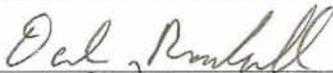
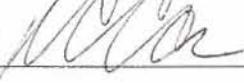


## Survey Unit Release Record

<b>Design #</b>	EP-Rx 138-2	<b>Revision #</b>	Original	<b>Page 1 of 4</b>
<b>Survey Unit #(s)</b>	Rx 138-2			
Description	<p>1) Embedded Pipe (EP) Survey Unit Rx 138-2 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP Rx 138-2 is a Class 1, Group 1 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP Rx 138-2 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.</p> <p>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.</p> <p>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.</p> <p>6) Only the eight 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.</p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			11-28-07	
Technical Reviewer (FSS/Characterization Engineer)			11-28-07	
FSS/Characterization Manager	R. Case 		11/29/07	

## Survey Unit: Rx 138-2

**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 138-2 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° elbows that prevent the travel of radiological detectors past the access points. Consequently, only eight of the approximate 22 feet of total length for this pipe was accessible for survey.

**2.0 Survey Design Information**

- 2.1 EP Rx 138-2 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 8 survey measurements.
- 2.3 Surface area for the 1" ID piping is 243 cm<sup>2</sup> for each foot of piping, corresponding to a total 1" ID piping surface area of 1,946 cm<sup>2</sup> (0.2 m<sup>2</sup>) for the entire accessible length of (8') 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 eight feet of the approximate overall length of 22 feet of this pipe was accessible for final survey.
- 5.3 All measurement results from the eight 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 eight 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

Survey Unit: Rx 138-2

radiological conditions represented by the eight 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<sup>2</sup> 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 138-2 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 138-2 passes FSS.

#### Statistical Summary Table

Statistical Parameter	1" Pipe
Total Number of Survey Measurements	8
Number of Measurements >MDC	8
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0855
Median	0.0794
Standard Deviation	0.0203
Maximum	0.1174
Minimum	0.0587

- 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.

Survey Unit: Rx 138-2

6.1 A review of the survey results has shown that the dose contribution for the accessible portion of EP Rx 138-2 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.086 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 138-2 & Spreadsheet

**SECTION 7**  
**ATTACHMENT 1**  
2 **PAGE(S)**



### BSI EP/BP SURVEY REPORT

Pipe ID	EP Rx 138-2	Survey Location	Quad D Seal Drain 25 el.
Survey Date	27-Nov-07	2350-1 #	203468
Survey Time	13:52	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 <sup>2</sup> )	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			8
Number of Measurements >MDC			8
Number of Measurements Above 50% DCGL			0
Number of Measurements Above DCGL			0
Mean			0.0855
Median			0.0794
Standard Deviation			0.0203
Maximum			0.1174
Minimum			0.0587
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	<i>Dal Marshall</i> 11-28-07		

**EP Rx 138-2**  
**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	20	20	28,169	11,582	459	10,986	2,921	338	81	0.069
2	24	24	33,803	13,898	551	13,184	3,505	406	97	0.083
3	22	22	30,986	12,740	505	12,085	3,213	372	89	0.076
4	34	34	47,887	19,689	780	18,677	4,965	575	137	0.117
5	32	32	45,070	18,531	734	17,578	4,673	541	129	0.111
6	22	22	30,986	12,740	505	12,085	3,213	372	89	0.076
7	27	27	38,028	15,635	620	14,832	3,943	456	109	0.093
8	17	17	23,944	9,844	390	9,339	2,483	287	69	0.059
									MEAN	0.085
									MEDIAN	0.079
									STD DEV	0.020
									MAX	0.117
									MIN	0.059

