

National Aeronautics and  
Space Administration

John H. Glenn Research Center  
Lewis Field  
Plum Brook Station  
Sandusky, OH 44870



September 11, 2007

Reply to Attn of: QD

U.S. NRC Region III  
Mr. William G. Snell, RIII/DNMS/DB  
2443 Warrenville Road  
Suite 210  
Lisle, IL 60532-4352

Subject: Submittal of Embedded Pipe Survey Unit Release Records, Plum Brook Reactor Facility,  
License No. TR-3, Docket No. 50-30, and License No. R-93, Docket No,  
50-185

Dear Mr. Snell:

Enclosed for your review and assessment are copies of the following completed embedded pipe  
survey unit release records:

Survey Unit Release Record EP-1.43A-6	Survey Unit Release Record EP-1.43A-4
Survey Unit Release Record EP-Rx 205	Survey Unit Release Record EP-1.32
Survey Unit Release Record EP-Rx126	Survey Unit Release Record EP-1.23
Survey Unit Release Record EP-1.395	Survey Unit Release Record EP-1.12A-3
Survey Unit Release Record EP-1.21	Survey Unit Release Record EP-1.34
Survey Unit Release Record EP-1.83	Survey Unit Release Record EP-1.84
Survey Unit Release Record EP-1.52	Survey Unit Release Record EP-1.22
Survey Unit Release Record EP-1.45A	Survey Unit Release Record EP-1.43-2.5" INST
Survey Unit Release Record EP-1.45	Survey Unit Release Record EP-1.39
Survey Unit Release Record EP-1.43-2" INST	Survey Unit Release Record EP-1.42-2.5" INST
Survey Unit Release Record EP-1.92	Survey Unit Release Record EP-1.72
Survey Unit Release Record EP-1.41-2" INST	Survey Unit Release Record EP-1.42A-6
Survey Unit Release Record EP-1.12 2.5	Survey Unit Release Record EP-Rx113
Survey Unit Release Record EP-1.35	Survey Unit Release Record EP-1.41 2.5" INST

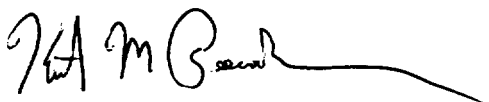
As discussed during your on site inspection on June 25 through June 27, 2007, we will periodically submit the completed survey unit release records for your inspection. Further, as discussed at the exit meeting, it is our intention to begin grouting of the embedded piping that has been shown by the Final Status Survey to meet the dose criteria of Subpart E, Section 20.1402, 10 CFR Part 20.

RECEIVED SEP 13 2007




If you have no issues with the records under this submittal, we will begin the grouting process on August 20, 2007.

Should you have any questions or need additional information, please contact Mr. William Stoner of my staff, NASA Plum Brook Station, 6100 Columbus Avenue, Sandusky, OH 44870, at (419) 621- 3349, or Mr. John Thomas of my staff, NASA Plum Brook Station, 6100 Columbus Avenue, Sandusky, OH 44870, at (419) 621- 3357.

Sincerely,

A handwritten signature in black ink, appearing to read 'Keith M. Peacock', followed by a long horizontal flourish line.

Keith M. Peacock  
Decommissioning Program Manager

Survey Unit Release Record			
<b>Design #</b>	EP-1.43A-6	<b>Revision #</b>	Original
		Page 1 of 3	
<b>Survey Unit #(s)</b>	1.43A-6		
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.43A-6 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.43A-6 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 1.43A-6 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>		
<b>Approval Signatures</b>		<b>Date:</b>	
FSS/Characterization Engineer		8-17-07	
Technical Reviewer (FSS/Characterization Engineer)		8-22-07 <del>8-22-06</del>	
FSS/Characterization Manager	 R. Case	8/29/07	

Survey Unit: 1.43A-6

**1.0 History/Description**

- 1.1 The subject pipe system is a 6" diameter system line.
- 1.2 EP 1.43A-6 is approximately 16 feet in length, located in the Reactor Building on the 27' elevation.

**2.0 Survey Design Information**

- 2.1 EP 1.43A-6 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 6" ID pipe was accessible for survey. The accessible 6" ID pipe was surveyed by static measurement at one foot increments, for a total of 16 survey measurements.
- 2.3 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 23,349 cm<sup>2</sup> (2.3 m<sup>2</sup>) for the entire length of (16') of 6" 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 All measurement results 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.
- 5.3 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 1.43A-6 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.



