DISTRIBUTION SHEET

To	From	Page 1 of 1
DISTRIBUTION	W. S. Lewis	Date 12/14/94
Project Title/Work Order		EDT No. 609879
HC-21C Off-Gas Test Procedure		ECN No.

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
D. A. Bruce	R3-77	X			
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G. B. Chronister	T5-50	X			
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M. W. Gibson	T5-55	X			
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ENGINEERING DATA TRANSMITTAL

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1. EDT

609879

2. To: (Receiving Organization) Distribution		3. From: (Originating Organization) PFP Process Engineering		4. Related EDT No.: N/A	
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8. Originator Remarks: Test Procedure for Off-Gas liquid				9. Equip./Component No.: N/A	
				10. System/Bldg./Facility: 73T/234-5Z/PFP	
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1	WHC-SD-CP-TC-032	1	0	HC-21C OFF-GAS TEST PROCEDURE	Q	1	1	

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)	(H)
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1	1	Cog.Eng. W. S. Lewis	<i>W.S. Lewis</i>	12/12/94	TS-55	L. T. Cunningham				3	
1	1	Cog. Mgr. M. W. Gibson	<i>M.W. Gibson</i>	12/14/94	TS-55						
1	1	QA D.R. Groth	<i>D.R. Groth</i>	12-12-94	TS-19						
		Safety									
		Env.									
3		Ops. G. B. Chronister									

18. L.T. Cunningham <i>L.T. Cunningham</i> Signature of EDT Originator Date 12-12-94		19. N/A Authorized Representative Date for Receiving Organization		20. M.W. Gibson <i>M.W. Gibson</i> Cognizant Manager Date 12/14/94		21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments	
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UNREVIEWED SAFETY QUESTION SAFETY REVIEW FORM

(Per WHC-IP-0842, 15.9)

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REFERENCE DOCUMENT(S):

EDT/~~ECN~~ No. 609879

PCA No.

Work Pkg No. N/A

Other (Specify) USQ PFP-005
WHC-SD-CP-SAR-021

TITLE: HC-21C Off-Gas Test Procedure

Does the PROPOSED CHANGE:

A. Represent a change to the facility as described in the AUTHORIZATION BASIS documentation?

☐ N/A ☒ No ☐ Yes/Maybe

Basis: The operation of the Thermal Stabilization furnaces located in glovebox HC-21C are described in USQ PFP-94-005. This test plan allows for modifications to the off gas system that will eliminate condensation of moisture in the off gas line. None of the modifications will affect the safety basis of the system as described in USQ PFP-94-005. *modifications will be installed with approved designs that will undergo USQ screening process also.*

B. Represent a change to procedures as described in the AUTHORIZATION BASIS?

☐ N/A ☒ No ☐ Yes/Maybe

Basis: This change does not affect the procedures as described in the safety basis. *Any operating procedure changes will be performed using PCA(s) that will include a USQ screening process.*

C. Represent a test or experiment not described in the AUTHORIZATION BASIS documentation?

☐ N/A ☒ No ☐ Yes/Maybe

Basis: This test will be controlled by this test plan. At no time will operations deviate from the safety basis as described in USQ PFP-94-005, or as described in *USQ Screening Process documents for the implementing design or PCA(s).*

D. Does the change Impact:

- Implemented OSRs or IOSRs? ☐ N/A ☒ No ☐ Yes/Maybe
- Approved IOSR Compliance Implementation Plans? ☐ N/A ☒ No ☐ Yes/Maybe

Basis: There are no OSRs associated with these operations or this change.

