mR/hr (per O&M manual GP-100C series G-M detector) JJKoenick 6/23/98

BB 6-23-98 4.2.2.4 Record the time when the upscale reading changed back to the reading recorded in Step 4.2.2.1. above (This time should be approximately 30 seconds, the time required for the check source to retract.). TIME: 30 Sec

JRBilla 6-23-98

4.2.3 On RIT-1361/RSH-1361/RXS-1361, verify the following:

BB 6-23-98 4.2.3.1 The top mounted red lamp is FLASHING.

BB 6-23-98 4.2.3.2 The red alert light is LIT.

BB 6-23-98 4.2.3.3 The audible horn is ON.

4.2.4 Verify the following alarms and lights:

BB 6-23-98 4.2.4.1 At IE-1361 and on ANN-1362, RAH-1361 is FLASHING and audible horn is ON.

BB 6-23-98 4.2.4.2 Strobe light RLH-1361 on Bldg. 241-C-91 is FLASHING.

BB 6-23-98 4.2.4.3 At CP-01 and on ANN-1361, RAH-1361A is FLASHING and audible horn is ON.

BB 6-23-98 4.2.4.4 In 2750-E Bldg., RAH-1361B displays a message at TMACS screen.

4.2.5 On RIT-1361/RSH-1361/RXS-1361:

BB 6-23-98 4.2.5.1 Depress RESET membrane switch on front panel face.

BB 6-23-98 4.2.5.2 Verify top mounted red lamp is NOT LIT.

BB 6-23-98 4.2.5.3 Verify integral red alert light is NOT LIT.

BB 6-23-98 4.2.5.4 Verify top mounted green lamp is LIT.

BB 6-23-98 4.2.5.5 Verify the audible horn is OFF

BB 6-23-98 4.2.6 Strobe light RLH-1361 on Bldg. 241-C-91 is OFF.

BB 6-23-98 4.2.7 At IE-1361 and on ANN-1362, depress acknowledge and verify RAH-1361 is STEADY ON and the audible horn is OFF. Then depress RESET and verify RAH-1361 is NORMAL.

BB 6-23-98 4.2.8 At CP-01 and on ANN-1361, depress acknowledge and verify RAH-1361A is STEADY ON and the audible horn is OFF. Then depress RESET and verify RAH-1361A is NORMAL.

BB 6-23-98 4.2.9 In 2750-E Bldg., verify RAH-1361B does NOT display a message at TMACS screen.

BB 6-23-98 4.2.10 On RIT-1361/RSH-1361/RXS-1361, depress and hold the TEST membrane switch on the front panel face, and verify that all Visual Displays, indicator lamps, and horn on the Radiation Monitor unit operate as designed (Refer to section 1.2 of Vendor operations and maintenance manual). Also, verify the following:

BB 6-23-98 4.2.10.1 The top mounted red lamp is FLASHING.

BB 6-23-98 4.2.10.2 The top mounted green lamp is LIT.

BB 6-23-98 4.2.10.3 The integral red alert light is LIT.

BB 6-23-98 4.2.10.4 The integral yellow fail light is LIT.

BB 6-23-98 4.2.10.5 The audible horn is ON.

BB 6-23-98 4.2.10.6 Annunciator windows RAH-1361 and RXA-1361 on ANN-1362 at IE-1361 are FLASHING and audible is ON.

BB 6-23-98 4.2.10.7 Strobe Light RLH-1361 on the Building 241-C-91 is FLASHING.

BB 6-23-98 4.2.10.8 Annunciator window RAH-1361A on ANN-1361 at CP-01 is FLASHING and audible is ON.

BB 6-23-98 4.2.10.9 In 2750-E Bldg., RAH-1361B displays message at TMACS screen.

4.2.11 Acknowledge and verify the following:

BB 6-23-98 4.2.11.1 Annunciator windows RAH-1361 and RXA-1361 on ANN-1362 at IE-1361 are STEADY ON and audible is OFF.

BB 6-22-98 4.2.11.2 Annunciator window RAH-1361A on ANN-1361 at CP-01 is STEADY ON and audible is OFF.

BB 6-22-98 4.2.12 On RIT-1361/RSH-1361/RXS-1361, RELEASE the TEST membrane switch on the front panel and verify all visual displays, indicator lamps, and horns on the Radiation Monitor unit are OFF, except for the green stack lamp. Reset alarms listed in Step 4.2.11 and verify annunciator windows are NORMAL.

BB 6-22-98 4.2.13 In 2750-E Bldg., verify RAH-1361B does NOT display a message at TMACS screen.

BB 6-22-98 4.2.14 On RIT-1361/RSH-1361/RXS-1361, turn key switch on the front panel to ON.

BB 6-22-98 4.2.15 Record radiation test source (RTS) gamma radiation field: 175.5 mR/hr

BB 6-22-98 4.2.16 In Rm 1, slowly move the RTS towards RE-1361 along the major axis perpendicular to it. During this activity, verify the following:

BB 6-22-98 4.2.16.1 On RIT-1361, that the indicator display goes through FLASHING "A", the audible horn is ON, and the integral amber alert light is LIT, before the top mounted red lamp is FLASHING.

BB 6-22-98 4.2.16.2 Annunciator window RAH-1361 on ANN-1362 at IE-1361 is FLASHING and audible is ON.

BB 6-22-98 4.2.16.3 Strobe Light RLH-1361 on the Building 241-C-91 is FLASHING.

BB 6-22-98 4.2.16.4 Annunciator window RAH-1361A on ANN-1361 at CP-01 is FLASHING and audible is ON.

BB 6-22-98 4.2.16.5 In 2750-E Bldg., RAH-1361B displays message at TMACS screen.

4.2.17 Acknowledge and verify the following:

BB 6-22-98 4.2.17.1 Annunciator window RAH-1361 on ANN-1362 at IE-1361 is STEADY ON and audible is OFF.

BB 6-22-98 4.2.17.2 Annunciator window RAH-1361A on ANN-1361 at CP-01 is STEADY ON and audible is OFF.

BB 6-22-98 4.2.18 Verify that the strobe light RLH-1361 on the Building 241-C-91 is still FLASHING.

4.2.19 On RIT-1361/RSH-1361/RXS-1361, verify the following:

BB 6-22-98 4.2.19.1 A flashing "H" appeared on the display.

BB 6-22-98 4.2.19.2 The top mounted green lamp is NOT LIT.

BB 6-22-98 4.2.19.3 The top mounted red lamp is FLASHING.

BB 6-22-98 4.2.19.4 The integral red alert light is LIT

BB 6-22-98 4.2.19.5 The integral horn is AUDIBLE.

BB 6-22-98 4.2.20 On the keypad of RIT-1361/RSH-1361/RXS-1361, depress RESET membrane switch and verify that a flashing "H" is still displayed, the top mounted red lamp continues to FLASH, the integral red alert light is still LIT, and the horn is SILENCED.

BB 6-22-98 4.2.21 Verify that the strobe light RLH-1361 on the Building 241-C-91 continues FLASHING.

BB 6-22-98 4.2.22 Record reading from RIT-1361/RSH-1361/RXS-1361 display: 2.31+1 mR/hr. Verify reading recorded is ~~within ±10% of that recorded in Step 4.2.15.~~ JK 6/23/98 greater than or equal to 20mR/hr. [signature] 6/23/98 [signature] 6/23/98

BB 6-22-98 4.2.23 Remove RTS from the detector, then perform the following:

BB 6-22-98 4.2.23.1 On RIT-1361/RSH-1361/RXS-1361, depress RESET membrane switch, then verify that the integral red light is NOT LIT, the top mounted red lamp is NOT LIT, the top mounted green lamp is LIT, and the integral yellow fail light is NOT LIT.

BB 6-22-98 4.2.23.2 On ANN-1362 at IE-1361, reset and verify RAH-1361 is in NORMAL condition.

BB 6-22-98 4.2.23.3 On ANN-1361 at CP-01, reset and verify RAH-1361A is in NORMAL condition.

BB 6-22-98 4.2.23.4 In 2750-E Bldg., verify RAH-1361B does NOT display a message at TMACS screen.

BB 6-22-98 4.2.24 On RIT-1361/RSH-1361/RXS-1361, turn key switch to KEYPAD position. Verify that the upscale reading recorded in Step 4.2.23 changed back to the previous reading recorded on Step 4.2.2.1.

NOTE: The reading to be recorded in the following step will be the result from the cumulative monitoring by the radiation detector to the gamma radiation field (from background and from RTS) over a period of time and will not be verified at this time.

BB 6-22-98 4.2.25 Depress MODE membrane switch until the display indicates gamma accumulated DOSE in mR, then record reading: 2.43+0 mR

BB 6-22-98 4.2.26 Depress MODE membrane switch until the display indicates the background gamma DOSE RATE in mR/hr.

BB 6-22-98 4.2.27 On RIT-1361/RSH-1361/RXS-1361, disconnect cable from RE-1361 connected to the connector labeled "PROBE 2 (J2)." After about 2 ½ minutes, verify the following:

BB 6-22-98 4.2.27.1 The NO COUNT failure message appeared on the display

BB 6-22-98 4.2.27.2 The top mounted green lamp is NOT LIT

BB 6-22-98 4.2.27.3 The top mounted red lamp is NOT LIT

BB 6-22-98 4.2.27.4 The integral horn is INAUDIBLE

BB 6-22-98 4.2.27.5 The integral red alert light is NOT LIT

BB 6-22-98 4.2.27.6 The integral yellow fail light is LIT

BB 6-22-98 4.2.28 Verify RXA-1361 on ANN-1362 at IE-1361 is FLASHING and audible is ON.

BB 6-22-98 4.2.29 Acknowledge and verify RXA-1361 on ANN-1362 at IE-1361 is STEADY ON and audible is OFF.

BB 6-22-98 4.2.30 On RIT-1361/RSH-1361/RXS-1361, reconnect cable from RE-1361 disconnected from the connector in Step 4.2.27. Depress RESET membrane switch and verify the following:

BB 6-22-98 4.2.30.1 The NO COUNT failure message disappeared from the display and display indicates mR/hr

BB 6-22-98 4.2.30.2 The top mounted green lamp is LIT

BB 6-22-98 4.2.30.3 The top mounted red lamp is NOT LIT

BB 6-22-98 4.2.30.4 The integral red alert light is NOT LIT

BB 6-22-98 4.2.30.5 The integral yellow fail light is NOT LIT

BB 6-22-98 4.2.31 Reset and verify RXA-1361 on ANN-1362 at IE-1361 went from STEADY ON to NORMAL condition.

END OF TEST

Test Director Name (printed) and signature: Daniel M. Stenkamp Daniel Stenkamp

AI Representative Name (printed) and initial: Brian Below BB

Completed copies to: JCS 2E-98-01055
TJ Kasnick
JR Bellomy

POST-MODIFICATION FUNCTIONAL CHECK
FOR RECIRC FAN FN-1361 INTERLOCK WITH EXHAUST FAN FN-1362
(Reference ECN 647840)

FLUOR DANIEL NORTHWEST (FDNW)

Author 6/4/98 (Date)	Checker 6/4/98 (Date)

NUMATEC HANFORD COMPANY (NHC) / LOCKHEED MARTIN HANFORD COMPANY (LMHC)

Project W-320 Eng 6-4-98 (Date)	Design Authority 6/4/98 (Date)
Cog. Eng 06-04-98 (Date)	Operations 6/4/98 (Date)
Quality Assurance 6-4-98 (Date)	Safety 6/4/98 (Date)

NOTE: Each step shall be initialed and dated by an AI representative.

1 REFERENCES

1.1 H-2-818558, SH 4, REV 3
1.2 H-2-818561, SH 3, REV 4
1.3 H-2-818561, SH 6, REV 4
1.4 H-2-818585, SH 2, REV 2
1.5 H-2-818585, SH 3, REV 2
1.6 H-2-818674, SH 2, REV 2
1.7 H-2-818674, SH 4, REV 1
1.8 H-2-818674, SH 5, REV 1
1.9 H-2-818675, SH 2, REV 1
1.10 H-2-818675, SH 3, REV 1
1.11 H-2-818675, SH 4, REV 1
1.12 H-2-818675, SH 6, REV 2
1.13 H-2-818678, SH 3, REV 2
1.14 H-2-818678, SH 5, REV 2
1.15 H-2-818680, SH 1, REV 1
1.16 H-2-818681, SH 2, REV 1

2 PREREQUISITES

BB 6-8-98 2.1 Power Distribution Panel C-PDP-1 is energized and voltages V_{AB}, V_{BC}, and V_{CA} are in range of 456 to 504 V AC.

BB 2.2 MCC-N1 supply breaker C-PDP-1 / 11 is CLOSED/ON.

BB 2.3 MCC-N1 Incoming Supply breaker MCC-N1 / 1FM is CLOSED/ON.

BB 2.4 Exhaust Fan VSD feeder breaker MCC-N1 / 2FML is OPEN/OFF.

BB 2.5 Exhaust Skid feeder breaker MCC-N1 / 2FMR is CLOSED/ON.

BB 2.6 Process Building feeder breaker MCC-N1 / 1FDR is CLOSED/ON.

BB 2.7 Exhaust Fan FN-1362 local disconnect switch is CLOSED/ON.

BB 2.8 HC-1362 Heater Control Panel SCP-1362 local disconnect switch is CLOSED/ON.

BB 2.9 Exhaust Skid incoming disconnect switch is CLOSED/ON.

BB 2.10 Process Building Main disconnect switch DS-1 is CLOSED/ON.

BB 2.11 Process Building Power Panel C106-PP1 Supply CB-01 is CLOSED/ON.

BB 2.12 Recirc Fan FN-1361 disconnect switch DS-4 is OPEN/OFF.

BB 2.13 Panelboard C106-PP1 (in Process Bldg.) Primary Main breaker is ON.

BB 2.14 Panelboard C106-PP1 Secondary Main breaker is ON.

BB 2.15 Process Building Instrumentation power (IE-1361) from Panelboard C106-PP1 breaker #5 is ON.

BB 2.16 Panelboard C106-PP5 (on Exhaust Skid) Primary Main breaker is ON.

BB 2.17 Panelboard C106-PP5 Secondary Main breaker is ON.

BB 2.18 Exhaust Skid Instrumentation power from Panelboard C106-PP5 breaker #5 is ON.

BB 2.19 Radiation Monitor Instrumentation & Control power from Panelboard C106-PP5 breaker #7 is ON.

BB 2.20 Voice communications are available between the Process Bldg. 241-C-91, the Electrical Equipment Skid (EES) 241-C-51, and the Operator Station in MO-211.

BB ✓ 2.21 All worker safety equipment required to perform test is readily available.

NOTE: If the results of any step do not agree with expectations, stop the test and NOTIFY the Test Director.

3 RECIRC FAN FN-1361 INTERLOCK WITH EXHAUST FAN FN-1362

CAUTION: Observe proper electrical safety precautions around energized equipment in accordance with FDNW Practice 134.653.2309, Electrical Work Safety.

3.1 Recirc Fan FN-1361 interlock with Exhaust Fan FN-1362 This test will verify correct operation of the new Recirc Fan FN-1361 interlock with Exhaust Fan FN-1362. This test will also re-verify correct operation of the existing HC-1362 Heater Control Panel SCP-1362 interlock with Exhaust Fan FN-1362.

NOTE: During the following tests, alarms may occur on the annunciator ANN-1361 in MO-211. Ignore alarms from windows XA-1362A, XA-1368 and XA-13640 by depressing ACK pushbutton for every occurrence.

BB 6-8-98 3.1.1 In EES, CLOSE Exhaust Fan VSD FN-1362 feeder breaker MCC-N1 / 2FML. close VSD exhaust Fan FN-1362 Local disconnect. BB 6-8-98 [signature] 6/8/98

BB ______ 3.1.2 North of Process Bldg., CLOSE Recirc Fan FN-1361 disconnect switch DS-4.