### 5.5 Statistical Summary Table

Statistical Parameter	6" Pipe
Total Number of Survey Measurements	16
Number of Measurements >MDC	16
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0619
Median	0.0582
Standard Deviation	0.0228
Maximum	0.1104
Minimum	0.0225

**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 EP 1.43A-6 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.062 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.43A-6 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.43A-6	Survey Location	-27' Trench
Survey Date	03-Jul-07	2350-1 #	189094
Survey Time	09:32	Detector-Sled #	1MG1 LVS-1/101
Pipe Size	6"	Detector Efficiency	0.0002
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	1,459
Pipe Area Incorporated by Survey Data (in m <sup>2</sup> )	2.3	Field BKG (cpm)	3.2
Routine Survey	X	Field MDCR (cpm)	9.2
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	3,143
Survey Measurement Results			
Total Number of Survey Measurements		16	
Number of Measurements >MDC		16	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0619	
Median		0.0582	
Standard Deviation		0.0228	
Maximum		0.1104	
Minimum		0.0225	
Survey Technician(s)	STOCK		
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	Del Marshall 8-17-07		

**EP 1.43A-6**  
**6" 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	16	16	80,000	5,482	217	5,200	1,382	160	38	0.033
2	11	11	55,000	3,769	149	3,575	950	110	26	0.022
3	22	22	110,000	7,538	299	7,150	1,901	220	53	0.045
4	25	25	125,000	8,566	339	8,125	2,160	250	60	0.051
5	24	24	120,000	8,223	326	7,800	2,074	240	57	0.049
6	29	29	145,000	9,936	394	9,425	2,506	290	69	0.059
7	27	27	135,000	9,251	367	8,775	2,333	270	64	0.055
8	42	42	210,000	14,390	570	13,651	3,629	420	100	0.086
9	34	34	170,000	11,649	462	11,051	2,938	340	81	0.069
10	40	40	200,000	13,705	543	13,001	3,456	400	96	0.082
11	38	38	190,000	13,020	516	12,351	3,283	380	91	0.078
12	35	35	175,000	11,992	475	11,376	3,024	350	84	0.072
13	54	54	270,000	18,502	733	17,551	4,666	540	129	0.110
14	19	19	95,000	6,510	258	6,175	1,642	190	45	0.039
15	28	28	140,000	9,594	380	9,100	2,419	280	67	0.057
16	41	41	205,000	14,048	557	13,326	3,543	410	98	0.084
									MEAN	0.062
									MEDIAN	0.058
									STD DEV	0.023
									MAX	0.110
									MIN	0.022

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

Pipe Interior Radiological Survey Form

Date: 2/3/07 Time: 0932  
 Pipe ID#: 143A Pipe Diameter: 6" Access Point Area: TRENCH  
 Building: R Elevation: -27' System: \_\_\_\_\_  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 1MGI LVS-1 / 101  
 Detector Cal Date: 1/11/07 Detector Cal Due Date: 1/11/08  
 Instrument: 2350-1 Instrument ID #: 189099  
 Instrument Cal Date: 1/11/07 Instrument Cal Due Date: 1/11/08

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

Background Value 3.2 cpm

MDCR<sub>static</sub> 9.2 cpm

Efficiency Factor for Pipe Diameter 0.0002 (from detector efficiency determination)

MDC<sub>static</sub> 3143 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: INITIAL EP3-9 COMPLETE

Technician Signature [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	48	7	16	16	n/a	n/a
2	49		11	11		
3	50		22	22		
4	51		25	25		
5	52		24	24		
6	53		29	29		
7	54		27	27		
8	55		42	42		
9	56		34	34		
10	57	✓	40	40	✓	✓

Package Page 1 of 2

REFERENCE COPY

## Pipe Interior Radiological Survey Form (Continuation Form)

Date: 7/3/07  
 Pipe ID#: 143A  
 Building: R

Pipe Diameter: 6"  
 Elevation: -27'

Access Point Area: TRENCH  
 System: \_\_\_\_\_

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	58	↓	38	38	n/a	n/a
12	59	↓	35	35	↓	↓
13	60	↓	54	54	↓	↓
14	61	↓	19	19	↓	↓
15	62	↓	28	28	↓	↓
16	63	↓	41	41	↓	↓
N/A						