Based on the above, a Safety Evaluation ☐ DOES ☒ DOES NOT
Need to be performed for this change

USQE No. 1

WS Lewis
Print Name

USQE No. 2

M W Gibson
Print Name

Signature

WS Lewis

Date

12/14/94

Signature

M W Gibson

Date

12/14/94

RELEASE AUTHORIZATION

Document Number: WHC-SD-CP-TC-032, REV 0

Document Title: HC-21C Off-Gas Test Procedure

Release Date: 12/14/94

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

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara M. Broz

December 14, 1994

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SUPPORTING DOCUMENT		1. Total Pages 19
2. Title HC-21C Off-Gas Test Procedure	3. Number WHC-SD-CP-TC-032	4. Rev No. 0
5. Key Words HC-21C, Thermal Stabilization, Off-gas, 26-inch Vacuum, Plutonium <i>KMB 12/14/94</i>	6. Author Name: L.T. Cunningham <i>W.C. Cunningham</i> Signature Organization/Charge Code 15530/K6031	
7. Abstract This test procedure will be used to help determine the cause and remediation of water formation in the off-gas system for the HC-21C sludge stabilization furnaces.		
8. RELEASE STAMP <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> OFFICIAL RELEASE BY WHC DATE DEC 14 1994 55 <i>Sta. 5</i> </div>		

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1.0 HISTORY OF LIQUID IN OFF-GAS SYSTEM

The formation of liquid in the off-gas system was first seen during the performance of the Operational Test Procedure (WHC-SD-CP-OTP-151). The liquid formation occurred during testing of the controller programs with no material present in the furnace. The appearance of the liquid was clear. Initial indications pointed to the 26" vacuum as being the source of the liquid. It was surmised that water was draining down from the 26" vacuum header in room 263. Several adjacent vacuum line drops were opened and water was removed from them, confirming this source of liquid. However, the liquid formation continued in the off-gas rotameters. Furnace activities continued, as the OTP concluded that some residual vacuum header liquid, and drying out of the cast in place insulation in the filter housings, could be the source of the water. Engineering and Operations agreed that minor amounts of liquid in the rotameters was acceptable to initially start-up operations provided the off-gas flow was not hindered by the liquid.

The liquid formation continued once the furnaces were placed in service and actual feed items were run through heating cycles. The liquid in the rotameters now was dark green. The development laboratory provided analysis of the green liquid showing the presence of Cr, Ni, and I. It was concluded the liquid contained nickel compounds from the corrosion of the Inconel 600 off-gas tubing. The green liquid in the rotameter when dried formed a layer of film in the rotameter requiring rotameter replacement due to sticking rotameter floats.

The heat exchangers were speculated to be the cause of condensation of liquid in the rotameters. The initial design of the off gas system was based on calculations showing temperatures in the range of 600 C at the heat exchanger's inlet. The expectation was that the water vapor and NO_x fumes from charge stabilization would remain in the hot off gas through the rotameter and needle valve, and the higher vapor capacity on the vacuum side of the needle valve would allow the liquid to stay in the vapor phase and exit through the 26" vacuum and subsequently the E-4 exhaust system. However, the OTP showed that temperatures were much cooler on the piping exiting the glovebox and entering/exiting the heat exchangers (about 160 F at the glovebox and 140/130 in/out of the heat exchanger).

The heat exchangers were bypassed and a test procedure (WHC-SD-CP-TC-031) was performed to check the effectiveness of removing the heat exchangers from service. The test showed that removing the heat exchangers did reduce the condensation of liquid in the rotameters. Four 'dry' oxide type feed charges were run without observing liquid formation in the rotameter. However, a slug of green liquid entered rotameter FI-21C-2 when running a fifth item, a much 'wetter' oxalate charge.

The sudden appearance of liquid in rotameter FI-21C-2 indicates that condensation is not the cause of the liquid appearance. It was suspected the liquid slug could be the result of condensation in the filter housing. Work package 2Z-94-2151 was written to inspect the filter housings and work package 2Z-94-2150 was written to replace the damaged rotameter. During the execution of package 2Z-94-2151, difficulty was encountered when

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1.0 HISTORY OF LIQUID IN OFF-GAS SYSTEM (cont.)

disconnecting the inlet to filter #1. A fitting galled and was replaced with work package 2Z-94-2152. Further inspection of the filters was suspended until this test procedure was written and initiated. Operation of the furnaces with 'dry' feed items was to continue in the interim.