BB ______ 3.1.3 On SCP-1362, position Heater ON/OFF selector switch HS-13630 to the ON position. Verify Power On status light YL-13629A is LIT and the Heater On status light YL-13629B is NOT LIT.

BB ______ 3.1.4 On IE-1361, DEPRESS Recirc Fan FN-1361 ON pushbutton HS-13635A. Verify status lights YL-13635A is NOT LIT and YL-13635B is LIT (fan OFF).

BB ______ 3.1.5 Verify Recirc Fan FN-1361 is NOT RUNNING. BB 6-8-98 [signature] 6/8/98
Install Jumper @ TB-4 Between terminals 23+24 in the radiation monitor cabinet, because rad monitor was not energized.

BB ______ 3.1.6 In EES, on VSD, select MANUAL and LOCAL membrane switches. Then DEPRESS START membrane switch. Verify Exhaust Fan FN-1362 is RUNNING and YL-13640C on CP-01 (MO-211) is LIT.

BB ______ 3.1.7 On IE-1361, DEPRESS Recirc Fan FN-1361 ON pushbutton HS-13635A. Verify status lights YL-13635A is LIT (fan ON) and YL-13635B is NOT LIT.

BB ______ 3.1.8 Verify Recirc Fan FN-1361 is RUNNING.

BB ✓ ______ 3.1.9 On SCP-1362, verify the Heater On status light YL-13629B is LIT.

BB 6-8-98 3.1.10 In EES, on VSD, DEPRESS STOP membrane switch. Verify Exhaust Fan FN-1362 has STOPPED and YL-13640D on CP-01 (MO-211) is LIT (fan OFF).

BB 3.1.11 On IE-1361, verify Recirc Fan FN-1361 has stopped by checking the status lights YL-13635A is NOT LIT and YL-13635B IS LIT (fan OFF).

BB 3.1.12 Verify Recirc Fan FN-1361 has STOPPED RUNNING.

BB 3.1.13 On SCP-1362, verify the Heater On status light YL-13629B is NOT LIT.

BB 3.1.14 In EES, OPEN Exhaust Fan VSD FN-1362 feeder breaker MCC-N1 / 2FML.

BB ✓ 3.1.15 North of Process Bldg., OPEN Recirc Fan FN-1361 disconnect switch DS-4.

END OF TEST

Test Director Name (printed) and signature: DANIEL M. STENKAMP [signature] 6-8-98

OBSERVER [signature] 6/8/98

AI Representative Name (printed) and intial: Brian Belew BB 6-8-98

Completed copies to: JCS 2E-98-01071
TJ Kasnick
JR Bellomy

ATTACHMENT A

SITE ACCEPTANCE TEST PROCEDURE

AIR MONITOR CORPORATION
1050 Hopper Avenue • Santa Rosa, CA 95403

MAIL TO: Corporate Offices
P.O. Box 6358
Santa Rosa, CA 95406
Tel: (707) 544-2706
Fax: (707) 526-9970

SITE ACCEPTANCE TEST PROCEDURE

HNF-SD-W320-ATP-012 REV. 1

**Tank 241-C-106 Exhaust
Isokinetic Sampling and
Radiation Monitoring System**

Location: 241-C-106

Project: W-320 Tank 241-C-106 Sluicing

Prepared By:

Air Monitor Corporation

for

Fluor Daniel Northwest

Purchase Order No. MZ2-XDV-80166

AMC Work Order No. 25255 & 31912

Prepared By: David Silfe (signature) Date: 1-30-98

Reviewed By: ______________ Date: ______________

Project Coordinator: Scott Minaker (signature) Date: 1-30-98

EXECUTION AND TEST APPROVAL

EXECUTED BY:

Daniel Starkey — 5/8/98
Test Director — Date

[signature] — 6-24-98
Test Operator — Date

Douglas Scott — 4/27/98
Recorder — Date

WITNESSED BY:

Douglas Scott/AMC — 4/27/98
Witness / Organization — Date

N/A
Witness / Organization — Date

[signature] — 6/30/98
Witness / Organization — Date

N/A
Witness / Organization — Date

A - E APPROVAL:

Fluor Daniel Northwest, Inc.

Without Exceptions ☒ With Exceptions Resolved ☐ With Exceptions Outstanding ☐

[signature] — 5/7/98
Design Engineer — Date

[signature] — 05/07/98
Project Manager — Date

TEST APPROVAL AND ACCEPTANCE:

Numatec Hanford Corporation

Without Exceptions ☒ With Exceptions Resolved ☐ With Exceptions Outstanding ☐

[signature] — 6-29-98
Title or Department — Date
W-320 ENGINEERING

R M Starkey — 6/24/98
Title or Department — Date
W-320 TEST ENGINEER

Keith Conrad — 6-30-98
Title or Department — Date
W-320 QUALITY ASSURANCE

[signature] — 6-30-98
Title or Department — Date
W-320 PROJECT MGR.

Robert R Bevins — 6/30/98
W320 START-UP MGR — DATE

Rev. 2 (1/22/98)

TABLE OF CONTENTS

SECTION 1.0 - PURPOSE

This Site Acceptance Test Procedure is to be performed to demonstrate that the Isokinetic Sampling and Radiation Monitoring System functions are required after installation at the site.

SECTION 2.0 - References

2.1 Drawings

W25255AA, Rev. 3 - ISO-samplr System Schematic
W31912CC, Rev. 1 - ISO-samplr Electrical Ladder
W31912CA, Rev. 1 - Electrical Schematics, Pump Swingover System
W31912CB, Rev. 1 - Wiring Details, Vacuum Pump Enclosure
W31912CD, Rev. 1 - ISO-samplr Enclosure Wiring Diagram
W31912CE, Rev. 1 - Instrument Enclosure Wiring Diagram
W25255CD, Rev. 0 - Instrument Enclosure Wiring Diagram
W31912AB, Rev. 1 - Instrumentation & Control Cabinet Arrangement
W25255DA, Rev. 3 - Stack and Enclosure General Arrangement
W31912AA, Rev. 2 - General Layout, Vacuum Pump Enclosure

2.2 Specifications

ICF Kaiser Hanford Company Procurement Specification: W-320-P41, Rev. 0

SECTION 3.0 - Prerequisites and Equipment Required

3.1 Prerequisites

3.1.1 Equipment shall have been inspected for compliance with construction documents.

3.1.2 Reference documents, (Section 2.0) including this procedure, shall be verified for corrections revision.

3.1.3 Electrical power of proper voltage shall be available.

3.1.4 Test instruments shall have valid calibration stamp attached. Test instrument identification numbers and calibration expiration dates shall be recorded in Subsection 3.2.

3.1.5 System shall be energized for minimum of one hour prior to recording any data required by Subsection 4.3.

3.2 Equipment Required

Supplied by Test Operator, unless otherwise noted.

3.2.1 Portable Electronics Manometer ID# 799-28-09-007 Expiration Date: 2/4/99

3.2.2 Digital Multimeter (DMM) ID# 95/45-08-027 Expiration Date: 6/16/99

3.2.3 Digital Multimeter (DMM) ID# ________ Expiration Date: ________

3.2.4 Digital Multimeter (DMM) ID# ________ Expiration Date: ________

3.2.5 Digital Multimeter (DMM) ID# ________ Expiration Date: ________

3.2.6 Variable Test pressure Source

SECTION 4.0 - Isokinetic Sampling and Radiation Monitoring System

The following tests and inspections shall verify the proper operation of the Isokinetic Sampling and Radiation Monitoring System.

4.1 PREPARATION

DS 4.1.1 Verify all prerequisites in Subsection 3.1 have been met.

DS 4.1.2 Verify stack assembly is correctly oriented and securely mounted in place.

DS 4.1.3 Verify instrumentation cabinet and Vacuum Pump Enclosure are securely mounted to floor/pad.

DS 4.1.4 Verify all signal connections between stack assembly and instrumentation/control cabinet are correct. These include Record Sample transport line, Beta Sample transport line, total and static pressure signal lines, stack temperature signal, power wiring, and signal wiring.

DS 4.1.5 Verify all sample, process, and electrical connections between Instrumentation Cabinet and Vacuum Pump Enclosure are correct and complete.

DS 4.1.6 Verify sample exhaust from Vacuum Pump Enclosure is routed back to the stack.

DS 4.1.7 Verify incoming electrical power is connected to the terminal block TB-1.

DS 4.1.8 Verify all wiring for remote signals is properly connected to terminal block TB-4.

DS 4.1.9 Verify stack exhaust fan status wiring is connected to terminal block TB-6.

4.2 POWER CHECK

DB 4.2.1 Verify ***Pump Start/Stop*** push-button PB-1 is in the ***OFF*** position.

DB 4.2.2 Turn power switch SW-1 and verify ***Power On*** light DS-6 is on, displays in FT-1, FT-2, FT-3, and PT/PC-4 are on, and heater fan in instrumentation cabinet comes on.

DB 4.2.3 Turn on power switches SW-2 and SW-3 and verify fans in HTR-1 and HTR-2 come on.

DB 4.2.4 With stack fan on, turn selector switch SW-5 to ***Pump #1 Lead*** position, depress ***Pump Start/Stop*** PB-1, and verify Pump #1 starts running after approximately 25 seconds.

DB 4.2.5 Turn selector switch SW-5 to the ***Pump #2 Lead*** position and verify Pump #1 stops running and Pump #2 starts running after approximately 25 seconds.

DB 4.2.6 Turn stack fan off and verify Pump #2 stops.

DB 4.2.7 Depress ***Pump Start/Stop*** PB-1 and verify light on button goes off. (SWITCH SEEMS TO STICK)

4.3 SAMPLE FLOW CONTROL LOOP

NOTE: Record required data on Data Sheet 4.3.

To verify sample flow controllers are maintaining samples proportional to stack flow, and manifold vacuum controller is maintaining a constant manifold vacuum under varying loads.

4.3.1 Ensure isolation valves HV-1 through HV-10 are open. Start either Pump #1 or #2.

4.3.2 Simulate a pressure input of approximately 40% of full scale to stack massflow transmitter FT-1.

4.3.3 Using stack flow (SCFM) displayed on FI-1 (part of FT-1), calculate percent of full scale (% FS) stack flow. Use 400 SCFM as full scale stack flow. Record both values.

$$\%\ FS\ Stack\ Flow = (displayed\ SCFM / 400\ SCFM) \times 100$$

4.3.4 Using %FS stack flow calculated in 4.3.3, determine ideal flow for Record and Beta Sample. Use 2.372 SCFM for full scale Record Sample flow and 2.358 SCFM for full scale Beta/Gamma Sample flow.

$$Ideal\ Sample\ Flow = \frac{\%\ FS\ Stack\ Flow}{100} \times (\#\#\#)\ (see\ above)$$

4.3.5 After several minutes the individual sample flows, as displayed on FI-2 and FI-3 (part of FT-2 and FT-3), should stabilize. Record these two flows.

4.3.6 For each sample flow (recorded in 4.3.5), calculate the percent deviation from the ideal sample flow (calculated in 4.3.4). These deviations should be ≤ 5%

$$\% \ Deviation = \frac{Displayed \ of \ SCFM - Ideal \ SCFM}{Ideal \ SCFM} x \ 100$$

4.3.7 Record sample manifold vacuum as displayed on PI-4(part of PT/PC-4) and verify that it is within ±5% of setpoint vacuum, -70" w.c. Record all values.

4.3.8 With pump still running, repeat steps 4.3.2 through 4.3.7 for approximately 60% and 80% full scale stack flow.

DATA SHEET 4.3

STEP	PARAMETER	STACK FLOW		
		40%	60%	80%
4.3.3	FI-Display Stack Flow	158 SCFM	240 SCFM	320 SCFM
	% Full Scale Stack Flow	40 %	60 %	80 %
4.3.4	Ideal Record Sample Flow	.95 SCFM	1.42 SCFM	1.90 SCFM
	Ideal Beta/Gamma Sample Flow	.94 SCFM	1.41 SCFM	1.88 SCFM
4.3.5	FI-2 Display Record Sample Flow	.95 SCFM	1.43 SCFM	1.87 SCFM
	FI-3 Display Beta/Gamma Sample Flow	.92 SCFM	1.42 SCFM	1.88 SCFM
4.3.6	% Deviation Record Sample (≤5%)	0 %	0.70 %	~~0~~ -1.58 %
	% Deviation Beta/Gamma Sample (≤5%)	-2.13 %	0.71 %	0 %
4.3.7	FI-1 Display Manifold Vacuum (°F)	-69 "w.c.	-69 "w.c.	-69 "w.c.
	Manifold Vacuum Setpoint	-70"w.c.	-70"w.c.	-70"w.c.
:	% Deviation Manifold Vacuum (≤5%)	-1.43 %	-1.43 %	-1.43 %

4.4 AUTO PUMP CONTROL

To verify that upon failure of one pump, the other pump will automatically start to maintain sampling system operation, and that failure alarms are working.

JB / DMS 4.4.1 Start system with Pump #1 in lead. After Pump #1 has started running, simulate a failure and verify Pump #1 stops and *Pump #1 On* light DS-7 goes off.

JB / DMS 4.4.2 Verify *Pump #1 Failure* light DS-4 and amber beacon are on, and horn sounds.

JB / DMS 4.4.3 Verify isolation valves ICV-6 and ICV-7 begin to reposition themselves to Pump #2.

DMS 4.4.4 Verify that after approximately 25 seconds Pump #2 starts running and ***Pump #2 On*** light DS-8 comes on.

DMS 4.4.5 Position SW-5 to ***Pump #2 In Lead*** and verify nothing happens.

4.4.6 Repair Pump #1 failure.

DMS 4.4.7 Momentarily depress ***Pump Reset*** PB-2 and verify ***Pump #1 Failure*** light DS-4 and amber beacon go off and horn is silenced.

DMS 4.4.8 Simulate a failure of Pump #2 and verify Pump #2 stops and ***Pump #2 On*** light DS-8 goes off.

DMS 4.4.9 Verify ***Pump #2 Failure*** light DS-5 and amber beacon are on and horn sounds.

DMS 4.4.10 Verify isolation valves ICV-6 and ICV-7 begin to reposition themselves to Pump #1.

DMS 4.3.11 Verify that after approximately 25 seconds Pump #1 starts running and ***Pump #1 On*** light DS-7 comes on.

DMS 4.4.12 Position SW-5 to ***Pump #1 In Lead*** and verify nothing happens.

4.4.13 Repair Pump #2 failure.

DMS 4.4.14 Momentarily depress ***Pump Reset*** PB-2 and verify ***Pump #2 Failure*** light DS-5 and amber beacon go off and horn is silenced.

4.5 NON-ISOKINETIC SAMPLE FLOW ALARM

To verify non-isokinetic stack flow alarms are functioning properly.

4.5.1 Adjust stack flow to approximately 50% of full scale flow and start with Pump #1 or #2.

4.5.2 Allow sufficient time for FCV-2 and FCV-3 to bring samples under control at the correct flows and then begin to slowly close isolation valves HV-7 and HV-8.

4.5.3 Continue to close HV-7 and HV-8 until FCV-2 and FCV-3 are fully open and sample flows are less than 90% of desired value.

DMS 4.5.4 Verify that after 5 minutes ***Non-Isokinetic Alarm*** lights DS-2 and DS-3 and amber beacon are on and horn sounds.

DMS 4.5.5 Increase sample flow and verify that once sample flow is greater than 90% of ideal, DS-2 and DS-3 and amber beacon go off and horn is silenced.

4.6 STACK LOW FLOW ALARM

To verify that stack low flow alarm is functioning properly.