**SECTION 7**  
**ATTACHMENT 2**  
5 **PAGE(S)**

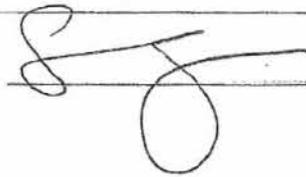
Pipe Interior Radiological Survey Form

Date: 11.27.07 Time: 1352  
 Pipe ID#: RX 138 #2 Pipe Diameter: 1" Access Point Area: QUAD "D"  
 Building: RX Elevation: -25' System: Ap. Seal Drain  
 Type of Survey Investigation        Characterization        Final Survey X Other ✓  
 Gross        Co60 ✓ Cs         
 Detector ID# / Sled ID# PMT FOI.SL-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<sub>static</sub> 12.12 cpm  
 Efficiency Factor for Pipe Diameter 0.00071 (from detector efficiency determination)  
 MDC<sub>static</sub> 66.38 dpm/ 100 cm<sup>2</sup>  
 Is the MDC<sub>static</sub> acceptable? Yes No (if no, adjust sample count time and recalculate MDCR<sub>static</sub>)  
 Comments: DeA #3 Positions 1-5 from Quad "D". Positions 8-10 from Sub-Pipe Rm.

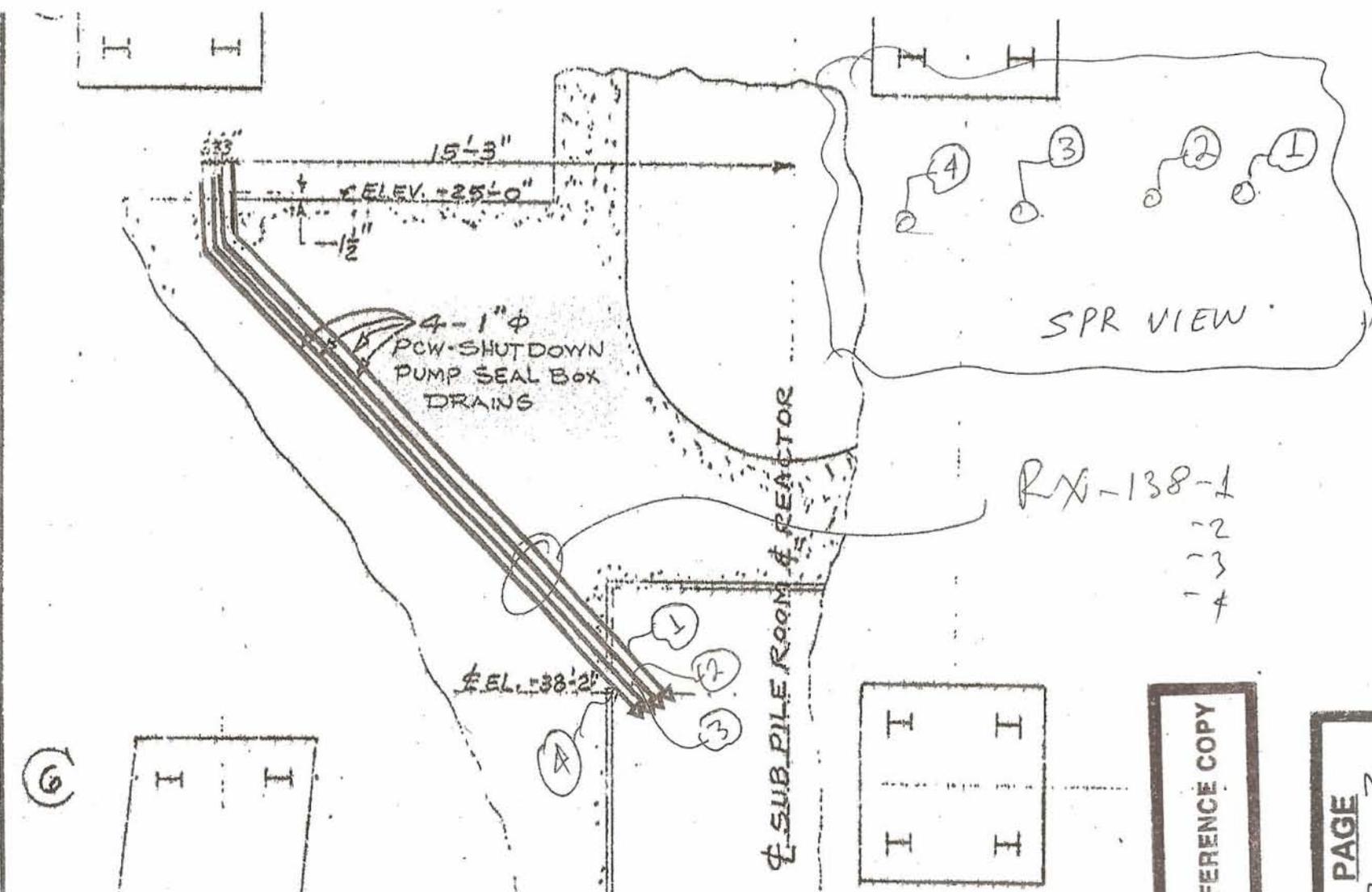
Technician Signature



Pipe Interior Radiological Survey

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	1	20	20	n/a	n/a
2	2	1	24	24	↓	↓
3	3	1	22	22	↓	↓
4	4	1	34	34	↓	↓
5	5	1	32	32	↓	↓
6	6 to 19 NOT ACCESSIBLE	N/a	N/a	N/a	N/a	N/a
7						
8	20	1	22	22	↓	↓
9	21	1	27	27	↓	↓
10	22	1	17	17	↓	↓

**REFERENCE COPY**



RX-138-1  
 -2  
 -3  
 -4

REFERENCE COPY

PAGE  
 2 of 3

DWG # PA-375

RX-138-1,2,3,4

FOR CONTINUATION  
SEE DWG. PF-00406

JOSAM TYPE 0412  
ANGLE DRAIN

P2W-SHUTDOWN PUMPS  
SEAL BOX DRAWING

18" x 32" ELECTRICAL PIT  
BOTTOM ELEVATION -25'-6"

Elect.  
Junction  
Box

QUADRANT C  
FLOOR EL. -25'-0"

PROJECT 3" IN SUB PILE RM.  
WITH ENDS THREADED.

3/8 SCH. 80 WROUGHT IRON SLEEVE  
WITH 150° WELDING NECK FLG. &  
BLIND FLGE BOTH ENDS.