Further processing was done until the off-gas filters became plugged. Filter #2 was determined to be plugged after a series of events took place. During operation of furnace 2 it was observed that small amounts of smoke was billowing from the door of the furnace. Upon further scrutiny, it was found the bottom of the door was not seated completely. The smoke from the door stopped, but the off-gas piping near rotameter FI-21C-2 was cool to the touch. The rotameter still indicated over 120 scfh. However, the rotameter could not sustain a flow greater than 130 scfh when the other rotameter was at operating flow (120-140 scfh). This indicated that leaks may be present in the off-gas tubing. The following day, one fitting (tee on outlet of filter) was tightened using work package 2Z-94-2193. The decreased flow capacity was still not remedied. A check of the filter differential pressure indicated a dP of >4 psi @ 120 scfh and 10.5 psi at 180 scfh. Work Package 2Z-94-2210 was initiated to replace the filter cartridge in filter #2.

During the operation of furnace #1 on the same day, off-gas air flow was lost and a brown film coated the interior of FI-21C-1 at a furnace temperature of about 700°C. The heating cycle was terminated. The scope of work package 2Z-94-2210 was increased to include the replacement of the filter cartridge in filter #1 as well as replace the inconel tubing from the filter housing to the rotameter. The off-gas tubing will be changed from Inconel 600 to SS 304 or SS 304L before performing this test procedure. The SS 304/304L is more resistant to corrosion from nitric acid than is Inconel 600 and should help prevent corrosion products in the condensed from damaging the rotameters. Also, any corrosion products currently in the lines, which may be transported by condensed liquids into the rotameters, will be eliminated.

2.0 TEST ITEM IDENTIFICATION

Stabilization of plutonium bearing scrape material occurs in furnaces, F-21C-1 and F-21C-2, located in glovebox HC-21C. During previous testing and processing operations, water has been observed forming in the off-gas rotameters, FI-21C-1 and FI-21C-2. The off-gas is filtered through a 2 micron ceramic filter, F-21C-1 or F-21C-2, before discharge into the 26" vacuum system.

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3.0 GENERAL DESCRIPTION

3.1 Test Objectives

The goal of this test plan is to determine the cause and location of water formation in the sludge stabilization off-gas system. The results should help determine what design improvements or processing steps will be implemented to prevent this phenomena from occurring in the future.

3.2 Test Method

This test procedure will include a series of tests to determine where and why liquid is condensing in the HC-21C furnace off-gas system. The tests will take a sequential, graded approach and may be concluded once the results/conclusions have satisfactorily resolved the liquid formation problem. Additional tests and modifications may be added to those in this test procedure by Engineering Change Notice if the liquid formation problem is not resolved. A possible modification being consider is an air/water separator located before the off-gas rotameter.

Temporary thermocouples will be attached to the off-gas piping before, after, and under each filter housing to assist in the collection of data for each test. The thermocouple configuration is shown in Figure 1. A baseline set of data will be collected after a layer of insulation has been installed under each of the off-gas filter.

Further testing will include setting-up a filter preheat cycle to be run prior to performing a heating cycle. The filter preheat program (Prn 5) will heat the furnaces up to 200°C at 300°C/hr and hold that temperature for 1½ hours. Each furnace will then be allowed to cool to 120°C before a charge is started.

After the replacement of the off-gas rotameters with larger capacity models, additional tests will be performed that can increase off-gas flow rates up to 5 cfm.

The next step will be to replace the existing rotameter/needle valve off-gas system with an orifice based scheme. The orifice will be sized to provide adequate off-gas flow (<120 scfh) from the furnace. A bleed-in orifice downstream of the off-gas orifice will provide additional air volume to help prevent air from becoming saturated and liquid to condense in the off-gas piping. A sight glass will be installed in the off-gas piping to allow observation of liquid formation should it occur.

4.0 TEST CONDITION LIMITS

The furnaces will be operated per the directions provided in procedure Z0-160-032. The preheat cycle test will be performed by the test engineer providing a Program #5 on the programmable controller, and a temporary Procedure Change Authorization to the procedure to include the extra cycle. A temporary PCA will also be used to implement the higher off gas flow rate when that test is performed.

If liquid appears in either flowmeter, the test engineer or supervision may request operations to stop heating cycle and off-gas flow for the affected furnace. The affected off-gas filter can then be inspected per 2Z-94-2151 once the furnace temperature reaches $<100^{\circ}\text{C}$.