4.6.1 Adjust stack flow to 90 SCFM.

B /DMS 4.6.2 Verify that after 5 minutes *Low Stack Flow Alarm* light DS-1 and amber beacon are on and horn sounds.

4.6.3 Increase stack flow to 110 SCFM and verify that *Low Stack Flow Alarm* light DS-1 and amber beacon go off and horn is silenced.

4.7 BETA MONITOR

NOTE: Record required data on Data Sheet 4.7.

4.7.1 Install known check source into remote detector head. Allow sufficient time for monitor to perform count. Record value displayed.

4.7.2 Verify displayed value is within acceptable limits.

4.7.3 Repeat steps 4.7.1 and 4.7.2 for all check sources to be used.

B /DMS 4.7.4 Create failure of the Beta Monitor and verify that the horn sounds and amber beacon flashes.

B /DMS 4.7.5 Depress alarm acknowledge button PB-3 and verify horn stops sounding, amber beacon continues to flash, and light in PB-3 is on.

4.7.6 Correct Beta Monitor failure.

B /DMS 4.7.7 Verify amber beacon stops flashing.

B /DMS 4.7.8 Depress acknowledge button PB-3 and verify horn does not sound and light in PB-3 is off.

B /DMS 4.7.9 Create a high radiation condition of the Beta Monitor and verify the bell rings and red beacon flashes.

B /DMS 4.7.10 Depress alarm acknowledge button PB-4 and verify bell stops ringing, red beacon continues to flash, and light in PB-4 is on.

4.7.11 Correct high radiation condition of Beta Monitor.

B /DMS 4.7.12 Verify red beacon stops flashing.

B /DMS 4.7.13 Depress acknowledge button PB-4 and verify bell does not ring and light in PB-4 is off.

DATA SHEET 4.7

STEP	PARAMETER	1st CHECK SOURCE	2nd CHECK SOURCE	3rd CHECK SOURCE	4th CHECK SOURCE
4.7.1	Displayed Activity	1637CPM	N/A	N/A	N/A
4.7.2	% Deviation	8.63%	N/A	N/A	N/A

SECTION 5.0 - Test for Accuracy, Zero Drift, and Calibration Drift

To determine accuracy of Air Monitor Corporation's measurement system compared to reference method and determine drift of measurement system as required by 40CFR52.

NOTE: The design constraints of the project, requiring ANSI N13.1 sampling probes be combined with the flow measuring probe on a single mounting flange, results in an assembly geometry that does not permit the performance of orientation sensitivity per Appendix E of 40 CFR52. Therefore, orientation sensitivity testing is not part of this Site Acceptance Test Procedure.

5.1 APPARATUS

5.1.1 Reference method outlined in 40CFR60, Appendix A, Method 2.

5.1.2 Air Monitor Corporation's measurement system completely installed, operational, and having successfully passed the precious sections of this procedure.

5.2 TEST SET-UP

Measurement system shall be run for a 168 hour conditioning period, during which it shall be continuously measuring stack flow.

5.2.1 Install reference method apparatus as defined in 40CFR, Part 60, Method 2.

5.3 TEST FOR ACCURACY

During this 168 hour test, the measurement system shall be continuously measuring stack flow.

5.3.1 During the 168 hour test, make a series of 14 stack flow determinations simultaneously using the reference method and the measurement system.

These 14 measurements can be made at any time interval at least one hour apart during the 168 hour period except that at least on determination on five different days must be made with on determination on the last day of such period.

Additionally, these measurements shall be taken over the range of flow under normal conditions.

Since the reference method flow measurement takes several minutes to complete, care should be taken to maintain stack flow at a constant volume once measurements are started. Similarly, once the reference method measurements are started, the measurement system's flow reading (as read on FT-1) should be noted and observed for any fluctuations during the course of reference method measurements.

5.3.2 Record on Data Sheet 5.3 the volumetric flow rate (SCFM) as determined by the reference method and as indicated by the measurement system.

5.4 Test for Calibration Drift and Zero Drift

5.4.1 At 24-hour intervals, subject the measurement system to the manufacturer's specified zero and calibration procedures.

5.4.2 Record the measurement system output reading (Volts DC) on Data Sheet 5.4 before and after adjustment.

5.5 Calculations

Upon completion of the above tests and the recording of all data, the following calculations shall be performed in preparation of Section 5.6.

On Data Sheet 5.3 calculate:

5.5.1 The mean (average) value of the 14 reference method values (volumetric) using the following equation.

$$\overline{RM} \text{ (Means reference method value)} = \sum_{1}^{14} RM \div 14$$

Where, $\sum RM$ *= sum of individual reference method values.*

5.5.2 The individual differences between the 14 pairs of reference method values (RM) and the measurement system values (MS) using the following equation:

$$d_i = \text{RM} - \text{MS}$$

5.5.3 The sum of the differences of the 14 pairs calculated above.

$$\sum_{1}^{14} d_i$$

5.5.4 The mean value of the differences of the 14 pairs calculated above, using the following equation:

$$\overline{d_i} \text{ (mean difference)} = \sum_{1}^{14} d_i \div 14$$

5.5.5 The square of each of the 14 values of d_i calculated in 5.5.2 above.

5.5.6 The sum of the squares of the differences calculated in 5.5.5 above.

$$\sum_{1}^{14} d_i^2$$

On Data Sheet 5.4, calculate for both zero and calibration:

5.5.7 The individual differences between the 7 pairs of successive readings.

5.5.8 The sum of the differences of the 7 pairs calculated in 5.5.7 above

$$\sum_{1}^{7} d_i$$

5.5.9 The mean value of the differences for the 7 pairs, using the following equation:

$$\overline{d_i} \text{ (mean difference\_} = \sum_{1}^{7} d_i \div 7$$

5.5.10 . The square of each of the 7 values of d_i calculated in 5.5.7 above.

5.5.11 The sum of the squares of the differences calculated in 5.5.10 above.

$$\sum_{1}^{7} d_i^2$$

5.6 DATA ANALYSIS

5.6.1 Relative Accuracy: The relative accuracy of the measurement system versus the reference method shall be determined using the following equation:

$$RA = \frac{|\overline{d_i}| + cc}{\overline{RM}} x\, 100$$

where,

$\overline{RM}$ = *arithmetic mean of the reference method.*

$|\overline{d_i}|$ = *the absolute value of the mean difference between the reference method values (volumetric) and the corresponding measurement system values (volumetric).*

cc = *confidence coefficient.*

$$Where\ cc = t_{.025} \frac{Sd}{\sqrt{14}},$$

$$t_{.025}\ for\ 14 = 2.160$$

$$\text{and } Sd = \sqrt{\frac{\sum_{1}^{14} d_i^2 - \left[\frac{\left(\sum_{1}^{14} d_i\right)^2}{14}\right]}{13}}$$

Note: The values of $\overline{RM}$, $\overline{d_i}$, $\sum_{1}^{14} d_i^2$, *and* $\sum_{1}^{14} d_i$ *can be found on Table 5.3.*

On Data Sheet 5.3, record the values calculated for *Sd*, *cc*, and *RA*.

5.6.2 Zero Drift: The zero drift of the measurement system shall be determined using the following equation:

$$\text{Zero Drift} = \left(\frac{|\overline{d_i}| + cc}{SV}\right) x\, 100$$

where,

$|\overline{d_i}|$ = *the absolute value of the mean difference between the 7 pairs of successive readings.*

cc = *confidence coefficient.*

$$\text{Where } cc = t_{0.025} \frac{Sd}{\sqrt{7}},$$

$$t_{0.025} \text{ for } 7 = 2.447$$

$$\text{and } Sd = \sqrt{\frac{\sum_{1}^{7} d_i^2 - \left[\frac{\left(\sum_{1}^{7} d_i\right)^2}{7}\right]}{6}}$$

NOTE: The values of $\overline{d_i}$, $\sum_{1}^{7} d_i^2$ *and* $\sum_{1}^{7} d_i$ *can be found on Table 5.4.*

On Data Sheet 5.4, record the values calculated for *Sd, cc*, and *Zero Drift*.

5.6.3 Calibration Drift: The Calibration Drift for the measurement system shall be determined using the same method and equations used for determining Zero Drift.

On Data Sheet 5.4, record the values calculated for *Sd, cc*, and *Calibration Drift*.

5.7 REPORTING

Acceptance criteria for Relative Accuracy, Zero Drift, and Calibration Drift are as follows:

Relative Accuracy:	$< 10\%$ of $\overline{RM}$
Zero Drift:	$< 3\%$ of Span
Calibration Drift:	$< 3\%$ of Span

TEST FOR ACCURACY

Run No.	Date	Time	Reference Method (SCFM)	Measurement System (SCFM)	Difference d_1 = RM - MS	d_1^2
1	3/20/98	1700	237	249.36	-12.36	165
2	3/20/98	1848	244	259.83	-15.83	250
3	3/23/98	1030	250	265	-15	225
4	3/23/98	1133	250	263	-13	169
5	3/23/98	1330	253	265	-12	144
6	3/23/98	1440	248	265	-17	289
7	3/24/98	0920	243	264	-21	441
8	3/24/98	1031	236	262	-26	676
9	3/25/98	0930	343	360	-17	289
10	3/25/98	1035	342	357	-15	225
11	3/26/98	0905	175	189	-14	196
12	3/26/98	1010	188	185	3	9
13	3/27/98	0910	249	260	-11	121
14	3/27/98	1015	244	267	-23	529
			$\overline{RM} = 250$		$\Sigma_{1}^{14} d_1 = -210$	$\Sigma_{1}^{14} d_1 = 3728$
					$\overline{d_1} = -15$	

Sd = 6.7
cc = 3.9
RA = 7.6%

Data Sheet 5.3

TEST FOR CALIBRATION DRIFT AND ZERO DRIFT

Run No, (n)	Date	Time	Zero Reading Volts		Difference		Calibration Reading Volts		Difference	
			Before	After	d_i	d_i^2	Before	After	d_i	d_i^2
0	----	----		---				---		
1	3/20/98	1700	0	0	0	0	---	5.0	0	0
2	3/23/98	1000	0	0	0	0	5.0	4.99	.01	.0001
3	3/23/98	0100	0	0	0	0	4.99	5.00	-.01	.0001
4	3/24/98	0905	0	0	0	0	5.00	5.00	0	0
5	3/25/98	0900	0	0	0	0	6.00	5.01	-.01	.0001
6	3/26/98	0825	0	0	0	0	5.01	5.01	0	0
7	3/27/98	0845	0		0	0	5.01		0	0
					$\sum_1^7 d_i = 0$	$\sum_1^7 d_i^2 = 0$			$\sum_1^7 d_i = -.01$	$\sum_1^7 d_i^2 = .0003$
					$\bar{d}_i = 0$				$\bar{d}_i = -.001$	

Sd: 0
cc: 0
Zero Drift: 0

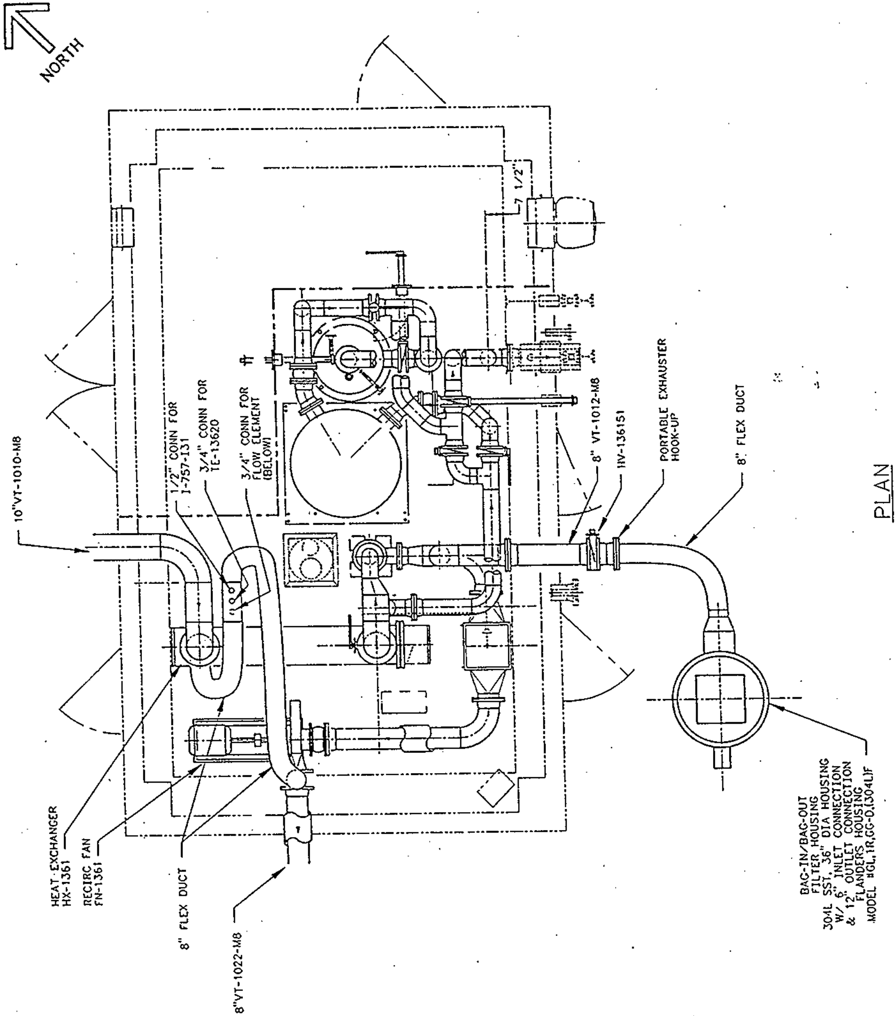
Sd: .0069
cc: .0064
Span Drift: 0.148%

Data Sheet 5.4

Page 16 of 16

ATTACHMENT B

COLD TEST PROCESS VENTILATION SYSTEM CONFIGURATION



COLD TEST
PROCESS VENTILATION SYSTEM CONFIGURATION

ATTACHMENT C

PRESSURE DECAY LEAKAGE RATE TEST - EXHAUST SKID

Leak Testing of Installed Exhaust Skid

1. VERIFY / CLOSE inlet valve HV-13654 and open outlet valve HV-13655. ECN # 789
2. VERIFY drain valve HV-136136 is CLOSED.
3. VERIFY drain valve HV-136122 is CLOSED.
4. VERIFY drain valve HV-136125 is CLOSED.
5. VERIFY drain valve HV-136127 is CLOSED.
6. REMOVE flex connector from fan outlet and blank off fan outlet.
7. INSTALL calibrated pressure indicating device accurate to ±0.1 in H_20 in first filter test port.
8. INSTALL calibrated temperature indicating device accurate to ±0.5 °F in second filter test port.
9. CONNECT a calibrated vacuum source (with safety relief mechanism, isolation valve, and flow control device) to third filter test port.
10. ISOLATE LG-1361, -1362, -1363, -1364 and PDISH-13618, -13619, and -13620.
11. START vacuum source until a test pressure of -50.0 in H_20 is achieved. Maintain test pressure constant until the temperature inside the exhaust skid remains constant within ±0.5 °F for a minimum of 10 minutes. Close shutoff valve to vacuum source.
12. RECORD initial time, pressure, and temperature. Record barometric pressure.
13. RECORD pressure readings once a minute until pressure decays to 75% of the test pressure, or for a maximum of 15 minutes.

