Survey Unit Release Record				
Design #	EP-Rx 138-3	**Revision #**	Original	**Page 1 of 4**
Survey Unit #(s)	Rx 138-3			
Description	1) Embedded Pipe (EP) Survey Unit Rx 138-3 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF). 2) EP Rx 138-3 is a Class 1, Group 1 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004. 3) Surveys in EP Rx 138-3 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 3-9 from Survey Request (SR)-13 was referenced for this decision. 4) Survey Instructions for this survey unit are incorporated into and performed in accordance with (IAW) the Babcock Services Incorporated (BSI)/LVS-002, Work Execution Package (WEP) 05-006. Survey instructions described in this document constitute "Special Methods" and the survey design used in the acquisition of survey measurements. 5) Instrument efficiency determinations are developed in accordance with the BSI/LVS-002, WEP 05-006, these determinations are appropriate for the types of radiation involved and the media being surveyed. 6) Only the seven feet of the approximate overall length of twenty two feet of this pipe was accessible for final survey. However, it is concluded that the final survey of the accessible portion of this pipe system is appropriate to demonstrate the radiological condition of the entire pipe and the suitability of the pipe for unrestricted release.			

Approval Signatures		**Date:**
FSS/Characterization Engineer	Carl Rumbaugh	11-28-07
Technical Reviewer (FSS/Characterization Engineer)	A Wood	11-28-07
FSS/Characterization Manager	R. Case	11/29/07

1.0 History/Description

1.1 The subject pipe system is a 1" system line. The ends of the piping section are accessible from the Sub Pile Room and Quad "D" on the -25' elevation of the Reactor Building.

1.2 EP Rx 138-3 is approximately 22 feet in length. The middle portion of the pipe run could not be accessed for survey due to a series of mitered, 90^{o} elbows that prevent the travel of radiological detectors past the access points. Consequently, only seven of the approximate 22 feet of total length for this pipe was accessible for survey.

2.0 Survey Design Information

2.1 EP Rx 138-3 was surveyed IAW Procedure #BSI/LVS-002.

2.2 The accessible portion of the 1" ID pipe was surveyed by static measurement at one foot increments, for a total of 7 survey measurements.

2.3 Surface area for the 1" ID piping is 243 cm^2 for each foot of piping, corresponding to a total 1" ID piping surface area of 1,703 cm^2 (0.2 m^2) for the entire accessible length of (7') of 1" piping.

3.0 Survey Unit Measurement Locations/Data

3.1 Pipe interior radiological survey forms are provided in Attachment 2 of this release record.

4.0 Survey Unit Investigations/Results

4.1 None

5.0 Data Assessment Results

5.1 Data assessment results are provided in the EP/Buried Pipe (BP) Survey Report provided in Attachment 1.

5.2 Only the seven feet of the approximate overall length of 22 feet of this pipe was accessible for final survey.

5.3 All measurement results from the seven feet of accessible pipe are less than the Derived Concentration Guideline Level (DCGL) for radionuclide specific EP that corresponds to the 1 mrem/yr dose goal established in Table 3-3 of the FSSP.

5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for the accessible portion of this survey unit.

5.5 In addition to the seven final survey measurements taken in the accessible portion of this pipe, additional radiological surveys were performed to the extent possible as allowed by the configuration of this piping. These surveys were performed to provide additional assurance that the

radiological conditions represented by the seven interior survey measurements are representative of the entire length of pipe.

5.6 Scan surveys were performed for pre and post remediation purposes, using a beta-gamma GM detector on the exterior of the access point for this pipe system. The surveys are documented as survey nos. NASA-07-3204 and NASA-07-3221, performed in support of RWP PB-07-100. Both pre and post surveys showed negligible levels of activity. The scan survey results indicated activity <1,000 dpm per direct frisk. In addition, smear rag was pulled through the length of the piping section. No loose radiological contamination greater than 1,000 dpm/100cm^2 was detected.

5.7 Based upon the results of the final survey measurements combined with the results of the operational survey, it is reasonable to conclude that the final survey of the accessible portion of this pipe system is appropriate to demonstrate the radiological condition of the entire pipe. Survey Unit EP Rx 138-3 demonstrates compliance with the DCGL values, as presented in Sections 3.3, 7.5 and Attachment C of the PBRF FSSP.