5.0 INSTRUMENTS AND CALIBRATION

Portable thermocouple
Transmation instrumentation from PPSL for temporary thermocouples

6.0 FACILITIES, EQUIPMENT, AND MATERIAL

Temporary thermocouples will be connected to the inlet and outlet piping for the off-gas filter. An additional thermocouple will be place under the filter housing. These thermocouples will be in place before testing starts.

A layer of insulation is to be placed under each filter housing before testing is to begin.

Additional off-gas rotameters (Dwyer Model RMC-103, 20-200 scfh) will be available for replacement of FI-21C-1 and FI-21C-2 as required.

An orifice off-gas setup to be install for test performed in section 11.4

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7.0 SAFETY

The testing described in this plan will be performed under the existing safety envelope for the HC-21C furnace operations, and all OSD limits will be met, with the exception of off gas flow rate increases for one test. The increased off gas flow will provide enhanced dilution of potential combustible gas and thus enhance safety. The preheat cycle is analogous to the current dwell cycle for sludge feeds, and the preheat temperature is well below the temperature for butene ignition documented in the safety envelope. An Unreviewed Safety Question Evaluation has been performed for this test procedure.

7.1 Safety - All individuals performing actions prescribed by this procedure are required to read applicable RWP's.

7.2 Pre-job Meeting - A pre-job safety meeting will be conducted for all individuals performing tasks associated with this test procedure.

7.3 Pre-job Meeting Attendance Sign-in Sheet.

PRESENTER:		DATE:
ATTENDEE	ORGANIZATION

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8.0 MAINTENANCE AND FAILURES

Should water formation occur during processing operations conducted under the direction of this test, the test engineer and operations supervisor can request that the heating cycle be stopped. The affected furnace's off-gas filter is to be inspected per work package 2Z-94-2151. Testing can resume once the affected equipment is deemed operable by engineering and operations.

Modification may occur as directed by this test procedure and any work packages needed to support the changes. This will suspend testing activities until the necessary modifications are complete. Testing can resume once the modifications are accepted by engineering.

9.0 TEST DATA

Various temperature data will be taken during the performance of each of the tests. Visual observations include for water formation will also be needed. Data tables for recording the desired information for each test are attached. In addition, the test engineer will keep a log of pertinent events for the duration of the testing.

10.0 PERSONNEL REQUIREMENTS

The test engineer must be present to obtain required data collection. Operators will perform operation of the furnaces per ZO-160-032 and will assist with data collection per supervision direction.

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11.0 PROCEDURE

11.1 Baseline determination

NOTE

A layer of insulation is to be installed beneath each of the off-gas filters before performing this test.

- 11.1.1 Request operations to prepare two oxide charges per Z0-160-032.
- 11.1.2 Record required time and temperature data on BASELINE TEST DATA SHEET during the heating cycle.

NOTE

The Dwyer model RMC-103 rotameters are rated for 130°F. This value is set based on the calibrations of the rotameters. The rotameter is made of an acrylic material which will not show signs of heat damage until temperatures in excess of 175°F per manufacturer.

- 11.1.3 Should the inlet temperature to the rotameter exceed 175°F, shutdown the heating cycle.
- 11.1.4 Observe and make note of any liquid formation in the off-gas rotameters.
- 11.1.5 If liquid is seen in the rotameters during the heating cycle, the test engineer may request operations to stop the heating cycle and stop the off-gas so that the filters can be inspected.

11.2 Off-Gas Filter Preheat Test Using Preheat Program

NOTE

This test may need to be repeated several days to establish the effectiveness of preheating the filters before initiating the heating cycle.

A temporary PCA will be written to provide directions for running filter preheat cycle.

The preheat program (Prn 5) is shown in Attachment 1.

- 11.2.1 Request operations to perform filter preheat cycle (Prn 5) per Temporary PCA to procedure ZO-160-032.
- 11.2.2 Request operations to prepare two oxalate or sludge charges per ZO-160-032.
- 11.2.3 Record time and temperature data required on FILTER PREHEAT DATA SHEET during the heating cycle.