Time	Pressure, in H_20	Time	Pressure, in H_20
Start Time- 14:10	50	8 min-	39.1
1 min-	48.4	9 min-	37.9
2 min-	47.0	10 min- 9:20	37.5
3 min-	45.6	11 min-	
4 min-	44.3	12 min-	
5 min-	43.0	13 min-	
6 min-	41.6	14 min-	
7 min-	40.4	15 min-	
Barometric Pressure, in Hg: BP = 29.41			
Initial Temperature, °F: Ti = 56.3			
Final Temperature, °F: Tf = 55.2			

14. RECORD final time, pressure, and temperature.

15. CALCULATE the leak rate using Data Sheet #1.

16. IF the calculated leak rate is less than 10 SCFM, then RECORD "PASS" on Data Sheet #1 and proceed to Step 17. Otherwise, RECORD "RETEST" on Data Sheet #1.

17. IF a retest is needed, then PERFORM the following:

    a. DISCONNECT vacuum source.

    b. CONNECT a pressure source (with safety relief mechanism, isolation valve, and flow control device) to third filter test port.

    c. PRESSURIZE the test boundary to a pressure adequate to locate leaks (not to exceed +50 in H_2O).

    d. With test boundary under pressure, apply bubble solution to LOCATE leaks.

    e. RELIEVE pressure and REPAIR leaks. DISCONNECT pressure source.

    f. REPEAT Steps 9 through 15 using a new table and new data sheets.

18. RELIEVE vacuum from filter train housing and remove vacuum source.

19. DISCONNECT the test equipment.

20. REINSTALL the filter test port plugs.

21. Close ECN # 789 ~~OPEN inlet valve HV-13654~~ and isolation valves for LG-1361, -1362, -1363, -1364 and PDISH-13618, -13619, and -13620. OUTLET VALVE HV-13655

22. REMOVE blank from fan outlet and REINSTALL flex connection to fan outlet.

23. Test Director SHALL VERIFY that leak testing of installed exhaust skid is complete by signing below.

D. M. Stenkamp (signature) 3/10/98

Test Director Signature Date

23. Acceptance Inspector SHALL VERIFY that leak testing of installed exhaust skid is complete by signing below.

Lloyd Snyder (signature) 3/10/98

Acceptance Inspector Signature Date

DATA SHEET #1: LEAK RATE CALCULATION

(This page may be reproduced as necessary)

GIVEN

1. Test Volume V = 66.4 ft^3
2. Gas Constant R = 53.35 (ft·lb/lb·°R)

RECORDED TEST DATA

1. Δt = 9.33 minutes
2. Convert °F to °R

   Ti = 56.3 °F + 460 = 516.3 °R

   Tf = 55.2 °F + 460 = 515.2 °R
3. Convert P (in H_20) to P (lb/ft^2)

   Pi = 50 in H_20 x 5.204 = 260.2 lb/ft^2

   Pf = 37.5 in H_20 x 5.204 = 195.15 lb/ft^2
4. Convert BP (in Hg) to BP (lb/ft^2)

   BP = 29.41 in Hg x 70.73 = 2080.1693 lb/ft^2
5. Convert gage pressure to absolute pressure

   Pi(abs) (lb/ft^2) = Pi (lb/ft^2) + BP (lb/ft^2)

   Pi(abs) = 2080.1693 lb/ft^2 + 260.2 lb/ft^2 = 2340.3693 lb/ft^2

   Pf(abs) (lb/ft^2) = Pf (lb/ft^2) + BP (lb/ft^2)

   Pf(abs) = 2080.1693 lb/ft^2 + 195.15 lb/ft^2 = 2275.3193 lb/ft^2
6. Leak Rate

$$Q=\left(\frac{Pi(abs)}{Ti}-\frac{Pf(abs)}{Tf}\right)\left(\frac{V}{R\cdot\Delta t\cdot(0.075\,lb/ft^2)}\right)$$

Q = .2074 SCFM

Allowable leak rate: 10 SCFM

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 1

ANY PROBLEMS CALL:

John Wright (PIC) (cell) 544-8551

* Dan Stenkamp (Engr)

Bill Woody (Planner) 373-4471

Gary Crummel (Env. Engr) 373-5175

Tom NUGENT 373-1824

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
	AIR FLOW INSTRUMENT	HYGROMETER
1.1	Flow Instrument Type MICRO	Equipment Number # 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date TR 3-20-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	4:30 P/m	29.15 (P_b)
	COMMENTS:				

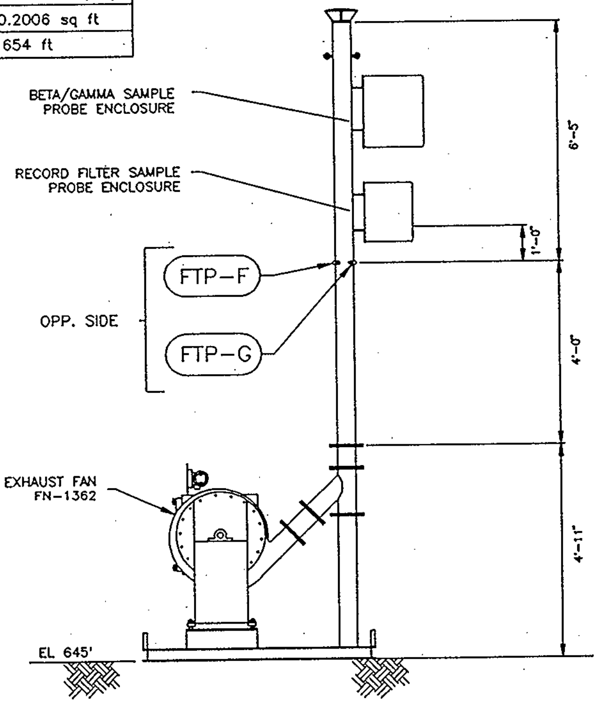
STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	250 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES)	NO
	Instrument in proper working condition?		(YES)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date TR 3-20-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft



H-2-818585
TF155P1.01

Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		27% (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.09 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	68	.094	~~128~~ 1228 TR 3-20-98		
	7/8	68	.089	1195		
5.1	1 3/8	68	.106	1304		
5.2	2	68	.073	1082		
5.3	4	68	.050	896		
5.4	4 5/8	68	.089	1195		
5.5	5 1/8	68	.113	1346		
	5 1/2	68	.073	1082		
	TEST PORT G					
	1/2	68	.113	1346		
	7/8	68	.136	1477		
9.1	1 3/8	68	.121	1393		
9.4	2	68	.105	1298		
	4	68	.103	1285		
	4 5/8	68	.060	981		
	5 1/8	68	.064	1013		
	5 1/2	68	.114 (VP1)	1352	(VP1)	
	TOTAL ts	1088	TOTAL FPM	19473	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = 4005 $\sqrt{VP}$

Time test completed: 5:00/Pm   Initials/Date TR 3-20-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) $P = [(\frac{.114}{VP1} - \frac{.114}{VP2}) \div \frac{.114}{VP1}] \times 100 =$ 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	PASS/FAIL (PASS circled)
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS/FAIL (PASS circled)
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 1088
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	68
9.3	Velocity (FPM) = $4005\sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 19,473
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1217
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	244

Initials/Date TR 3-20-98

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	29.16
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 29.15
P_g	Stack static pressure, in. wg	(Sht 3) 0.09
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	528
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 68
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.93

CALCULATION (Q_{sd})

$60(1-0.006)\,85.49(0.99)\frac{1217}{4005}(0.2006)\left[\frac{528}{29.92}\right]\sqrt{\frac{29.16}{528(28.93)}}$

$= 237.1$

Q_{sd} = 237 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 237
FI-1	Stack massflow reading, scfm	(Sht 2) 250

CALCULATION (D_i)

237 − 250 = −12.86

D_i = −12.86 scfm

COG Engr Initials/Date: Gme / 3-23-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Barcot — V&B Review (print name) Signature 7-1-98 — Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez — Facility PIC 7-6-98 — Date N/A — Work Request Number N/A — Work Request Number N/A — Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrammel — Cog. Engr. (print name) Signature 3-23-98 — Date

COMMENTS:

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p (\sqrt{VP})_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.006
RH	Stack relative humidity, percent	27% (Sht 3)
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.69065
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.3039
$fpm_{(avg)}$	Average stack gas velocity, ft/min	1217 (Sht 4)
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00PM	237	-12.86	165
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gm / 3-23-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10%	FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 2

ANY PROBLEMS CALL:

John Wright (PIC) (cell) 544-8551

* Dan Stenkamp (Engr)

Bill Woody (Planner) 373-4471

Gary Crummel (Env. Engr) 373-5175

Tom NUGENT 373-1824

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA

GENERAL INFORMATION

Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).

REFERENCES

Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel:

H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.

PRECAUTIONS & LIMITATIONS

Flow test ports shall be accessed using the work platform installed on exhauster skid.

A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.

PREREQUISITES

No additional prerequisites.

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type MICRO	Equipment Number # 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date FR 3-20-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	625/pm	29.12 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	260 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES)	NO
	Instrument in proper working condition?		(YES)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date FR 3·20·98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

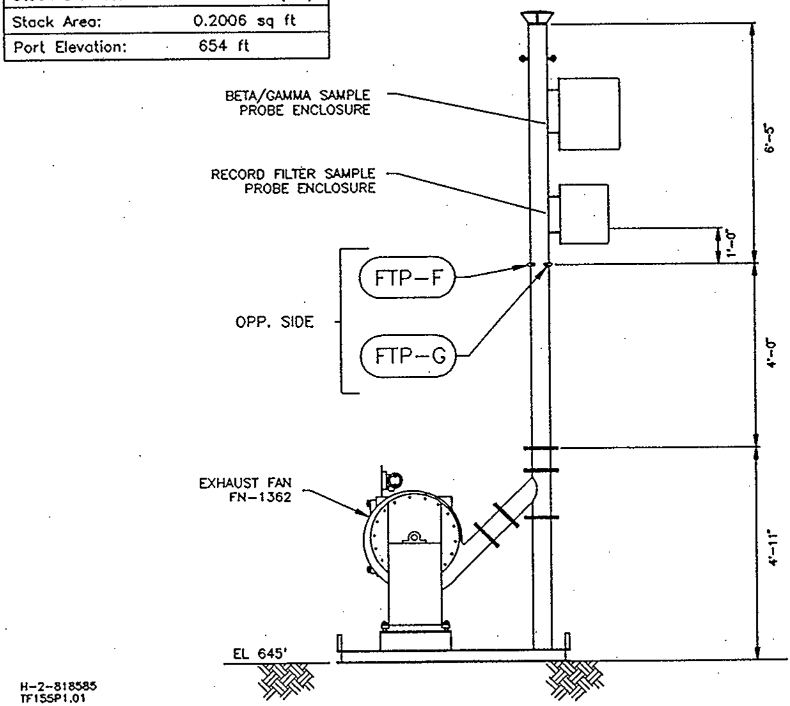


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		37% (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.09" (P_g)		(P_g)	
	Traverse Points* (in.)	Temp. ts (°F)	Velocity VP (in. wg)	Velocity FPM** (ft/min)	Velocity VP (in. wg)	Velocity FPM** (ft/min)
	1/2	59°	.104	1292		
	7/8	59°	.097	1247		
5.1	1 3/8	59°	.096	1241		
5.2	2	59°	.092	1215		
5.3	4	59°	.080	1133		
5.4	4 5/8	59°	.076	1104		
	5 1/8	59°	.116	1364		
5.5	5 1/2	59°	.118	1376		
	TEST PORT G					
	1/2	59°	.135	1472		
	7/8	59°	.126	1422		
9.1	1 3/8	59°	.121	1393		
9.4	2	59°	.088	1188		
	4	59°	.060	981		
	4 5/8	59°	.052	913		
	5 1/8	59°	.093	1221		
	5 1/2	59°	.109 (VP1)	1322	(VP1)	
	TOTAL ts	944	TOTAL FPM	19884	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** $FPM = 4005 \sqrt{VP}$

Time test completed: 6:48 PM   Initials/Date TK 3-20-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) $P = [(\underset{VP1}{.109} - \underset{VP2}{.109}) \div \underset{VP1}{.109}] \times 100 =$ 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 944
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	59
9.3	Velocity (FPM) $= 4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 19884
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1243
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	249

Initials/Date TK 3·30·98

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	29.13
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 29.12
P_g	Stack static pressure, in. wg	(Sht 3) 0.09
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	519
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 59
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.93

CALCULATION (Q_{sd})

$60(1-0.006)\,85.49(0.99)\frac{1243}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{29.13}{519(28.93)}}$

$= 244.17$

Q_{sd} = 244 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 244
FI-1	Stack massflow reading, scfm	(Sht 2) 260

CALCULATION (D_i)

244 − 260 = −15.83

D_i = −15.83 scfm

COG Engr Initials/Date: [initials] / 3-23-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. BARCOT ______ [signature] ______ 7-1-98 V&B Review (print ~~name~~) ~~Signature~~ Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez 7-6-98 Facility PIC Date NA NA N/A Work Request Number Work Request Number Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrummel [signature] 3-23-98 Cog. Engr. (print name) Signature Date

COMMENTS:

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p (\sqrt{VP})_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.006
RH	Stack relative humidity, percent	37 % (Sht 3)
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.50362
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.3104
$fpm_{(avg)}$	Average stack gas velocity, ft/min	1243 (Sht 4)
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00 Pm	237	-12.86	165
2	3-20-98	6:48 Pm	244	-15.83	250
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gme / 3-23-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

Eq. Input	Description	Value
$|\overline{D_i}|$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10%	FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 3

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA

GENERAL INFORMATION

Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).

REFERENCES

Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel:

H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.

PRECAUTIONS & LIMITATIONS

Flow test ports shall be accessed using the work platform installed on exhauster skid.

A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.

PREREQUISITES

No additional prerequisites.