5.8 When implementing the Unity Rule, provided in Section 3.6.3 of the FSSP, and applying the Nuclide Fraction (NF), provided in TBD-06-004, the survey unit that is constituted by EP Rx 138-3 passes FSS.

Statistical Summary Table

Statistical Parameter	1" Pipe
Total Number of Survey Measurements	7
Number of Measurements >MDC	6
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.2290
Median	0.2832
Standard Deviation	0.1363
Maximum	0.3938
Minimum	0.0380

6.0 Documentation of evaluations pertaining to compliance with the unrestricted use limit of 25 mrem/yr and dose contributions from Embedded Pipe and radionuclides contributing 10% in aggregate of the total dose for both structural scenarios and soils.

6.1 A review of the survey results has shown that the dose contribution for the accessible portion of EP Rx 138-3 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.229 mrem/yr based on the average of the actual gross counts.

7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report
Attachment 2 -Pipe Interior Radiological Survey Form & Radiation Protection Survey Forms
Attachment 3 – DQA Worksheet
Attachment 4 –Disc containing RR for EP Rx 138-3 & Spreadsheet

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BSI EP/BP SURVEY REPORT

Pipe ID	**EP Rx 138-3**	**Survey Location**	Quad D Seal Drain - 25 el.
Survey Date	27-Nov-07	**2350-1 #**	203468
Survey Time	13:59	**Detector-Sled #**	PMT FO 1.5L-X 0047/no sled
Pipe Size	1"	**Detector Efficiency**	0.00071
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm2)	243
Pipe Area Incorporated by Survey Data (m^2)	0.2	**Field BKG** (cpm)	7.0
Routine Survey	X	**Field MDCR** (cpm)	12.1
QA Survey		**Nominal MDC** (dpm/100cm2)	6,638

Survey Measurement Results	
Total Number of Survey Measurements	7
Number of Measurements >MDC	6
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.2290
Median	0.2832
Standard Deviation	0.1363
Maximum	0.3938
Minimum	0.0380

Survey Technician(s)	JACOBS

Survey Unit Classification	1
TBD 06-004 Piping Group	1
SR-13 Radionuclide Distribution Sample	EP 3-9
Measured Nuclide	Co-60
Area Factor/EMC Used	No
Pass/Fail FSS	Pass
MREM/YR Contribution	<1

COMMENTS:
ACTIVITY VALUES NOT BACKGROUND CORRECTED

RP Engineer | Date	Dal Rudall 11-28-07

EP Rx 138-3
1" Pipe
TBD 06-004 Group 1

Measurement #	gcpm	ncpm	Co-60 activity (total dpm)	Co-60 activity (dpm/100cm2)	Cs-137 activity (dpm/100cm2)	Eu-152 activity (dpm/100cm2)	Eu-154 activity (dpm/100cm2)	Nb-94 activity (dpm/100cm2)	Ag-108m activity (dpm/100cm2)	Unity
1	88	88	123,944	50,960	2,020	48,341	12,851	1,487	355	0.304
2	74	74	104,225	42,852	1,698	40,650	10,806	1,250	299	0.256
3	83	83	116,901	48,064	1,905	45,594	12,121	1,403	335	0.287
4	82	82	115,493	47,485	1,882	45,045	11,975	1,386	331	0.283
5	114	114	160,563	66,016	2,616	62,623	16,648	1,926	460	0.394
6	12	12	16,901	6,949	275	6,592	1,752	203	48	0.041
7	11	11	15,493	6,370	252	6,043	1,606	186	44	0.038
									MEAN	0.229
									MEDIAN	0.283
									STD DEV	0.136
									MAX	0.394
									MIN	0.038

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Pipe Interior Radiological Survey Form

Date: 11.27.07 Time: 1359

Pipe ID#: Rx 138 #3 Pipe Diameter: 1" Access Point Area: QUAD "D"