NOTE

The rotameters are rated for 130°F. This value is set based on the calibrations of the rotameters. The rotameter is made of an acrylic material which will not show signs of heat damage until temperatures in excess of 175°F per manufacturer.

- 11.2.4 Should the inlet temperature to the rotameter exceed 175°F, shutdown the heating cycle.
- 11.2.5 Observe and make note of any liquid formation in the off-gas rotameters.
- 11.2.6 If liquid is seen in the rotameters during the heating cycle, the test engineer may request operations to stop the heating cycle and stop the off-gas so that the filters can be inspected.
- 11.2.7 Repeat steps 11.2.1 through 11.2.6 as requested by Test Engineer.

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11.3 Increased Off-Gas Flow Test

NOTE

This test may need to be repeated several days to establish the effectiveness of increased off-gas flow.

The existing rotameters will need to be replaced with high capacity rotameters before this test can proceed.

A temporary PCA will be issued to procedure ZO-160-032 to allow the off-gas flow rate to be set per supervision and engineering direction.

- 11.3.1 Install rotameters before this test is to begin. List ECN and Work Package for installing this design change.
ECN: _____
Work Package: _____
- 11.3.2 Request operations to prepare two oxalate or sludge charges per ZO-160-032.
- 11.3.3 Request operations to start furnace heating cycle using the off-gas flow rate requested by engineering.
- 11.3.4 Record off-gas flow rate and required time and temperature data on INCREASED OFF-GAS FLOW TEST DATA SHEET during the heating cycle.
- 11.3.5 Observe and make note of any liquid formation in the off-gas rotameters.
- 11.3.6 If liquid is seen in the rotameters during the heating cycle, the test engineer may request operations to stop the heating cycle and stop the off-gas so that the filters can be inspected.
- 11.3.7 Repeat steps 11.3.2 to 11.3.6 for additional off-gas flow rate as requested by Test Engineer.

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11.4 Off-Gas Orifice Test

NOTE

This test may need to be repeated several days to establish the effectiveness of using an orifice for metering the off-gas flow.

An orifice monitoring system for off-gas flow can be installed in the off-gas piping after the filter housing inside the glovebox. This will replace the current rotameter/needle valve arrangement. A sight glass would be installed in the off-gas piping so that any liquid formation can be seen.

The orifice system will need to be tested to check its performance at potential processing pressure drop and temperature conditions.

- 11.4.1 Before the orifice setup is put into service, a test will be performed by PPSL to ensure proper flow is seen at operating conditions.

Engineering Hold Point: The orifice metering system provides adequate off-gas flow ($2 \text{ cfm} \geq \text{flow} \geq 3 \text{ cfm}$):

Signature Date

- 11.4.2 Install the orifice metering system after testing shows acceptable design. List ECN and Work Package for installing this design change.
ECN: _____
Work package: _____
- 11.4.3 Request operations to prepare two oxalate or sludge charges per ZO-160-032.
- 11.4.4 Record time and temperature data required on OFF-GAS ORIFICE TEST DATA SHEET during the heating cycle.
- 11.4.5 Observe and make note of any liquid formation in the off-gas sight glasses.
- 11.4.6 If liquid is seen in the off-gas sight glass during the heating cycle, the test engineer may request operations to stop the heating cycle and stop the off-gas so that the filters can be inspected.
- 11.4.7 Repeat steps 11.4.3 through 11.4.6 as requested by Test Engineer.

12.0 DISPOSITION OF TEST ITEMS

The temporary thermocouples installed on the inlet and outlet filter piping and under filter housing will be removed at the end of the tests and disposed of as waste.

The transman instrumentation will be returned to PPSL.

Any additional temporary modifications will be removed per appropriate work package.