**REFERENCE COPY**

Package Page 2 of 2

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




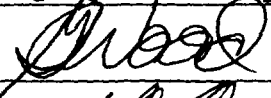

### DQA Check Sheet

Design #	EP 1.43A-6	Revision #	Original					
Survey Unit #	EP 1.43A-6							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)						<i>Dale Rappaport</i> <i>R. Case</i>		
FSS/ Characterization Manager (print/sign)						Date	8-17-07	
						Date	8/29/07	

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

**COPY**

Survey Unit Release Record				
<b>Design #</b>	EP-1.43A-4	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.43A-4			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.43A-4 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.43A-4 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 1.43A-4 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>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			8-17-07	
Technical Reviewer (FSS/Characterization Engineer)			8-27-07	
FSS/Characterization Manager	 R. Case		8/29/07	

Form  
CS-09/1  
Rev 0

## Survey Unit: 1.43A-4

**1.0 History/Description**

- 1.1 The subject pipe system is a 4" diameter system line.
- 1.2 EP 1.43A-4 is approximately 48 feet in length, located in the Reactor Building on the 27' elevation.

**2.0 Survey Design Information**

- 2.1 EP 1.43A-4 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 4" ID pipe was accessible for survey. The accessible 4" ID pipe was surveyed by static measurement at one foot increments, for a total of 48 survey measurements.
- 2.3 Surface area for the 4" ID piping is 973 cm<sup>2</sup> for each foot of piping, corresponding to a total 4" ID piping surface area of 46,698 cm<sup>2</sup> (4.7 m<sup>2</sup>) for the entire length of (48') of 4" 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 All measurement results 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.
- 5.3 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 1.43A-4 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	4" Pipe
Total Number of Survey Measurements	48
Number of Measurements >MDC	48
Number of Measurements Above 50% of DCGL	1
Number of Measurements Above DCGL	0
Mean	0.1416
Median	0.1161
Standard Deviation	0.0894
Maximum	0.5341
Minimum	0.0507

**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 EP 1.43A-4 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.142 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.43A-4 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.43A-4	Survey Location	-27' Trench
Survey Date	28-Feb-06	2350-1 #	203488
Survey Time	10:25	Detector-Sled #	1MG1 LVS-1/101
Pipe Size	4"	Detector Efficiency	0.00052
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	973
Pipe Area Incorporated by Survey Data (in <sup>2</sup> )	4.7	Field BKG (cpm)	18.9
Routine Survey	X	Field MDCR (cpm)	17.9
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	1,557
Survey Measurement Results			
Total Number of Survey Measurements		48	
Number of Measurements >MDC		48	
Number of Measurements Above 50% DCGL		1	
Number of Measurements Above DCGL		0	
Mean		0.1416	
Median		0.1161	
Standard Deviation		0.0894	
Maximum		0.5341	
Minimum		0.0507	
Survey Technician(s)		ROSENHAGEN	
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		Ocl Penhall 8-17-07	