Building: Rx Elevation: -25' System: Pp. Seal Drain

Type of Survey Investigation ____ Characterization ____ Final Survey X Other ✓

Gross ____ Co60 ✓ Cs ____

Detector ID# / Sled ID# PMT Fo 1.5L-X / 00471 N/A

Detector Cal Date: 9.14.07 Detector Cal Due Date: 9.14.08

Instrument: 2350-1 Instrument ID #: 203468

Instrument Cal Date: 9.14.07 Instrument Cal Due Date: 9.14.08

From the Daily Pipe Survey Detector Control Form for the Selected Detector

Background Value 7.0 cpm

$MDCR_{static}$ 12.12 cpm

Efficiency Factor for Pipe Diameter 0.00071 (from detector efficiency determination)

MDC_{static} 6638 dpm/ 100 cm^2

Is the MDC_{static} acceptable? (Yes) No (if no, adjust sample count time and recalculate $MDCR_{static}$)

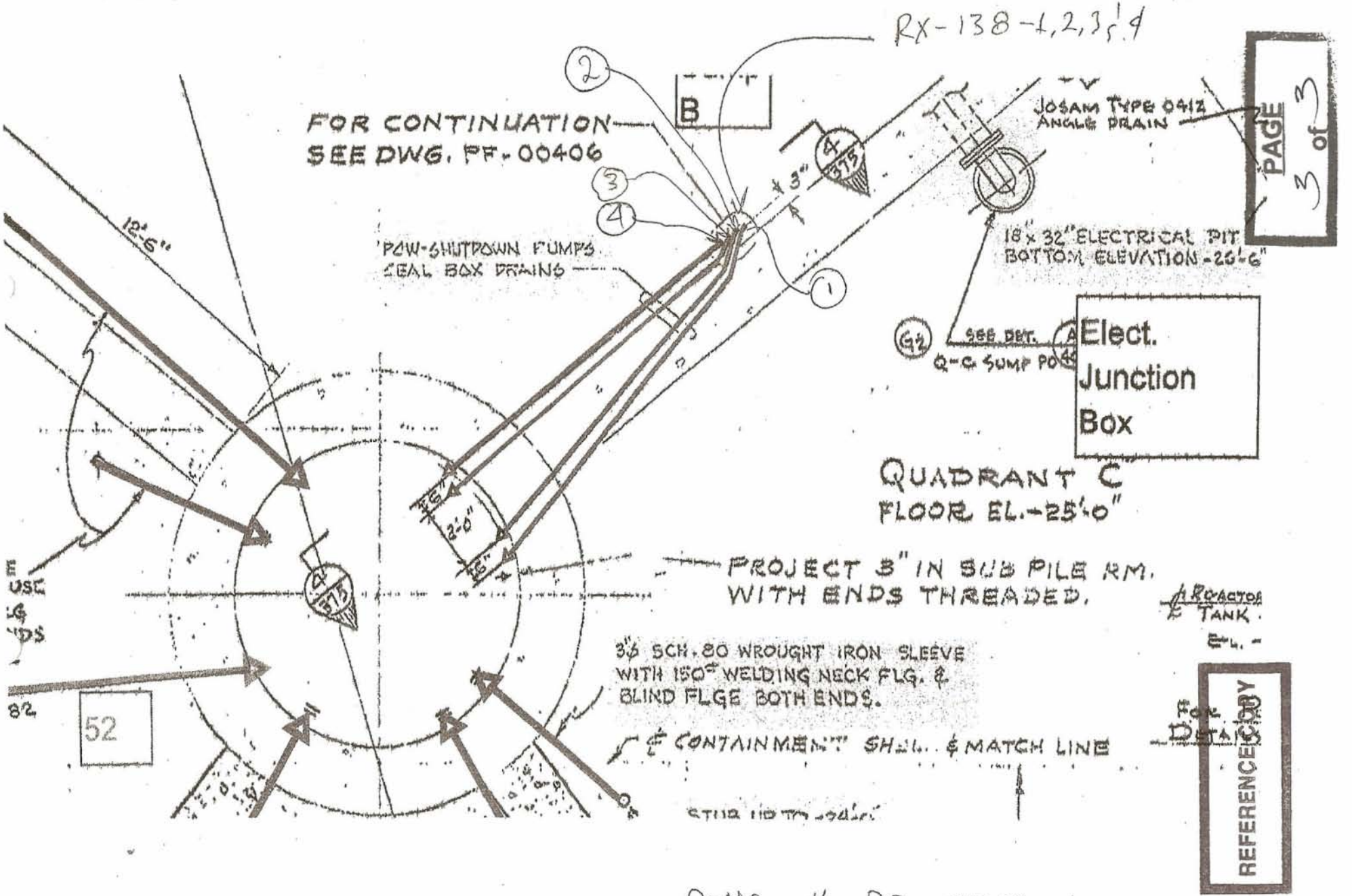
Comments: Det #3. Positions 1-5 from QUAD "D". Positions 9 and 10 from Sub-Pile Rm.