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Figure 1 - Temporary Thermocouple Location

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BASELINE TEST DATA SHEETS
Page of
Date Test is Started: / /

Test Engineer:															
Time															
TIC-21C-1 (°C)															
Filter F-21C-1 Inlet (°F)															
Filter F-21C-1 Outlet (°F)															
Filter F-21C-1 Bottom (°F)															
Off-gas Tubing (Furn 1) @ glovebox wall (°F)															
FI-21C-1 Inlet (°F)															
FI-21C-1 Outlet (°F)															
TIC-21C-2 (°C)															
Filter F-21C-2 Inlet (°F)															
Filter F-21C-2 Outlet (°F)															
Filter F-21C-2 Bottom (°F)															
Off-gas Tubing (Furn 2) @ glovebox wall (°F)															
FI-21C-2 Inlet (°F)															
FI-21C-2 Outlet (°F)															

Comments _____

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FILTER PREHEAT TEST DATA SHEETS

Page of
Date Test is Started: / /

Test Engineer:	TIME													
Time														
TIC-21C-1 (°C)														
Filter F-21C-1 Inlet (°F)														
Filter F-21C-1 Outlet (°F)														
Filter F-21C-1 Bottom (°F)														
Off-gas Tubing (Furn 1) @ glovebox wall (°F)														
FI-21C-1 Inlet (°F)														
FI-21C-1 Outlet (°F)														
TIC-21C-2 (°C)														
Filter F-21C-2 Inlet (°F)														
Filter F-21C-2 Outlet (°F)														
Filter F-21C-2 Bottom (°F)														
Off-gas Tubing (Furn 2) @ glovebox wall (°F)														
FI-21C-2 Inlet (°F)														
FI-21C-2 Outlet (°F)														

Comments _____

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INCREASED OFF-GAS FLOW TEST DATA SHEETS

Page of
Date Test is Started: / / Off-gas Flow Rate - (cfm)

Test Engineer:	TIME													
Time														
TIC-21C-1 (°C)														
Filter F-21C-1 Inlet (°F)														
Filter F-21C-1 Outlet (°F)														
Filter F-21C-1 Bottom (°F)														
Off-gas Tubing (Furn 1) @ glovebox wall (°F)														
FI-21C-1 Inlet (°F)														
FI-21C-1 Outlet (°F)														
TIC-21C-2 (°C)														
Filter F-21C-2 Inlet (°F)														
Filter F-21C-2 Outlet (°F)														
Filter F-21C-2 Bottom (°F)														
Off-gas Tubing (Furn 2) @ glovebox wall (°F)														
FI-21C-2 Inlet (°F)														
FI-21C-2 Outlet (°F)														

Comments _____

TEST PROCEDURE	SLUDGE STABILIZATION TEST PROCEDURE	WHC-SD-CP-TC-032 REV-0 PAGE 18 OF 19
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OFF-GAS ORIFICE TEST DATA SHEETS

Page of
Date Test is Started: / /

Test Engineer:	TIME													
Time														
TIC-21C-1 (°C)														
Filter F-21C-1 Inlet (°F)														
Filter F-21C-1 Outlet (°F)														
Filter F-21C-1 Bottom (°F)														
Off-gas Tubing (Furn 1) @ glovebox wall (°F)														
FI-21C-1 Inlet (°F)														
FI-21C-1 Outlet (°F)														
TIC-21C-2 (°C)														
Filter F-21C-2 Inlet (°F)														
Filter F-21C-2 Outlet (°F)														
Filter F-21C-2 Bottom (°F)														
Off-gas Tubing (Furn 2) @ glovebox wall (°F)														
FI-21C-2 Inlet (°F)														
FI-21C-2 Outlet (°F)														

Comments _____

Attachment 1 - Controller Program 5 (Prn 5)

Program Prn 5			
Pr1	300	Pr6	End
Or1	- -	Or6	- -
P11	200	P16	0
Pd1	1.5	Pd6	0.0
Od1	- -	Od6	- -
Pr2	Step	Pr7	End
Or2	- -	Or7	- -
P12	25	P17	0
Pd2	0.0	Pd7	0.0
Od2	- -	Od7	- -
Pr3	End	Pr8	End
Or3	- -	Or8	- -
P13	0	P18	0
Pd3	0.0	Pd8	0.0
Od3	- -	Od8	- -
Pr4	End	Cnt	Cnt n
Or4	- -	Plc	1
P14	0		
Pd4	0.0		
Od4	- -		
Pr5	End		
Or5	- -		
P15	0		
Pd5	0.0		
Od5	- -		