CONTAINMENT SHELL & MATCH LINE

REACTOR  
TANK  
E.L. -

REFERENCE COPY

PAGE

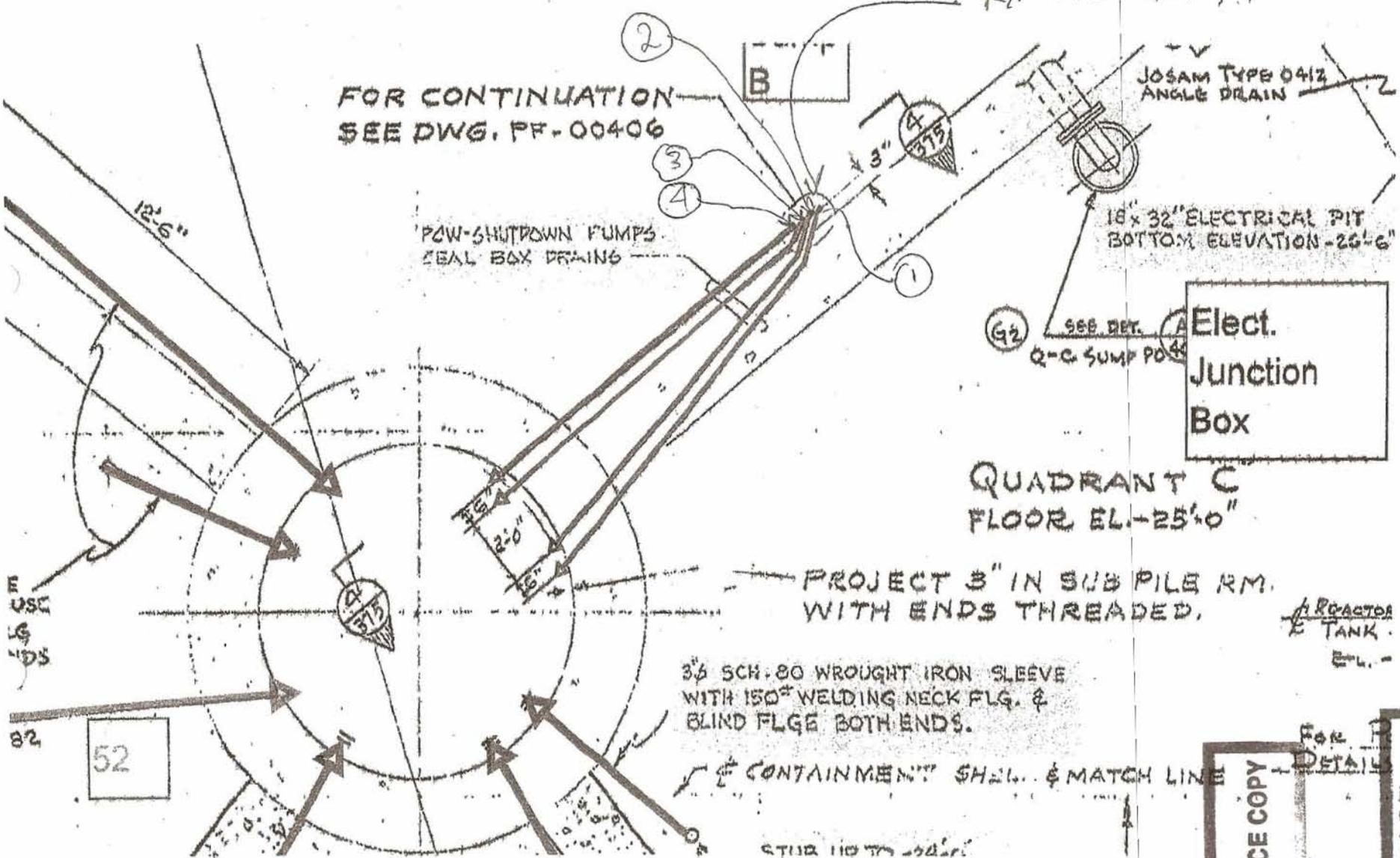
3 of 3

DWG # PF-375

M  
USE  
1/2  
105

82

52



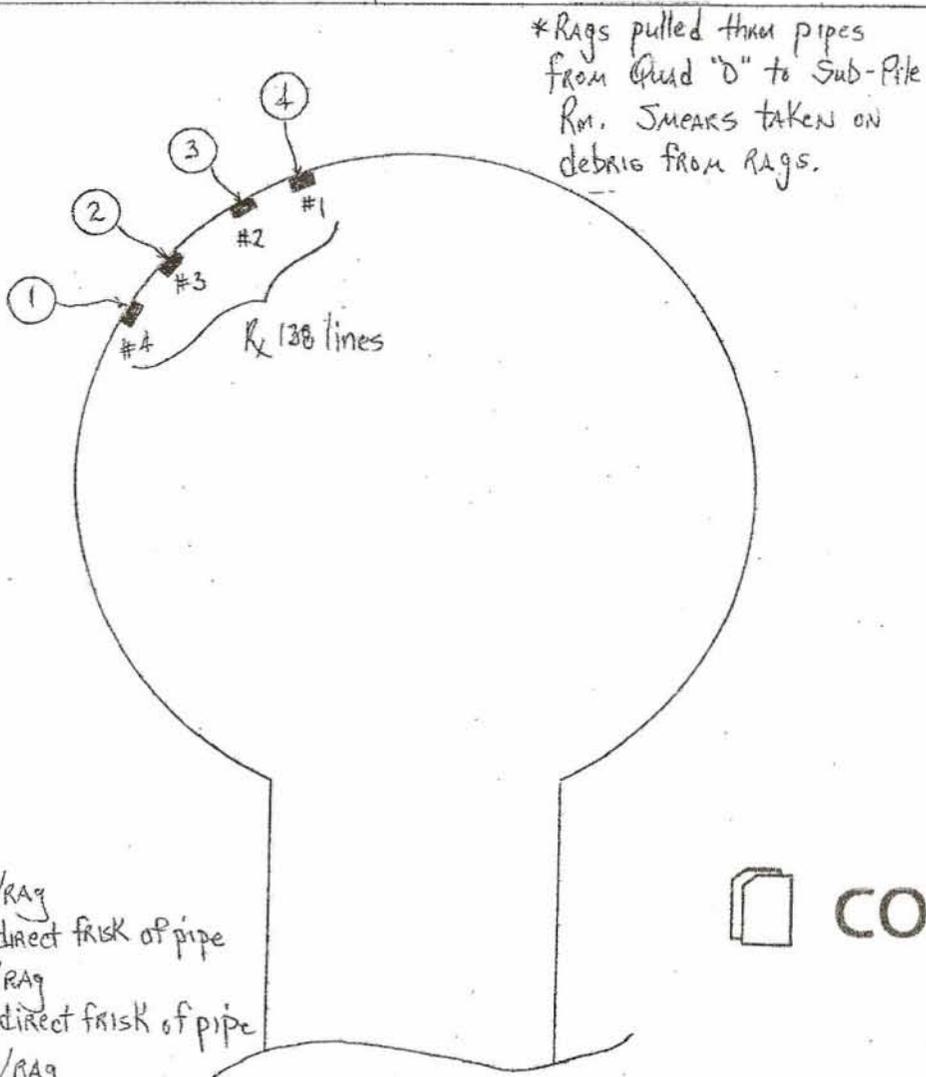
# RADIATION PROTECTION SURVEY FORM

Location: Post Clean-out in Sub-Pile Rm. (Rx 138 LINES 1, 2, 3 & 4)					RWP: PB-07-100
Instrument(s)					Date: 11-27-07
Model	S/N	Cal. Due	Bkgd / cpm	MDA / dpm	Time: 0845
M-3	207396	6-29-08	140	N/A	Survey #: NASA-07-3221
HANDE COURT	416	4-25-08	2.93 B 42.2	16.55 B 250	Smear # & Location
N/A					Contamination (dpm/100cm <sup>2</sup> )
					β γ α

Reason for Survey:

<input type="checkbox"/> Daily	<input checked="" type="checkbox"/> Job Coverage	<input type="checkbox"/> Dose rates in mR/hr unless otherwise noted
<input type="checkbox"/> Weekly	<input type="checkbox"/> Other: N/A	<input type="checkbox"/> Dose rates in μR/hr unless otherwise noted
		<input checked="" type="checkbox"/> N/A

1	FROM RAG	<MDA	<MDA
2	↓	↓	↓
3	↓	↓	↓
4	↓	<MDA	<MDA
5			
6			
7			
8			
9			
10			
11			
12			
13			
14		N/A	
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			



- 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.

COPY

**Legend**

xxxx - Radiological boundary  
 xxx - 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  
 B. Morin