Technician Signature

Pipe Interior Radiological Survey

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm²
1	1	1	88	88	n/a	n/a
2	2	1	74	74		
3	3	1	83	83		
4	4	1	82	82		
5	5	1	114	114		
6	6 to 20 NOT	n/a	n/a	n/a	n/a	n/a
7	ACCESSABLE					
8	/					
9	21	1	12	12		
10	22	1	11	11		

15'-3"
℄ ELEV. -25'-0"
1½"
4-1"ϕ
PCW-SHUTDOWN
PUMP SEAL BOX
DRAINS
℄ EL. -38'-2"
℄ SUB PILE ROOM & REACTOR
SPR VIEW
RX-138-1
-2
-3
-4
DWG # PF-325
PAGE 2 of 3
REFERENCE COPY


RX-138-1,2,3,4
FOR CONTINUATION SEE DWG. PF-00406
B
JOSAM TYPE 0412 ANGLE DRAIN
PAGE 3 of 3
18" x 32" ELECTRICAL PIT BOTTOM ELEVATION -26'-6"
POW-SHUTDOWN PUMPS SEAL BOX DRAINS
12'-6"
SEE DET. A
Q-C SUMP PO
Elect. Junction Box
QUADRANT C
FLOOR EL.-25'-0"
PROJECT 3" IN SUB PILE RM. WITH ENDS THREADED.
3" SCH. 80 WROUGHT IRON SLEEVE WITH 150# WELDING NECK FLG. & BLIND FLGE BOTH ENDS.
CONTAINMENT SHELL & MATCH LINE
REACTOR & TANK EL. -
FOR DETAILS
52
REFERENCE COPY

DWG # PF-375

RADIATION PROTECTION SURVEY FORM

Location: Building 1111, CV, Quad D / Sub-Pile Room

RWP: PB-07-100

Date: 11-26-07

Time: 0910

Survey #: NASA-07/3204

Instrument(s)

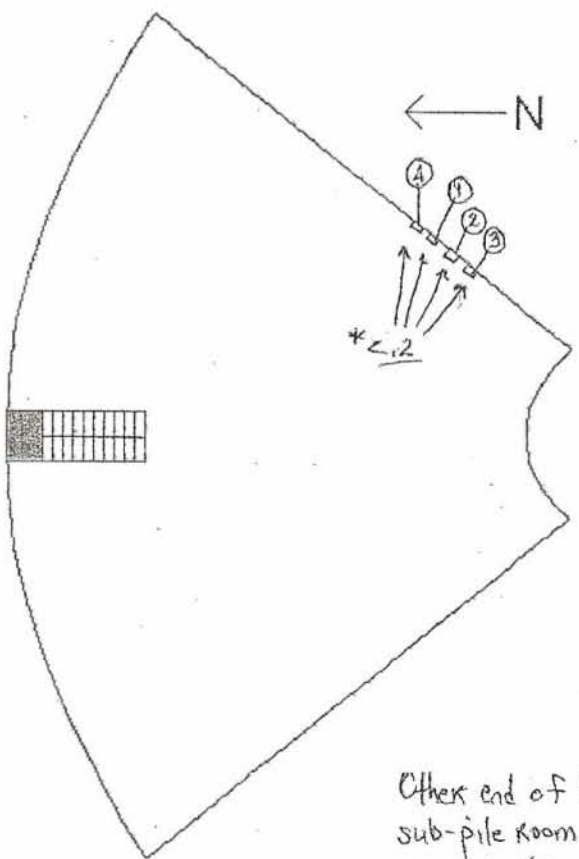
Model	S/N	Cal. Due	Bkgd / cpm	MDA / dpm
M-3	207391	6-29-08	100	N/A
M-9	177089	8-9-08	<.2 MR/HR	N/A
		N/A		