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
	AIR FLOW INSTRUMENT	HYGROMETER
1.1	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date SC 3-23-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	10:20	28.88 (P_b)
	COMMENTS:				

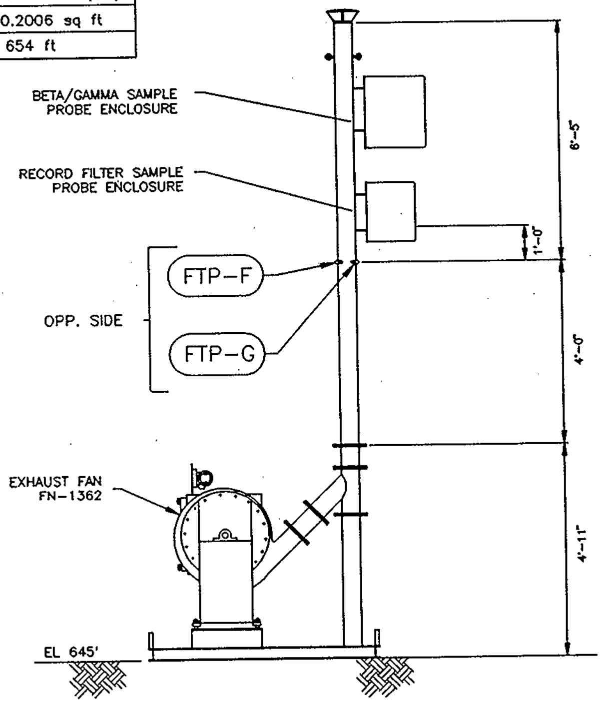
STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	265 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES) circled	NO
	Instrument in proper working condition?		(YES) circled	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS) circled	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [initials] 3-23-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft



H-2-818585
TF155P1.01

Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		90 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.09 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	46	.091	1208		
	7/8	46	.091	1208		
5.1	1 3/8	46	.105	1298		
5.2	2	46	.076	1104		
5.3	4	46	.091	1208		
	4 5/8	46	.127	1427		
5.4	5 1/8	46	.128	1433		
5.5	5 1/2	46	.112	1340		
	TEST PORT G					
	1/2	46	.125	1416		
	7/8	46	.122	1399		
9.1	1 3/8	46	.113	1346		
9.4	2	46	.094	1228		
	4	46	.045	850		
	4 5/8	46	.059	973		
	5 1/8	46	.120	1387		
	5 1/2	46	.124 (VP1)	1410	(VP1)	
	TOTAL ts	736	TOTAL FPM	20235	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = 4005 $\sqrt{VP}$

Time test completed: 10:30 Initials/Date [signature] 3-23-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) $P = [(\frac{.124}{VP1} - \frac{.124}{VP2}) \div \frac{.124}{VP1}] \times 100 =$ 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	PASS (circled)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS (circled)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 736
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	46
9.3	Velocity (FPM) = $4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 20235
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1265
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	254

Initials/Date lc 3-23-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (V_s)

$$V_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) V_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p (\sqrt{VP})_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	∅.010
RH	Stack relative humidity, percent	(Sht 3) 90%
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	∅.31205
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	∅.3159
$fpm_{(avg)}$	Average stack gas velocity, ft/min	(Sht 4) 1265
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.89
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.88
P_g	Stack static pressure, in. wg	(Sht 3) 0.09
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	506
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 46
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.89

CALCULATION (Q_{sd})

$60(1-0.10)\,85.49(0.99)\frac{1265}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{28.89}{506(28.89)}}$

$= 249.96$

Q_{sd} = 250 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5)
FI-1	Stack massflow reading, scfm	(Sht 2) 265

CALCULATION (D_i)

250 − 265 = −15

D_i = −15 scfm

COG Engr Initials/Date: [initials] / 3-24-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. BARCOT (V&B Review (print name)) — [signature] (Signature) — 7-1-98 (Date)
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez (Facility PIC) — 7-6-98 (Date) N/A (Work Request Number) — N/A (Work Request Number) — N/A (Date)
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrummel (Cog. Engr. (print name)) — [signature] (Signature) — 3-24-98 (Date)

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:03PM	237	-12.86	165
2	3-20-98	6:48PM	244	-15.83	250
3	3-23-98	10:30AM	250	-15	225
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gme / 3-24-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

Eq. Input	Description	Value
$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 4

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date [signature] 3-23-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	11:30	28.91 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	263 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES) circled	NO
	Instrument in proper working condition?		(YES) circled	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS) circled	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date Jec 3-23-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

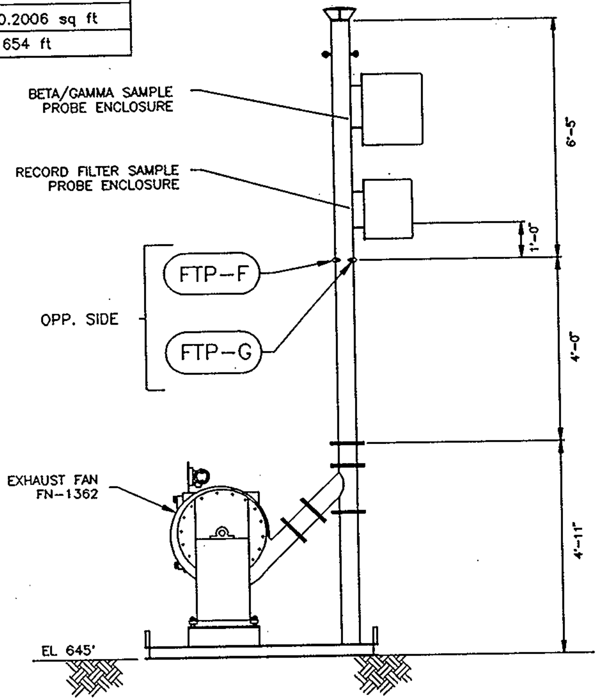


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		95 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.09 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	46	.09	1202		
	7/8	46	.121	1393		
5.1	1 3/8	46	.094	1228		
5.2	2	46	.091	1208		
5.3	4	46	.044	840		
5.4	4 5/8	46	.116	1364		
	5 1/8	46	.138	1488		
5.5	5 1/2	46	.123	1405		
	TEST PORT G					
	1/2	46	.126	1422		
	7/8	46	.121	1393		
9.1	1 3/8	46	.102	1279		
9.4	2	46	.059	973		
	4	46	.053	922		
	4 5/8	46	.093	1221		
	5 1/8	46	.140	1499		
	5 1/2	46	.123 (VP1)	1405	(VP1)	
	TOTAL ts	736	TOTAL FPM	20242	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.
** FPM = $4005\sqrt{VP}$

1438   Initials/Date SEC 3-23-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.123 (VP1) - .123 (VP2)) ÷ .123 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS circled)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS circled)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 736
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	46
9.3	Velocity (FPM) = $4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 20242
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1265
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	254

Initials/Date *[initials]* 3-23-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p \left(\sqrt{VP}\right)_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws})\, v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\, K_p C_p \left(\sqrt{VP}\right)_{avg} A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\, M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	∅.∅10
RH	Stack relative humidity, percent	95% (Sht 3)
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	∅.31205
K_p	Pitot tube constant: $85.49 \frac{ft}{sec}\left[\frac{(lb)(in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$\left(\sqrt{VP}\right)_{avg}$	Average of velocity pressure sqrt, in. wg: $\left(\sqrt{VP}\right)_{avg} = fpm_{(avg)} \div 4005$	∅.3159
$fpm_{(avg)}$	Average stack gas velocity, ft/min	1265 (Sht 4)
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.92
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.91
P_g	Stack static pressure, in. wg	(Sht 3) 0.09
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	506
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 46
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.89

CALCULATION (Q_{sd})

$$60(1-0.010)\,85.49(0.99)\,\frac{1265}{4005}(0.2006)\,\frac{528}{29.92}\sqrt{\frac{28.92}{506(28.89)}}$$

$= 249.97$

Q_{sd} = 250 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 250
FI-1	Stack massflow reading, scfm	(Sht 2) 263

CALCULATION (D_i)

250 − 263 = −13

D_i = −13 scfm

COG Engr Initials/Date: [initials] / 3-24-98

DATA SHEET 6

STEP 10	DISPOSITION		
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible.		
	M. Barcot V&B Review (print name)	[signature] Signature	7-1-98 Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance:		
	System configuration restored:	R. Gutierrez Facility PIC	7-6-98 Date
	N/A Work Request Number	N/A Work Request Number	N/A Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471):		
	Gary M Crummel Cog. Engr. (print name)	[signature] Signature	3-24-98 Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00 PM	237	-12.86	165
2	3-20-98	6:48 PM	244	-15.83	250
3	3-23-98	10:30 AM	250	-15	225
4	3-23-98	11:38 AM	250	-13	169
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: [initials] / 3-24-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 5

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date [signature] 3-23-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	1325	28.87 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	265 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES) circled	NO
	Instrument in proper working condition?		(YES) circled	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS) circled	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [initials] 3-23-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

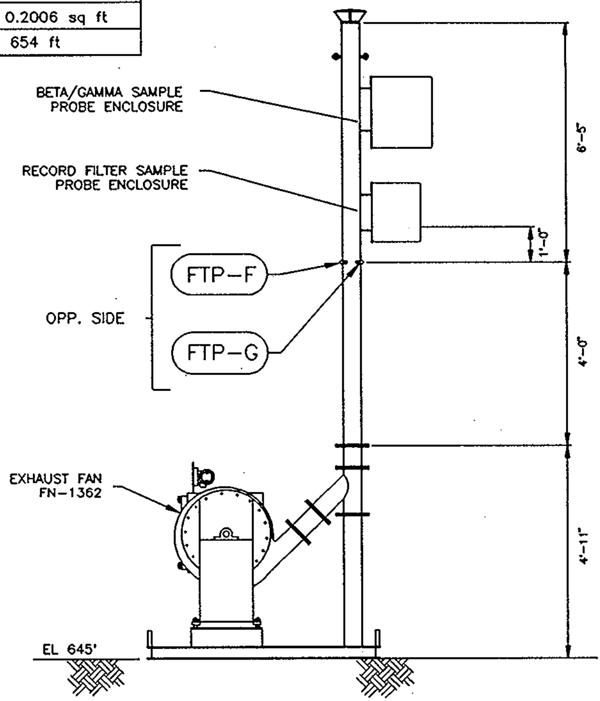


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		97.4 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.10 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	47	.115	1358		
	7/8	47	.101	1273		
5.1	1 3/8	47	.076	1104		
5.2	2	47	.078	1119		
5.3	4	47	.106	1304		
5.4	4 5/8	47	.103	1285		
5.5	5 1/8	47	.122	1399		
	5 1/2	47	.075	1097		
	TEST PORT G					
	1/2	47	.112	1340		
	7/8	47	.117	1370		
9.1	1 3/8	47	.129	1438		
9.4	2	47	.120	1387		
	4	47	.112	1340		
	4 5/8	47	.062	997		
	5 1/8	47	.119	1382		
	5 1/2	47	.115 (VP1)	1358	(VP1)	
	TOTAL ts	752	TOTAL FPM	20551	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.
** $FPM = 4005 \sqrt{VP}$

Time test completed: 1330   Initials/Date [signature] 3-23-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.115 (VP1) - .115 (VP2)) ÷ .115 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	PASS/FAIL (PASS circled)
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS/FAIL (PASS circled)
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 752
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	47
9.3	Velocity (FPM) = $4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 20551
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1284
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	258

Initials/Date *[initials]* 3-23-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p\ (\sqrt{VP})_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.011
RH	Stack relative humidity, percent	97.4% (Sht 3)
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.32407
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.3206
$fpm_{(avg)}$	Average stack gas velocity, ft/min	1284 (Sht 4)
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.88
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.87
P_g	Stack static pressure, in. wg	(Sht 3) 4.10
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	507
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 47°
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.88

CALCULATION (Q_{sd})

$60(1-.011)85.49(.99)\frac{1284}{4005}(.2006)\frac{528}{29.92}\sqrt{\frac{28.88}{507(28.88)}}$

$= 253.16$

Q_{sd} = 253 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 253
FI-1	Stack massflow reading, scfm	(Sht 2) 265

CALCULATION (D_i)

$253 - 265 = -12$

D_i = -12 scfm

COG Engr Initials/Date: GMC / 3-24-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Barcot ___ V&B Review (print name) ___ [signature] Signature ___ 7-1-98 Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: ___ R. Gutierrez Facility PIC ___ 7-6-98 Date N/A Work Request Number ___ N/A Work Request Number ___ N/A Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrammond / Cog. Engr. (print name) ___ [signature] Signature ___ 3-24-98 Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00PM	237	-12.86	165
2	3-20-98	6:48PM	244	-15.83	250
3	3-23-98	10:30AM	250	-15	225
4	3-23-98	11:38AM	250	-13	169
5	3-23-98	1330	253	-12	144
6					
7					
8					
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gm / 3-24-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

Eq. Input	Description	Value
$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 6

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date [signature] 3-23-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	1430	28.89 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	265 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES)	NO
	Instrument in proper working condition?		(YES)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [initials] 3-23-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

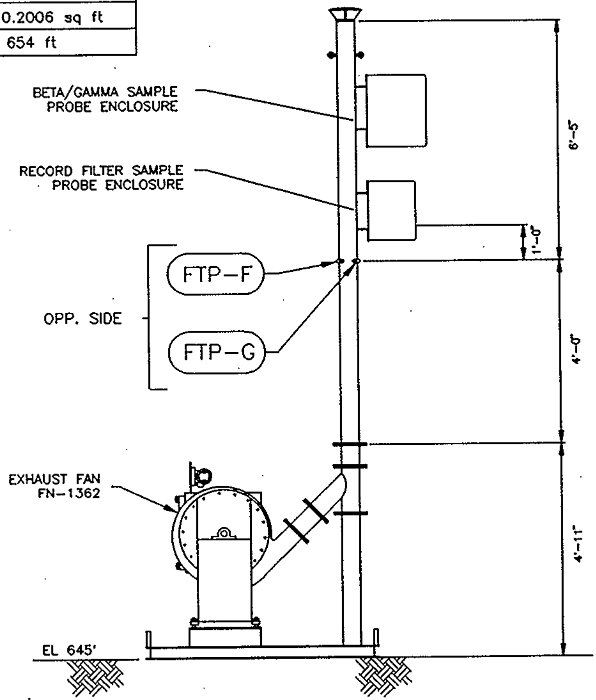


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		90 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.11 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	49	.073	1082		
	7/8	49	.099	1260		
5.1	1 3/8	49	.118	1376		
5.2	2	49	.103	1285		
5.3	4	49	.101	1273		
5.4	4 5/8	49	.082	1147		
	5 1/8	49	.066	1029		
5.5	5 1/2	49	.102	1279		
	TEST PORT G					
	1/2	49	.114	1352		
	7/8	49	.113	1346		
9.1	1 3/8	49	.114	1352		
9.4	2	49	.064	1013		
	4	49	.119	1382		
	4 5/8	49	.118	1376		
	5 1/8	49	.104	1292		
	5 1/2	49	.114 (VP1)	1352	(VP1)	
	TOTAL ts	784	TOTAL FPM	20196	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** $FPM = 4005 \sqrt{VP}$

Time test completed: 1440 Initials/Date fu 3-~~28~~ 23-98 ~~92~~ 3-23-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.114 (VP1) - .114 (VP2)) ÷ .114 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS circled)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS circled)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 284
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	49
9.3	Velocity (FPM) = $4005\sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 20196
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1262
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	253

Initials/Date [signature] ~~3-28~~ 3-23-98 3-23-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p \left(\sqrt{VP}\right)_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws})\, v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\, K_p C_p \left(\sqrt{VP}\right)_{avg} A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\, M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.011
RH	Stack relative humidity, percent	90% (Sht 3)
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.34935
K_p	Pitot tube constant: $85.49 \frac{ft}{sec}\left[\frac{(lb)(in.\ Hg)}{(lb\text{-}mole)\ {}^\circ R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$\left(\sqrt{VP}\right)_{avg}$	Average of velocity pressure sqrt, in. wg: $\left(\sqrt{VP}\right)_{avg} = fpm_{(avg)} \div 4005$	0.3151
$fpm_{(avg)}$	Average stack gas velocity, ft/min	1262 (Sht 4)
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.90
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.89
P_g	Stack static pressure, in. wg	(Sht 3) ∅.11
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	509
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 49
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.88

CALCULATION (Q_{sd})

$60(1-\emptyset.\emptyset 11)\,85.49(449)\,\frac{1262}{4005}\,(\emptyset.2006)\,\frac{528}{29.92}\sqrt{\frac{28.90}{509(28.88)}}$

$= 248.43$

Q_{sd} = 248 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 248
FI-1	Stack massflow reading, scfm	(Sht 2) 265

CALCULATION (D_i)

248 - 265 = -17

D_i = -17 scfm

COG Engr Initials/Date: [initials] / 3-24-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Barrett — V&B Review (print name) ; [signature] — Signature ; 7-1-98 — Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez — Facility PIC ; 7-6-98 — Date N/A — Work Request Number ; N/A — Work Request Number ; N/A — Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrummel — Cog. Engr. (print name) ; [signature] — Signature ; 3-24-98 — Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00PM	237	-12.86	165
2	3-20-98	6:48PM	244	-15.83	250
3	3-23-98	10:30 AM	250	-15	225
4	3-23-98	11:38AM	250	-13	169
5	3-23-98	1330	253	-12	144
6	3-23-98	1440	248	-17	289
7					
8					
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma (D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gne /3-24-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

Eq. Input	Description	Value
$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 7

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date JVC 3-24-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	0915	28.99 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	264 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		YES (circled)	NO
	Instrument in proper working condition?		YES (circled)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS (circled)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [initials] 3-24-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