**EP 1.43A-4**  
**4" 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	78	78	150,000	15,418	611	14,626	3,888	450	107	0.092
2	52	52	100,000	10,279	407	9,751	2,592	300	72	0.061
3	84	84	161,538	16,604	658	15,751	4,187	485	116	0.099
4	82	82	157,692	16,209	642	15,376	4,088	473	113	0.097
5	64	64	123,077	12,651	501	12,001	3,190	369	88	0.075
6	96	96	184,615	18,976	752	18,001	4,785	554	132	0.113
7	116	116	223,077	22,930	909	21,751	5,782	669	160	0.137
8	93	93	178,846	18,383	729	17,438	4,636	536	128	0.110
9	113	113	217,308	22,337	885	21,189	5,633	652	156	0.133
10	148	148	284,615	29,255	1,159	27,751	7,377	854	204	0.174
11	151	151	290,385	29,848	1,183	28,314	7,527	871	208	0.178
12	223	223	428,846	44,080	1,747	41,815	11,116	1,286	307	0.263
13	163	163	313,462	32,220	1,277	30,564	8,125	940	225	0.192
14	102	102	196,154	20,162	799	19,126	5,084	588	141	0.120
15	190	190	365,385	37,557	1,489	35,627	9,471	1,096	262	0.224
16	351	351	675,000	69,382	2,750	65,816	17,497	2,025	483	0.414
17	185	185	355,769	36,569	1,449	34,689	9,222	1,067	255	0.218
18	157	157	301,923	31,034	1,230	29,439	7,826	906	216	0.185
19	279	279	536,538	55,150	2,186	52,315	13,907	1,609	384	0.329
20	453	453	871,154	89,544	3,549	84,942	22,581	2,613	624	0.534
21	163	163	313,462	32,220	1,277	30,564	8,125	940	225	0.192
22	111	111	213,462	21,941	870	20,814	5,533	640	153	0.131
23	97	97	186,538	19,174	760	18,188	4,835	560	134	0.114
24	126	126	242,308	24,906	987	23,626	6,281	727	174	0.149
25	90	90	173,077	17,790	705	16,876	4,486	519	124	0.106
26	117	117	225,000	23,127	917	21,939	5,832	675	161	0.138
27	92	92	176,923	18,186	721	17,251	4,586	531	127	0.108
28	78	78	150,000	15,418	611	14,626	3,888	450	107	0.092
29	76	76	146,154	15,023	595	14,251	3,788	438	105	0.090
30	53	53	101,923	10,476	415	9,938	2,642	306	73	0.062
31	53	53	101,923	10,476	415	9,938	2,642	306	73	0.062
32	54	54	103,846	10,674	423	10,126	2,692	311	74	0.064



**EP 1.43A-4**  
**4" 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)	Unlity
33	43	43	82,692	8,500	337	8,063	2,143	248	59	0.051
34	74	74	142,308	14,627	580	13,876	3,689	427	102	0.087
35	101	101	194,231	19,965	791	18,938	5,035	583	139	0.119
36	67	67	128,846	13,244	525	12,563	3,340	386	92	0.079
37	75	75	144,231	14,825	588	14,063	3,739	433	103	0.088
38	83	83	159,615	16,407	650	15,563	4,137	479	114	0.098
39	84	84	161,538	16,604	658	15,751	4,187	485	116	0.099
40	88	88	169,231	17,395	689	16,501	4,387	508	121	0.104
41	100	100	192,308	19,767	783	18,751	4,985	577	138	0.118
42	89	89	171,154	17,593	697	16,688	4,436	513	123	0.105
43	106	106	203,846	20,953	830	19,876	5,284	611	146	0.125
44	118	118	226,923	23,325	924	22,126	5,882	681	163	0.139
45	119	119	228,846	23,523	932	22,314	5,932	686	164	0.140
46	141	141	271,154	27,871	1,105	26,439	7,029	813	194	0.166
47	83	83	159,615	16,407	650	15,563	4,137	479	114	0.098
48	102	102	196,154	20,162	799	19,126	5,084	588	141	0.120
									MEAN	0.142
									MEDIAN	0.116
									STD DEV	0.089
									MAX	0.534
									MIN	0.051

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

Pipe Interior Radiological Survey Form

Date: 2-28-06 Time: 7025 Access Point Area: -25 QUAD C  
 Pipe ID#: 1.43A Pipe Diameter: 4" Building: RX Elevation: -25 System: 15ft up vessel with Ring Header  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# Bicron IM61 / LV5-11 101  
 Detector Cal Date: 20-Dec-05 Detector Cal Due Date: 20-Dec-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Instrument Cal Date: 17-Nov-05 Instrument Cal Due Date: 17-Nov-06

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

Background Value 18.9 cpm

MDCR<sub>static</sub> 17.9 cpm

Efficiency Factor for Pipe Diameter 0.00052 (from detector efficiency determination)

MDC<sub>static</sub> 1.557 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: INITIAL SURVEY

Technician Signature

*[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	78	78	N/A	N/A
2	2	↓	52	52	↓	↓
3	3		84	84		
4	4		82	82		
5	5		64	64		
6	6		96	96		
7	7		116	116		
8	8		93	93		
9	9		113	113		
10	10		148	148		

Package Page 1 of 1

REFERENCE COPY

Pipe Interior Radiological Survey Form (Continuation Form)

Date: 2-28-06  
Pipe ID#: 1-43 Pipe Diameter: 4" Access Point Area: -25 QUAD  
Building: RX Elevation: -25 System: 15 ft HP VESSEL WALL  
RING HEADER