Reason for Survey:
- ☐ Daily
- ☒ Job Coverage
- ☐ Weekly
- ☐ Other: N/A

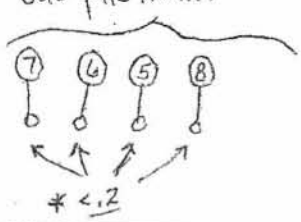
- ☒ Dose rates in mr/hr unless otherwise noted
- ☐ Dose rates in µr/hr unless otherwise noted
- ☐ N/A

Smear # & Location	Contamination (dpm/100cm²) β γ	α
1 end of Pipe	<1K	N/A
2		
3		
4		
5		
6		
7	↓	↓
8	<1K	N/A
9 N/A		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		N/A

Survey of (4) four spare pump seal drain lines.



Other end of lines in sub-pile room.



Legend
- xxxx - Radiological boundary
- x-x-x- Contaminated area
- # - General area dose rate
- *Contact/30cm dose rates
- O - Smear location
- LAS - Large area smear
- # - Direct frisk
- A/S - Air sampler location

Performed by: (print/sign/date)
G. MORW 11-26-07

Reviewed by: (sign/date)
11-27-07

Form RP-005 / 1 Rev. 0

RADIATION PROTECTION SURVEY FORM

Location: Post Clean-out in Sub-Pile Rm. (Rx 138 Lines 1, 2, 3 & 4)

RWP: PB-07-100

Date: 11-27-07

Time: 0845

Survey #: NASA-07-3221

Instrument(s)

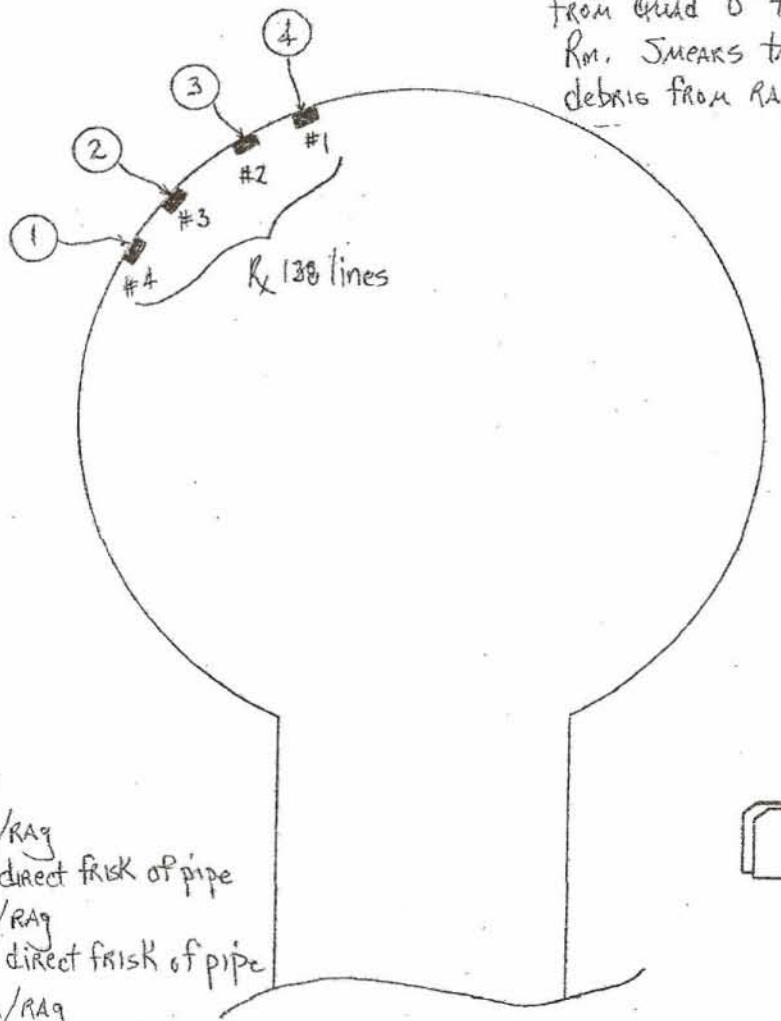
Model	S/N	Cal. Due	Bkgd / cpm	MDA / dpm
M-3	207396	6-29-08	140	N/A
Hand Count	416	4-25-08	α 2.93 β 42.2	α 16.55 β 250
		N/A		