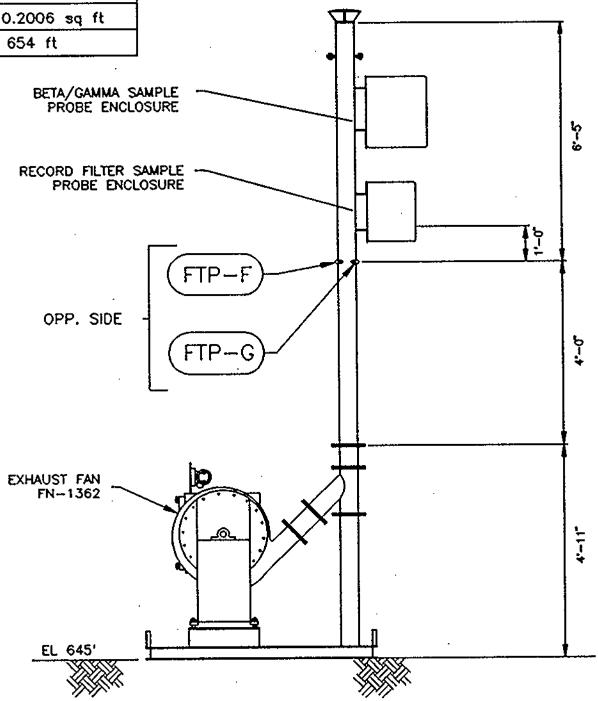


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		69.9 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.092 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	54	.073	1082		
	7/8	54	.108	1316		
5.1	1 3/8	54	.116	1364		
5.2	2	54	.109	1322		
5.3	4	54	.089	1195		
5.4	4 5/8	54	.09	1202		
5.5	5 1/8	54	.113	1346		
	5 1/2	54	.15	1551		
	TEST PORT G					
	1/2	54	.096	1241		
	7/8	54	.124	1410		
9.1	1 3/8	54	.125	1416		
9.4	2	54	.119	1382		
	4	54	.045	850		
	4 5/8	54	.049	887		
	5 1/8	54	.110	1328		
	5 1/2	54	.05 (VP1)	896	(VP1)	
	TOTAL ts	864	TOTAL FPM	19788	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = 4005 $\sqrt{VP}$

Time test ... 2920 Initials/Date [initials] 3-24-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.05 / VP1 - .05 / VP2) ÷ .05 / VP1] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 864
9.2	Average t_s = Total t_s ÷ 16	$t_{s(avg)}$	54
9.3	Velocity (FPM) = $4005\sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 19788
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1237
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	248

Initials/Date [signature] 3-24-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p (\sqrt{VP})_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	∅.010
RH	Stack relative humidity, percent	(Sht 3) 69.9%
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	∅.42031
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	∅.3089
$fpm_{(avg)}$	Average stack gas velocity, ft/min	(Sht 4) 1237
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.997
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.99
P_g	Stack static pressure, in. wg	(Sht 3) 0.092
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	514
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 54
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.89

CALCULATION (Q_{sd})

$$60(1-0.010)85.49(0.99)\frac{1237}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{28.997}{514(28.89)}}$$

$= 242.87$

Q_{sd} = 243 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 243
FI-1	Stack massflow reading, scfm	(Sht 2) 264

CALCULATION (D_i)

243 − 264 = −21

D_i = −21 scfm

COG Engr Initials/Date: GmC / 3-25-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Barcot — V&B Review (print name) / [signature] — Signature / 7-1-98 — Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez — Facility PIC / 7-6-98 — Date N/A — Work Request Number / N/A — Work Request Number / N/A — Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary M Crummel — Cog. Engr. (print name) / [signature] — Signature / 3-25-98 — Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00 PM	237	-12.86	165
2	3-20-98	6:48 PM	244	-15.83	250
3	3-23-98	10:30 AM	250	-15	225
4	3-23-98	11:38 AM	250	-13	169
5	3-23-98	1330	253	-12	144
6	3-23-98	1440	248	-17	289
7	3-24-98	0920	243	-21	441
8					
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gme / 3-25-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 8

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date [initials] 3-24-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	1020	28.98 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	262 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES) circled	NO
	Instrument in proper working condition?		(YES) circled	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS) circled	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date *[initials]* 3-24-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

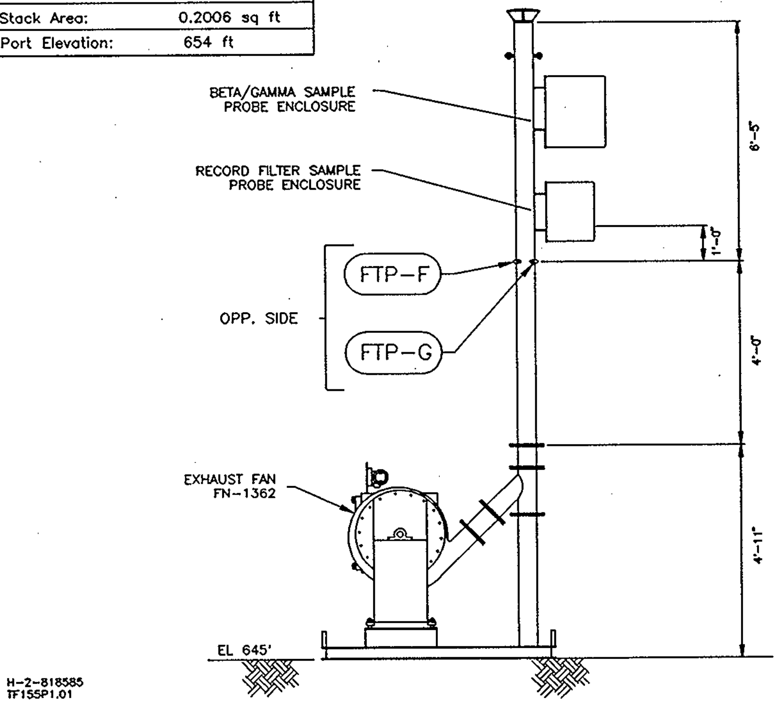


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		~~58.3~~ ~~68.3~~ 68.3 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.092 (P$_g$)		(P$_g$)	
	Traverse Points* (in.)	Temp. ts (°F)	Velocity VP (in. wg)	Velocity FPM** (ft/min)	Velocity VP (in. wg)	Velocity FPM** (ft/min)
	1/2	58	.101	1273		
	7/8	58	.106	1304		
5.1	1 3/8	58	.10	1266		
5.2	2	58	.104	1292		
5.3	4	58	.073	1082		
5.4	4 5/8	58	.089	1195		
	5 1/8	58	.053	922		
5.5	5 1/2	58	.125	1416		
	TEST PORT G					
	1/2	58	.135	1472		
	7/8	58	.122	1399		
9.1	1 3/8	58	.054	931		
9.4	2	58	.089	1195		
	4	58	.083	1154		
	4 5/8	58	.078	1119		
	5 1/8	58	.075	1097		
	5 1/2	58	.095 (VP1)	1234	(VP1)	
	TOTAL ts	928	TOTAL FPM	19351	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = 4005 $\sqrt{VP}$

Time test completed: 1031

Initials/Date [signature]

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.095 (VP1) - .095 (VP2)) ÷ .095 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 928
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	58
9.3	Velocity (FPM) = $4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 19351
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1209
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	243

Initials/Date *[signature]* 3-24-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p (\sqrt{VP})_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.011
RH	Stack relative humidity, percent	(Sht 3) 68.3 %
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.48588
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.3019
$fpm_{(avg)}$	Average stack gas velocity, ft/min	(Sht 4) 1209
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.99
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.98
P_g	Stack static pressure, in. wg	(Sht 3) 0.092
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	518
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 58
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.87

CALCULATION (Q_{sd})

$$60(1-0.011)\,85.49(4.49)\frac{1209}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{28.99}{518(28.87)}}$$

$= 236.19$

Q_{sd} = 236 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 236
FI-1	Stack massflow reading, scfm	(Sht 2) 262

CALCULATION (D_i)

236 - 262 = -26

D_i = -26 scfm

COG Engr Initials/Date: [initials] / 3-25-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Brad — V&B Review (print name) [signature] — Signature 7-1-98 — Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez — Facility PIC; 7-6-98 — Date N/A — Work Request Number; N/A — Work Request Number; N/A — Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary M Crummel — Cog. Engr. (print name) [signature] — Signature 3-25-98 — Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00 PM	237	-12.86	165
2	3-20-98	6:48PM	244	-15.83	250
3	3-23-98	10:30AM	250	-15	225
4	3-23-98	11:38AM	250	-13	169
5	3-23-98	1330	253	-12	144
6	3-23-98	1440	248	-17	289
7	3-24-98	0920	243	-21	441
8	3-24-98	1031	236	-26	676
9					
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gene / 3-25-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 9

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date flc 3-25-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	0925	28.95 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	360 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES) circled	NO
	Instrument in proper working condition?		(YES) circled	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS) circled	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [initials] 3-25-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

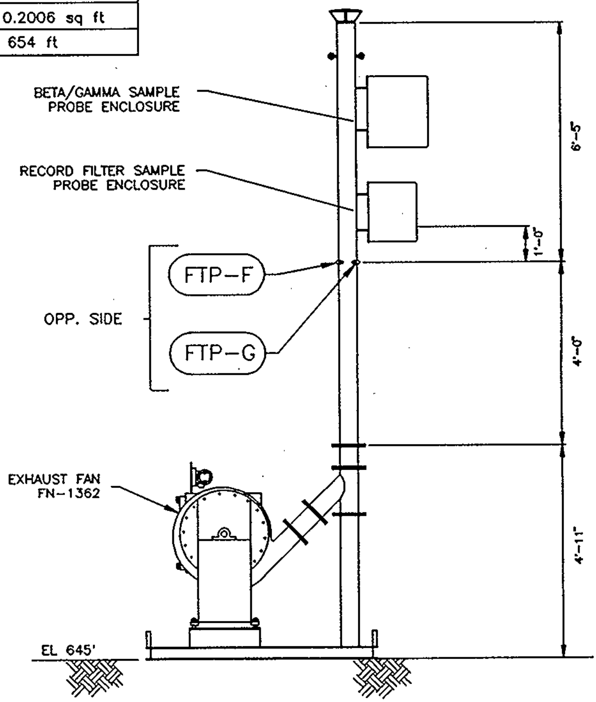


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		54 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.183 ~~28.95~~ (Pg) [initials] 3-25-98		(Pg)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	59	.173	1666		
	7/8	59	.193	1759		
5.1	1 3/8	59	.195	1769		
5.2	2	59	.191	1750		
5.3	4	59	.20	1791		
5.4	4 5/8	59	.186	1727		
	5 1/8	59	.20	1791		
5.5	5 1/2	59	.25	2003		
	TEST PORT G					
	1/2	59	.23	1921		
	7/8	59	.20	1791		
9.1	1 3/8	59	.183	1713		
9.4	2	59	.148	1541		
	4	59	.21	1835		
	4 5/8	59	.143	1515		
	5 1/8	59	.20	1791		
	5 1/2	59	.192 (VP1)	1755	(VP1)	
	TOTAL ts	944	TOTAL FPM	28118	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = 4005 $\sqrt{VP}$

Time test completed: 0930 Initials/Date [initials] 3-25-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.192 (VP1) - .192 (VP2)) ÷ .192 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	PASS/FAIL (PASS circled)
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS/FAIL (PASS circled)
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 944
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	59
9.3	Velocity (FPM) = $4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 28118
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1757
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	352

Initials/Date Sve 3-25-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p \left(\sqrt{VP}\right)_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p \left(\sqrt{VP}\right)_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.009
RH	Stack relative humidity, percent	54% (Sht 3)
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.50362
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ ^\circ R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$\left(\sqrt{VP}\right)_{avg}$	Average of velocity pressure sqrt, in. wg: $\left(\sqrt{VP}\right)_{avg} = fpm_{(avg)} \div 4005$	0.4387
$fpm_{(avg)}$	Average stack gas velocity, ft/min	1757 (Sht 4)
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.96
P_b	Barometric pressure at test port, in. Hg	28.95 (Sht 2)
P_g	Stack static pressure, in. wg	0.183 (Sht 3)
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	519
$t_{s(avg)}$	Average stack gas temperature, °F	59 (Sht 4)
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.90

CALCULATION (Q_{sd})

$$60(1-0.009)\,85.49(0.99)\frac{1757}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{28.96}{519(28.90)}}$$

$= 343.28$

Q_{sd} = 343 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	343 (Sht 5)
FI-1	Stack massflow reading, scfm	360 (Sht 2)

CALCULATION (D_i)

343 - 360 = -17

D_i = -17 scfm

COG Engr Initials/Date: [initials] / 3-30-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Barrett — V&B Review (print name) / [signature] — Signature / 7-1-98 — Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez — Facility PIC / 7-6-98 — Date N/A — Work Request Number / N/A — Work Request Number / N/A — Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary M Crummel — Cog. Engr. (print name) / [signature] — Signature / 3/30/98 — Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1					
2					
3					
4					
5					
6					
7					
8	3-24-98	1031	236	-26	676
9	3-25-98	0930	343	-17	289
10					
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: [illegible] / 3/30/98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)		
95% CONFIDENCE COEFFICIENT (CC) $CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$		
Eq. Input	Description	Value
$\Sigma (D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	
CALCULATION (CC)		CC =
PERCENT RELATIVE ACCURACY (RA) $RA = \left[\frac{\lvert\overline{D_i}\rvert + CC}{\overline{Q_{sd}}}\right] \times 100$		
$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	
CALCULATION (RA)		RA = %
168-HOUR AIR FLOW TEST RESULTS		
PASS = RA ≤ 10% FAIL = RA > 10%		PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 10

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA

GENERAL INFORMATION

Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).

REFERENCES

Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel:

H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.

PRECAUTIONS & LIMITATIONS

Flow test ports shall be accessed using the work platform installed on exhauster skid.

A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.

PREREQUISITES

No additional prerequisites.