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

# RADIATION PROTECTION SURVEY FORM

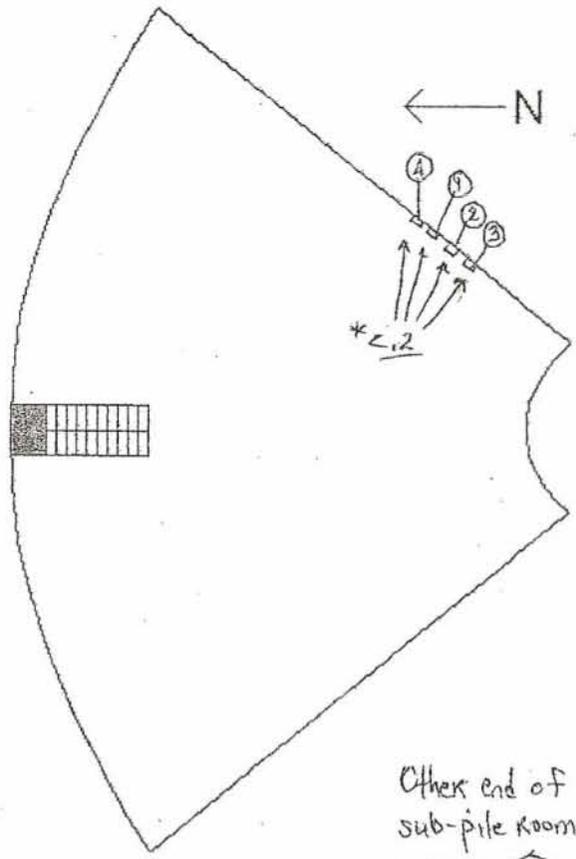
Location: Building 1111, CV, Quad D / <u>Sub-Pile Room</u>					RWP: PB-07-100
Instrument(s)					Date: <u>11-26-07</u>
Model	S/N	Cal. Due	Bkgd / cpm	MDA / dpm	Time: <u>0910</u>
M-3	<u>207391</u>	<u>6-29-08</u>	<u>100</u>	<u>N/A</u>	Survey #: <u>NASA-07/3204</u>
M-9	<u>177089</u>	<u>8-9-08</u>	<u>&lt;.2 MR/HR</u>	<u>N/A</u>	Smear # & Location
<u>N/A</u>					Contamination (dpm/100cm <sup>2</sup> )
					β
					γ
					α

Reason for Survey:

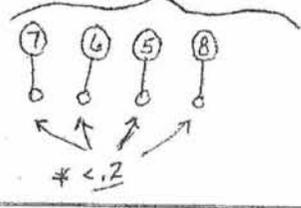
Daily       Job Coverage       Dose rates in mR/hr unless otherwise noted  
 Weekly       Other: N/A       Dose rates in μR/hr unless otherwise noted  
 N/A

1	<u>end of pipe</u>	<u>&lt;1K</u>	<u>N/A</u>
2			
3			
4			
5			
6			
7			
8		<u>&lt;1K</u>	<u>N/A</u>
9	<u>N/A</u>		
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			<u>N/A</u>

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



Other end of lines in sub-pile room.



COPY

**Legend**  
 xxx - 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  
[Signature] 11-26-07

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

**SECTION 7**  
**ATTACHMENT 3**  
  1   **PAGE(S)**

**DQA Check Sheet**

Design #	EP Rx 138-2	Revision #	Original
Survey Unit #	EP Rx 138-2		

**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 <sub>W</sub> for Class 1 and 2 survey units, or below 0.5 DCGL <sub>W</sub> for Class 3 survey units?			X
3. Is the instrumentation MDC for embedded/buried piping static measurements below the DCGL <sub>W</sub> ?	X		
4. Was the instrumentation MDC for structure scan measurements, soil scan measurements, and embedded/buried piping scan measurements below the DCGL <sub>W</sub> , 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 <sub>W</sub> ?			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 <sub>W</sub> (Class 1 & 2), or 0.5 DCGL <sub>W</sub> (Class 3)?	X		
2. Is the mean of the sample data < DCGL <sub>W</sub> ?	X		
3. If elevated areas have been identified by scans and/or sampling, is the average activity in each elevated area < DCGL <sub>EMC</sub> (Class 1), < DCGL <sub>W</sub> (Class 2), or <0.5 DCGL <sub>W</sub> (Class 3)?			X
4. Is the result of the Elevated Measurements Test < 1.0?			X
5. Is the result of the statistical test ( <b>S+</b> for Sign Test or <b>W<sub>r</sub></b> for WRS Test) ≥ the critical value?			X

Comments:

FSS/Characterization Engineer (print/sign)	<i>Dale Randall / Orl Randall</i>	Date	11-28-07
FSS/ Characterization Manager (print/sign)	R. Case <i>[Signature]</i>	Date	11/29/07

Form  
CS-09/2  
Rev 0

**SECTION 7  
ATTACHMENT 4  
1 DISC**