Reason for Survey:
- ☐ Daily
- ☐ Weekly
- ☒ Job Coverage
- ☐ Other: N/A

- ☐ Dose rates in mr/hr unless otherwise noted
- ☐ Dose rates in μr/hr unless otherwise noted
- ☒ N/A

Smear # & Location	Contamination (dpm/100cm²) β γ	α
1 From Rag	<MDA	<MDA
2	↓	↓
3	↓	↓
4	<MDA	<MDA
5		
6		
7		
8		
9		
10		
11		
12		
13		
14	NA	
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

*Rags pulled thru pipes from Quad "D" to Sub-Pile Rm. Smears taken on debris from Rags.



Smear (Rags):

1 = <1K dpm/Rag
<1K dpm direct frisk of pipe

2 = <1K dpm/Rag
<1K dpm direct frisk of pipe

3 = <1K dpm/Rag
<1K dpm direct frisk of pipe

4 = <1K dpm/Rag
3K dpm direct frisk of pipe

*All direct frisks taken on end of pipes.

Legend
- xxxx - Radiological boundary
- xxxx Contaminated area
- # - General area dose rate
- *Contact/30cm dose rates
- O - Smear location
- LAS - Large area smear
- # - Direct frisk
- A/S - Air sampler location

Performed by: (print/sign/date)
G. Morin
11-27-07

Reviewed by: (sign/date)
11-27-07

Form RP-005 / 1 Rev. 0

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___1___ PAGE(S)

DQA Check Sheet				
Design #	EP Rx 138-3	Revision #	Original	
Survey Unit #	EP Rx 138-3			

Preliminary Data Review			
Answers to the following questions should be fully documented in the Survey Unit Release Record	Yes	No	N/A
1. Have surveys been performed in accordance with survey instructions in the Survey Design?	X		
2. Is the instrumentation MDC for structure static measurements below the $DCGL_W$ for Class 1 and 2 survey units, or below 0.5 $DCGL_W$ for Class 3 survey units?			X
3. Is the instrumentation MDC for embedded/buried piping static measurements below the $DCGL_W$?	X		
4. Was the instrumentation MDC for structure scan measurements, soil scan measurements, and embedded/buried piping scan measurements below the $DCGL_W$, or, if not, was the need for additional static measurements or soil samples addressed in the survey design?			X
5. Was the instrumentation MDC for volumetric measurements and smear analysis < 10% $DCGL_W$?			X
6. Were the MDCs and assumptions used to develop them appropriate for the instruments and techniques used to perform the survey?	X		
7. Were the survey methods used to collect data proper for the types of radiation involved and for the media being surveyed?	X		
8. Were "Special Methods" for data collection properly applied for the survey unit under review?	X		
9. Is the data set comprised of qualified measurement results collected in accordance with the survey design, which accurately reflects the radiological status of the facility?	x		
Graphical Data Review			
1. Has a posting plot been created?			X
2. Has a histogram (or other frequency plot) been created?			X
3. Have other graphical data tools been created to assist in analyzing the data?			X
Data Analysis			
1. Are all sample measurements below the $DCGL_W$ (Class 1 & 2), or 0.5 $DCGL_W$ (Class 3)?	X		
2. Is the mean of the sample data < $DCGL_W$?	X		
3. If elevated areas have been identified by scans and/or sampling, is the average activity in each elevated area < $DCGL_{EMC}$ (Class 1), < $DCGL_W$ (Class 2), or <0.5 $DCGL_W$ (Class 3)?			X
4. Is the result of the Elevated Measurements Test < 1.0?			X
5. Is the result of the statistical test (***S+*** for Sign Test or W_r for WRS Test) ≥ the critical value?			X

Comments:

FSS/Characterization Engineer (print/sign)	Dale Randall / Dale Randall	Date	11-28-07
FSS/ Characterization Manager (print/sign)	R. Case	Date	11/29/07

Form CS-09/2 Rev 0

SECTION 7
ATTACHMENT 4
1 DISC