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date [signature] 3-25-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	1030	28.94 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	357 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES)	NO
	Instrument in proper working condition?		(YES)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [signature] 3-25-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

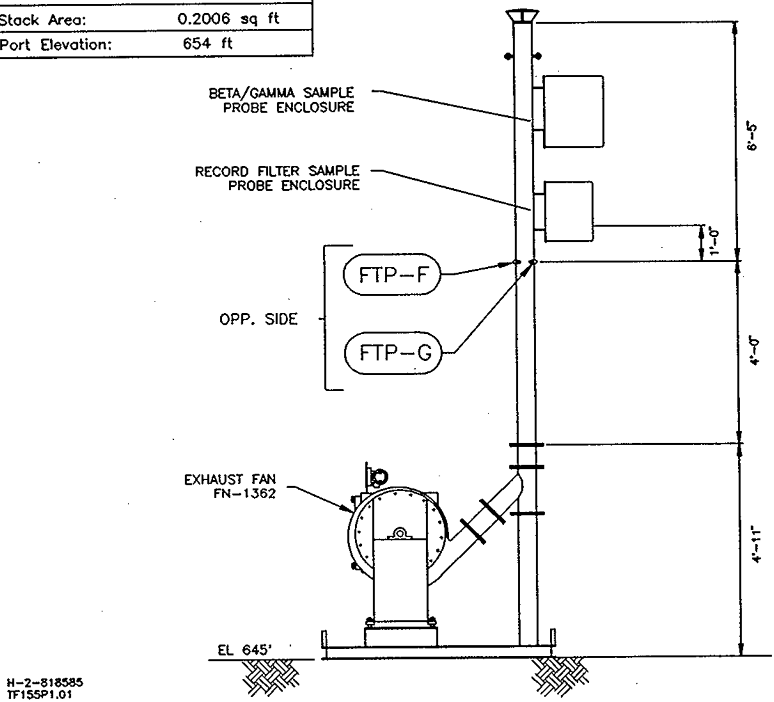


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		50.5 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.189 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	62	.20	1791		
	7/8	62	.22	1879		
5.1	1 3/8	62	.152	1561		
5.2	2	62	.172	1661		
5.3	4	62	.115	1358		
5.4	4 5/8	62	.22	1879		
5.5	5 1/8	62	.24	1962		
	5 1/2	62	.29	2157		
	TEST PORT G					
	1/2	62	.23	1921		
	7/8	62	.25	2003		
9.1	1 3/8	62	.188	1737		
9.4	2	62	.136	1477		
	4	62	.168	1642		
	4 5/8	62	.12	1387		
	5 1/8	62	.22	1879		
	5 1/2	62	.20 (VP1)	1791	(VP1)	
	TOTAL ts	992	TOTAL FPM	28085	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = $4005\sqrt{VP}$

Time test completed: 10 35 Initials/Date [illegible] 3-25-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.20 (VP1) − .20 (VP2)) ÷ .20 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	PASS (circled) / FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS (circled) / FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 992
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	62
9.3	Velocity (FPM) = $4005\sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 28085
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1755
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	352

Initials/Date [initials] 3-25-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right) \left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws}) K_p C_p (\sqrt{VP})_{avg} A \left(\frac{T_{std}}{P_{std}}\right) \sqrt{\frac{P_s}{T_{s(avg)} M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.00977
RH	Stack relative humidity, percent	50.5 (Sht 3)
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.56029
K_p	Pitot tube constant: $85.49 \frac{ft}{sec} \left[\frac{(lb)(in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.4382
$fpm_{(avg)}$	Average stack gas velocity, ft/min	1755 (Sht 4)
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.95
P_b	Barometric pressure at test port, in. Hg	28.94 (Sht 2)
P_g	Stack static pressure, in. wg	0.189 (Sht 3)
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	522
$t_{s(avg)}$	Average stack gas temperature, °F	62 (Sht 4)
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.89

CALCULATION (Q_{sd})

$$60(1-0.00977)85.49(0.99)\frac{1755}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{28.95}{522(28.89)}}$$

$= 341.77$

Q_{sd} = 342 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	342 (Sht 5)
FI-1	Stack massflow reading, scfm	357 (Sht 2)

CALCULATION (D_i)

342 - 357 = -15

D_i = -15 scfm

COG Engr Initials/Date: Gne / 3-30-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. DARCOT — V&B Review (print name) / [signature] — Signature / 7-1-98 — Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez — Facility PIC / 7-6-98 — Date N/A — Work Request Number / N/A — Work Request Number / N/A — Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrammel — Cog. Engr. (print name) / [signature] — Signature / 3-30-98 — Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1					
2					
3					
4					
5					
6					
7					
8					
9	3-25-98	0930	343	-17	289
10	3-25-98	1035	342	-15	225
11					
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gme / 3-30-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 11

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date [signature] 12-1-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	0900	28.99 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	189 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		YES (circled)	NO
	Instrument in proper working condition?		YES (circled)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS (circled)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [signature] 3-26-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

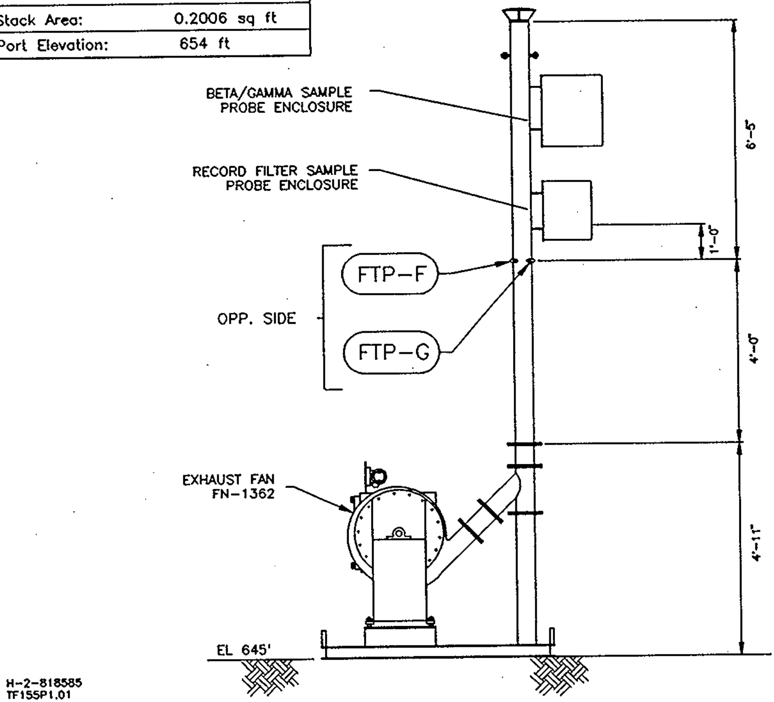


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		50.7 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.07 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	50	.053	922		
	7/8	50	.053	922		
5.1	1 3/8	50	.054	931		
5.2	2	50	.037	770		
5.3	4	50	.038	781		
5.4	4 5/8	50	.051	904		
	5 1/8	50	.057	956		
5.5	5 1/2	50	.045	850		
	TEST PORT G					
	1/2	50	.047	868		
	7/8	50	.063	1005		
9.1	1 3/8	50	.062	997		
9.4	2	50	.032	716		
	4	50	.03	694		
	4 5/8	50	.064	1013		
	5 1/8	50	.055	939		
	5 1/2	50	.046 (VP1)	859	(VP1)	
	TOTAL ts	600	TOTAL FPM	14127	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = 4005 $\sqrt{VP}$

Time test completed: 0905 Initials/Date [initials] 3-26-97

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.046 (VP1) - .046 (VP2)) ÷ .046 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	PASS (circled)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS (circled)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 800
9.2	Average t_s = Total t_s ÷ 16	$t_{s(avg)}$	50
9.3	Velocity (FPM) = $4005\sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 14127
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	~~886~~ 883 7-1-98 [initials]
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	~~178~~ 177 7-1-98 [initials]

Initials/Date [signature] 3-26-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws}) K_p C_p (\sqrt{VP})_{avg} A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)} M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.00634
RH	Stack relative humidity, percent	(Sht 3) 50.7
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.36263
K_p	Pitot tube constant: $85.49 \frac{ft}{sec}\left[\frac{(lb)(in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.2212
$fpm_{(avg)}$	Average stack gas velocity, ft/min	(Sht 4) 886
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	29.00
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.99
P_g	Stack static pressure, in. wg	(Sht 3) 0.07
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	510
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 50
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.93

CALCULATION (Q_{sd})

$60(1-0.00634)\,85.49(4.99)\frac{886}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{29.00}{510(28.93)}}$

$= 175.19$

Q_{sd} = 175 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 175
FI-1	Stack massflow reading, scfm	(Sht 2) 189

CALCULATION (D_i)

175 - 189 = -14

D_i = -14 scfm

COG Engr Initials/Date: Gne / 3-30-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Barcot — V&B Review (print name) [signature] — Signature 7-1-98 — Date
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez — Facility PIC 7-6-98 — Date N/A — Work Request Number N/A — Work Request Number N/A — Date
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary M Crummel — Cog. Engr. (print name) [signature] — Signature 3-30-98 — Date

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10	3-25-98	1035	342	-15	225
11	3-26-98	0905	175	-14	196
12					
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gm / 3-30-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

Eq. Input	Description	Value
$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 12

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date fw 3-26-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
2.2 2.3	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
	200 East	6	680	10 00	28.98 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	185 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES)	NO
	Instrument in proper working condition?		(YES)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date fin 3-26-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

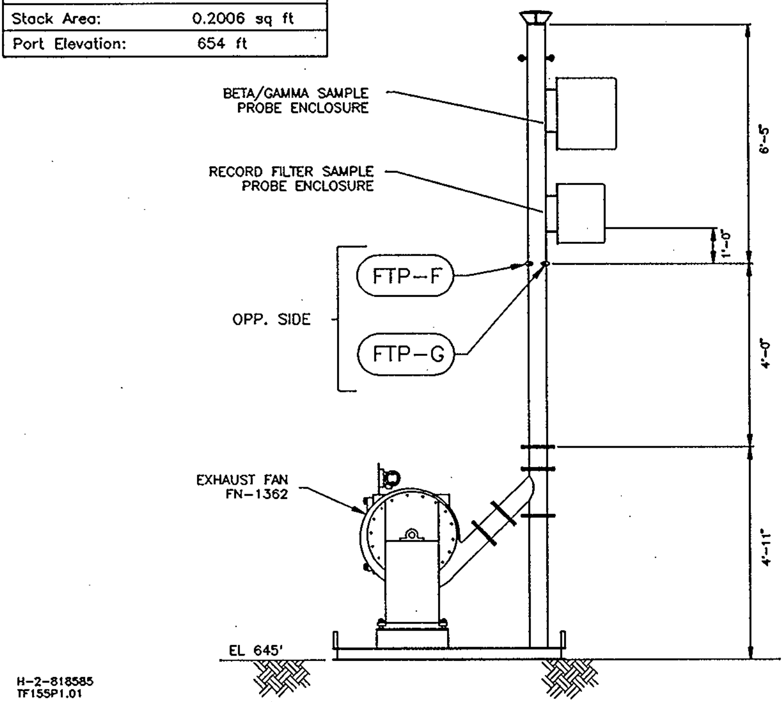


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		50.9 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.053 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	52	.043	830		
	7/8	52	.052	913		
5.1	1 3/8	52	.067	1037		
5.2	2	52	.049	887		
5.3	4	52	.075	1097		
5.4	4 5/8	52	.06	981		
5.5	5 1/8	52	.074	1089		
	5 1/2	52	.065	1021		
	TEST PORT G					
	1/2	52	.069	1052		
	7/8	52	.065	1021		
9.1	1 3/8	52	.053	922		
9.4	2	52	.026	645		
	4	52	.06	981		
	4 5/8	52	.06	981		
	5 1/8	52	.057	956		
	5 1/2	52	.045 (VP1)	850	(VP1)	
	TOTAL ts	832	TOTAL FPM	15263	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** $FPM = 4005\sqrt{VP}$

Time test completed: 10 10   Initials/Date fu 3-26-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.045 (VP1) - .045 (VP2)) ÷ .045 (VP1)] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS circled)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS circled)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 832
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	52
9.3	Velocity (FPM) = $4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 15263
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	954
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	191

Initials/Date [initials] 3-26-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws})\ K_p C_p (\sqrt{VP})_{avg}\ A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)}\ M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.00686
RH	Stack relative humidity, percent	(Sht 3) 50.9
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.39054
K_p	Pitot tube constant: $85.49\ \frac{ft}{sec}\left[\frac{(lb)\ (in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.2382
$fpm_{(avg)}$	Average stack gas velocity, ft/min	(Sht 4) 954
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	28.98
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 28.98
P_g	Stack static pressure, in. wg	(Sht 3) -0.053
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	512
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 52
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.92

CALCULATION (Q_{sd})

$60(1-.00686)\ 85.49(.99)\frac{.954}{.005}(.2006)\frac{528}{29.92}\sqrt{\frac{28.98}{512(28.92)}}$

$= 188.14$

Q_{sd} = 188 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 188
FI-1	Stack massflow reading, scfm	(Sht 2) 185

CALCULATION (D_i)

188 - 185 = 3

D_i = 3 scfm

COG Engr Initials/Date: [initials] / 3-30-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. BARSOT (V&B Review (print name)) — [signature] (Signature) — 7-1-98 (Date)
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez (Facility PIC) — 7-6-98 (Date) N/A (Work Request Number) — N/A (Work Request Number) — N/A (Date)
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrummel (Cog. Engr. (print name)) — [signature] (Signature) — 3-30-98 (Date)

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11	3-26-98	0905	175	-14	196
12	3-26-98	1010	188	3	9
13					
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	[$\Sigma (D_i)^2$]
AVG = SUM ÷ 14			($\bar{Q}_{sd}$)	($\bar{D}_i$)	

COG Engr Initials/Date: Gne / 3-30-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

Eq. Input	Description	Value
$\|\overline{D_i}\|$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 13

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	INSTRUMENT CALIBRATION DATA	
	AIR FLOW INSTRUMENT	HYGROMETER
1.1	Flow Instrument Type micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date fic 3-27-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
2.2 2.3	200 East	6	680	0900	29.136 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS			
3.1	Operating exhaust fan:		FN-1362	
3.2	Instrument	Location	Reading*	
	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	260 (FI-1) (SCFM)	
3.3	Instrument calibration sticker current?		(YES)	NO
	Instrument in proper working condition?		(YES)	NO
	COMMENTS:			

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [initials] 3-27-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

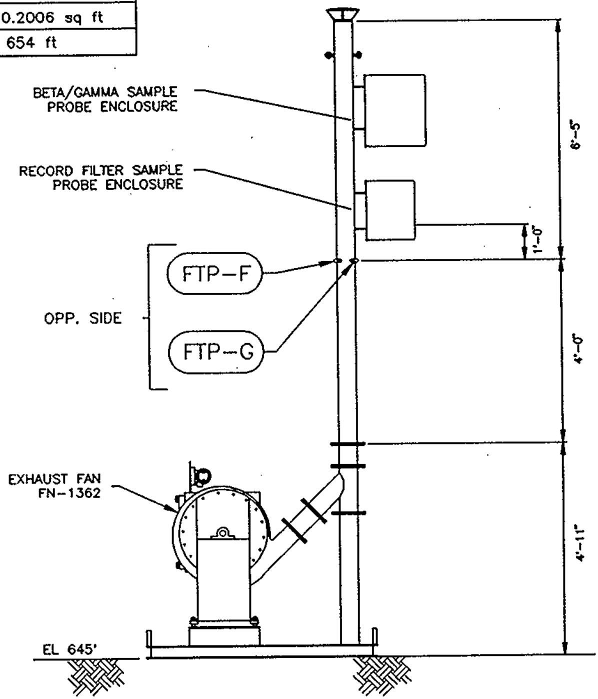


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		44 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.105 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	46	.079	1126		
	7/8	46	.108	1316		
5.1	1 3/8	46	.115	1358		
5.2	2	46	.084	1161		
5.3	4	46	.08	1133		
5.4	4 5/8	46	.131	1450		
5.5	5 1/8	46	.119	1382		
	5 1/2	46	.103	1285		
	TEST PORT G					
	1/2	46	.098	1254		
	7/8	46	.132	1455		
9.1	1 3/8	46	.103	1285		
9.4	2	46	.087	1181		
	4	46	.079	1126		
	4 5/8	46	.089	1195		
	5 1/8	46	.088	1188		
	5 1/2	46	.073 (VP1)	1082	(VP1)	
	TOTAL ts	736	TOTAL FPM	19977	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.

** FPM = $4005\sqrt{VP}$

Time test completed: 0910 Initials/Date [initials] 3-27-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) $P = [(\frac{.073}{VP1} - \frac{.073}{VP2}) \div \frac{.073}{VP1}] \times 100 =$ 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	(PASS)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	(PASS)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 736
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	46
9.3	Velocity (FPM) = $4005 \sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 19977
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1249
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	251

Initials/Date *flc* 3-27-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws}) K_p C_p (\sqrt{VP})_{avg} A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)} M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.00471
RH	Stack relative humidity, percent	(Sht 3) 44%
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.31205
K_p	Pitot tube constant: $85.49 \frac{ft}{sec}\left[\frac{(lb)(in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.3119
$fpm_{(avg)}$	Average stack gas velocity, ft/min	(Sht 4) 1249
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	29.144
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 29.136
P_g	Stack static pressure, in. wg	(Sht 3) 0.105
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	506
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 46
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.95

CALCULATION (Q_{sd})

$$60(1-0.00471)\,85.49\,(0.99)\frac{1249}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{29.144}{506(28.95)}}$$

$= 248.88$

Q_{sd} = 249 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 249
FI-1	Stack massflow reading, scfm	(Sht 2) 260

CALCULATION (D_i)

249 − 260 = −11

D_i = −11 scfm

COG Engr Initials/Date: Gne / 3-30-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M Barnett (V&B Review (print name)) — M Barnett (Signature) — 7-1-98 (Date)
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez (Facility PIC) — 7-6-98 (Date) N/A (Work Request Number) — N/A (Work Request Number) — N/A (Date)
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary McCrone (Cog. Engr. (print name)) — Gary McCrone (Signature) — 3-30-98 (Date)

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12	3-26-98	1010	188	3	9
13	3-27-98	0910	249	-11	121
14					
SUM = RUN1 + RUN2 + ...			(ΣQ_{sd})	(ΣD_i)	$[\Sigma(D_i)^2]$
AVG = SUM ÷ 14			$(\bar{Q}_{sd})$	$(\bar{D}_i)$	

COG Engr Initials/Date: Gue /3-30-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	
ΣD_i	Sum of 14 flow rate differences	

CALCULATION (CC)

CC =

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	
$\overline{Q_{sd}}$	Average reference flow rate	

CALCULATION (RA)

RA = %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10% FAIL = RA > 10%	PASS / FAIL

WORK PACKAGE 2E-98-00590

241-C-106 EXHAUST STACK 296-C-6
168-HOUR AIR FLOW TEST

DATA SHEETS TEST NO. 14

TANK EXHAUSTER 296-C-6 SITE-SPECIFIC DATA	
GENERAL INFORMATION	
Stack:	15'-4" (height); 6.056" i.d. (sch 40 pipe) 645 ft grade elevation (ref)
Flow Test Ports:	FTP F, G; 1" pipe w/cap; 8'-11" above grade
Scaffolding:	Work platform installed on skid
Exhaust Fan:	FN-1362; 230 cfm @ 53°F (variable: 180 std cfm @ 19 in. wg to 360 std cfm @ 42 in. wg).
REFERENCES	
Include the following references if requested by Air Balance (AB), Operations (NPO), or Tank Farm Power Operator (OP) personnel: H-2-818561, Project W-320 P & ID Tk 241-C-106 HVAC.	
PRECAUTIONS & LIMITATIONS	
Flow test ports shall be accessed using the work platform installed on exhauster skid. A flagman is required for vehicle movement within the Tank Farm. Only vehicles meeting the requirements of HNF-IP-1266 AC 5.16 are permitted within the tank farms.	
PREREQUISITES	
No additional prerequisites.	

DATA SHEET 1

STEP 1.0	**INSTRUMENT CALIBRATION DATA**	
1.1	AIR FLOW INSTRUMENT	HYGROMETER
	Flow Instrument Type Micro	Equipment Number 5
	Instrument Code Number 799-28-09-007	Instrument Code Number 799-32-03-003
	Cal Due Date 8-15-98	Cal Due Date 12-1-98
1.2	ADDITIONAL INSTRUMENT CALIBRATION DATA	
	COMMENTS:	

Initials/Date Jic 3-27-98

DATA SHEET 2

STEP 2.0	BAROMETRIC PRESSURE READING				
2.1	Hanford Weather Forecaster (373-2716)				
	Location	Station Number	Elevation (ft)	Time of Reading	Barometric Pressure (in. Hg)
2.2 2.3	200 East	6	680	1010	29.136 (P_b)
	COMMENTS:				

STEP 3.0	INSTALLED INSTRUMENT READINGS		
3.1	Operating exhaust fan:		FN-1362
	Instrument	Location	Reading*
3.2	Stack Flow Indicator FI-13627A	Stack Monitoring Cabinet	267 (FI-1) (SCFM)
3.3	Instrument calibration sticker current?	YES (circled)	NO
	Instrument in proper working condition?	YES (circled)	NO
	COMMENTS:		

STEP 4.0	PRE-TEST PRESSURE LEAK CHECK		
4.3 4.6	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS (circled)	FAIL
	COMMENTS:		

* Stack Mass Flow Indicator is read in conjunction with VP measurements (Step 5.5). Observe reading at least once per minute while taking VP measurments and enter average instrument reading.

Initials/Date [initials] 3-27-98

STACK 296-C-6	
MEASUREMENT	FLOW TEST PORT
Humidity	F
Static Pressure	F
Temperature	F, G
Velocity Pressure	F, G
Stack Diameter:	6.056 in. (i.d.)
Stack Area:	0.2006 sq ft
Port Elevation:	654 ft

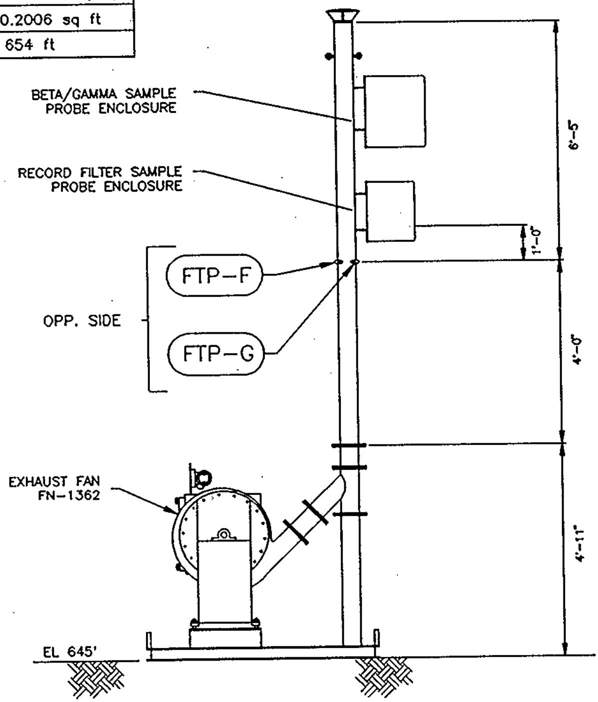


Figure 1. 241-C 106 Stack 296-C-6 Air Flow Test Ports.

DATA SHEET 3

STEP 5.0	STACK AIR FLOW MEASUREMENTS					
	TEST PORT F					
	Relative Humidity:		34 (RH)		RETEST (IF REQUIRED)	
	Static Pressure:		.098 (P_g)		(P_g)	
	Traverse Points* (in.)	Temp.	Velocity		Velocity	
		ts (°F)	VP (in. wg)	FPM** (ft/min)	VP (in. wg)	FPM** (ft/min)
	1/2	51	.088	1188		
	7/8	51	.124	1410		
5.1	1 3/8	51	.114	1352		
5.2	2	51	.106	1304		
5.3	4	51	.068	1044		
	4 5/8	51	.045	850		
5.4	5 1/8	51	.084	1161		
5.5	5 1/2	51	.142	1509		
	TEST PORT G					
	1/2	51	.114	1352		
	7/8	51	.132	1455		
9.1	1 3/8	51	.118	1376		
9.4	2	51	.067	1037		
	4	51	.053	922		
	4 5/8	51	.119	1382		
	5 1/8	51	.101	1273		
	5 1/2	51	.071 (VP1)	1067	(VP1)	
	TOTAL ts	816	TOTAL FPM	19682	TOTAL FPM	

* Traverse points are measured relative to internal diameter (i.d.); none may be located within 0.5 in. of stack walls.
** FPM = 4005 $\sqrt{VP}$

Time test completed: 10 15   Initials/Date fur 7-27-98

DATA SHEET 4

STEP 6.0	PITOT TUBE PERFORMANCE CHECK	
6.1 6.3 6.4	(PASS = P ≤ ± 5%); FAIL = P > ± 5%) P = [(.071 VP1 − .071 VP2) ÷ .071 VP1] x 100 = 0 % If P > ± 5% AND VP1 < 0.04 in. wg, air flow retest is NOT required; COG Engineer will determine acceptability of pitot tube performance.	PASS (circled)/FAIL
	COMMENTS:	

STEP 7.0	POST-TEST PRESSURE LEAK CHECK	
7.1 7.2	[Reading ≥ 3.0 in. wg and stable (± 0.2 in. wg) for 15 sec.] Impact Pressure ✓ Static Pressure ✓	PASS (circled)/FAIL
	COMMENTS:	

STEP 9.0	STACK AIR FLOW CALCULATIONS		
9.1	Total $t_s = t_{s1} + t_{s2} + t_{s3} + \ldots$	$t_{s(total)}$	(Sht 3) 816
9.2	Average t_s = Total $t_s \div 16$	$t_{s(avg)}$	51
9.3	Velocity (FPM) = $4005\sqrt{VP}$	Data Sheet 3	
9.4	Total FPM = $FPM_1 + FPM_2 + FPM_3 + \ldots$	$FPM_{(total)}$	(Sht 3) 19682
9.5	Average FPM = Total FPM ÷ 16	$fpm_{(avg)}$	1230
9.6	Total CFM = Average FPM x 0.2006 sq ft	$cfm_{(total)}$	247

Initials/Date *[initials]* 3-27-98

DATA SHEET 5 (Sheet 1 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET

AVERAGE ACTUAL STACK GAS VELOCITY (v_s)

$$v_s = K_p C_p (\sqrt{VP})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

AVERAGE STACK GAS DRY VOLUMETRIC FLOW RATE (Q_{sd})

$$Q_{sd} = 60(1-B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

$$= 60(1-B_{ws}) K_p C_p (\sqrt{VP})_{avg} A \left(\frac{T_{std}}{P_{std}}\right)\sqrt{\frac{P_s}{T_{s(avg)} M_s}}$$

Eq. Input	Description	Value
B_{ws}	Stack gas water vapor: $B_{ws} = \left(\frac{RH}{100}\right)\left(\frac{P_{ws}}{P_s}\right)$	0.00439
RH	Stack relative humidity, percent	(Sht 3) 34%
P_{ws}	Vapor pressure of H_2O at temperature $t_{s(avg)}$	0.37635
K_p	Pitot tube constant: $85.49 \frac{ft}{sec}\left[\frac{(lb)(in.\ Hg)}{(lb\text{-}mole)\ °R\ (in.\ H_2O)}\right]^{\frac{1}{2}}$	85.49
C_p	Pitot tube coefficient, standard	0.99
$(\sqrt{VP})_{avg}$	Average of velocity pressure sqrt, in. wg: $(\sqrt{VP})_{avg} = fpm_{(avg)} \div 4005$	0.3071
$fpm_{(avg)}$	Average stack gas velocity, ft/min	(Sht 4) 1230
A	Cross-sectional stack area, ft^2	0.2006
T_{std}	Standard absolute temperature, °R	528

DATA SHEET 5 (Sheet 2 of 2)

COGNIZANT ENGINEER AIR FLOW CALCULATION WORKSHEET		
P_{std}	Standard absolute pressure, in. Hg	29.92
P_s	Absolute stack gas pressure, in. Hg: $P_s = P_b + (P_g \div 13.6)$	29.14
P_b	Barometric pressure at test port, in. Hg	(Sht 2) 29.136
P_g	Stack static pressure, in. wg	(Sht 3) 0.098
$T_{s(avg)}$	Average absolute stack temperature, °R $T_{s(avg)} = 460 + t_{s(avg)}$	511
$t_{s(avg)}$	Average stack gas temperature, °F	(Sht 4) 51
M_s	Molecular weight stack gas, wet, lb/lb-mole: $M_s = 29(1-B_{ws}) + 18B_{ws}$	28.95

CALCULATION (Q_{sd})

$60(1-0.00439)85.49(0.99)\frac{1230}{4005}(0.2006)\frac{528}{29.92}\sqrt{\frac{29.14}{511(28.95)}}$

$= 243.95$

Q_{sd} = 244 dscfm

STACK MONITOR FLOW RATE DIFFERENCE (D_i)

$$D_i = Q_{sd} - (FI\text{-}1)$$

Eq. Input	Description	Value
Q_{sd}	Avg stack gas dry volumetric flow rate, dscfm	(Sht 5) 244
FI-1	Stack massflow reading, scfm	(Sht 2) 267

CALCULATION (D_i)

244 − 267 = −23

D_i = −23 scfm

COG Engr Initials/Date: Gme / 3-30-98

DATA SHEET 6

STEP 10	DISPOSITION
10.1 10.2	Vent & Balance Reviewer (PIC) shall ensure Data Sheets are accurate, complete, and legible. M. Bhat (V&B Review (print name)) — [signature] (Signature) — 7-1-98 (Date)
10.3	Facility Person-In-Charge (PIC) shall ensure all caps, plugs, and instrumentation have been restored to original configuration and record Work Request Number of items requiring additional maintenance: System configuration restored: R. Gutierrez (Facility PIC) — 7-6-98 (Date) N/A (Work Request Number) — N/A (Work Request Number) — N/A (Date)
10.5	Facility PIC forward data sheet package to Environmental Engineer for air flow test calculations & data analysis (Env. Engr. sign when complete & return data sheets to Planner, Bill Woody 373-4471): Gary M Crummel (Cog. Engr. (print name)) — [signature] (Signature) — 3-30-98 (Date)

COMMENTS:

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 1 OF 2)					
RUN	DATE	TIME	Q_{sd}	D_i	$(D_i)^2$
1	3-20-98	5:00PM	237	-12.36	165
2	3-20-98	6:48PM	244	-15.83	250
3	3-23-98	10:30AM	250	-15	225
4	3-23-98	11:33AM	250	-13	169
5	3-23-98	1330	253	-12	144
6	3-23-98	1440	248	-17	289
7	3-24-98	0920	243	-21	441
8	3-24-98	1031	236	-26	676
9	3-25-98	0930	343	-17	289
10	3-25-98	1035	342	-15	225
11	3-26-98	0905	175	-14	196
12	3-26-98	1010	188	3	9
13	3-27-98	0910	249	-11	121
14	3-27-98	1015	244	-23	529
SUM = RUN1 + RUN2 + . . .			3502 (ΣQ_{sd})	-210 (ΣD_i)	3,728 [$\Sigma(D_i)^2$]
AVG = SUM ÷ 14			250 ($\bar{Q}_{sd}$)	-15 ($\bar{D}_i$)	

COG Engr Initials/Date: Gme / 3-30-98

ENVIRONMENTAL ENGINEER AIR FLOW DATA ANALYSIS (SHEET 2 OF 2)

95% CONFIDENCE COEFFICIENT (CC)

$$CC = 2.160 \sqrt{\frac{\Sigma (D_i)^2 - \left[\frac{(\Sigma D_i)^2}{14}\right]}{13 \times 14}}$$

Eq. Input	Description	Value
$\Sigma(D_i)^2$	Sum of 14 squared flow rate differences	3728
ΣD_i	Sum of 14 flow rate differences	-210

CALCULATION (CC)

$$2.160 \sqrt{\frac{3728 - \left[\frac{(-210)^2}{14}\right]}{13 (14)}} = 3.85$$

CC = 4

PERCENT RELATIVE ACCURACY (RA)

$$RA = \left[\frac{|\overline{D_i}| + CC}{\overline{Q_{sd}}}\right] \times 100$$

Eq. Input	Description	Value
$\lvert\overline{D_i}\rvert$	Abosolute average flow rate difference	15
$\overline{Q_{sd}}$	Average reference flow rate	250

CALCULATION (RA)

$$\frac{15 + 4}{250} = 4.076$$

RA = 7.6 %

168-HOUR AIR FLOW TEST RESULTS

PASS = RA ≤ 10%	FAIL = RA > 10%	PASS (circled) / FAIL