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	151	151	N/A	N/A
12	12		223	223		
13	13		163	163		
14	14		102	102		
15	15		190	190		
16	16		351	351		
17	17		185	185		
18	18		157	157		
19	19		279	279		
20	20		453	453		
21	21		163	163		
22	22		111	111		
23	23		97	97		
24	24		126	126		
25	25		90	90		
26	26		117	117		
27	27		92	92		
28	28		78	78		
29	29		76	76		
30	30		53	53		
31	31		53	53		
32	32		54	54		
33	33		43	43		
34	34		74	74		
35	35		101	101		
36	36		67	67		
37	37		75	75		
38	38		83	83		
39	39		84	84		
40	40		88	88		
41	41		100	100		
42	42		89	89		
43	43		106	106		
44	44		118	118		
45	45		119	119		

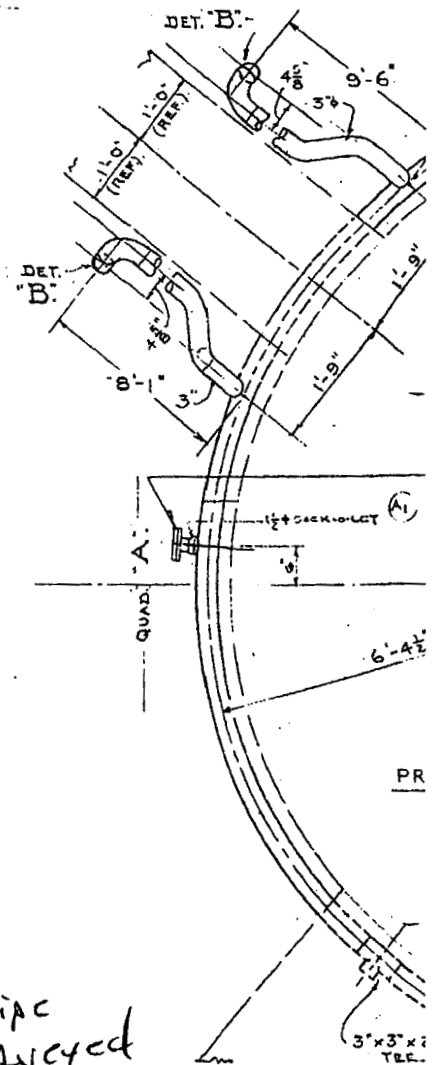
Package Page 2 of 4

REFERENCE COPY

System: RING HEAD AL

Package Page 3 of 4

**REFERENCE COPY**



**REFERENCE COPY**

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

### DQA Check Sheet

Design #	EP 1.43A-4	Revision #	Original	
Survey Unit #	EP 1.43A-4			

#### 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		

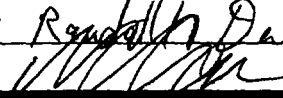
#### Graphical Data Review

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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?			X

Comments:

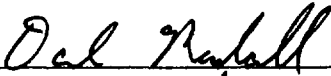
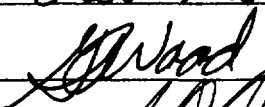
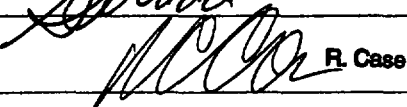
FSS/Characterization Engineer (print/sign)	<i>Dale Reynolds</i> <i>Dale Reynolds</i>	Date	8-17-07
FSS/ Characterization Manager (print/sign)	 R. Case	Date	8/29/07

Form  
CS-09/2  
Rev 0



**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-Rx 205	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	EP-Rx 205			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit EP Rx-205 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 205 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 205 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: center; font-size: 2em; font-weight: bold;">COPY</p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-21-07	
Technical Reviewer (FSS/Characterization Engineer)			6-29-07	
FSS/Characterization Manager	 R. Case		8/27/07	

Form  
CS-09/1  
Rev 0

Survey Unit: EP-Rx 205

**1.0 History/Description**

- 1.1 The subject piping described in this report is an instrumentation line for equipment and accessories utilized in Quad B. This survey unit involves ~ 6' of instrument piping.

**2.0 Survey Design Information**

- 2.1 EP Rx 205 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2.5" ID pipe was accessible for survey. The accessible 2.5" ID pipe was surveyed by static measurement at one foot increments, for a total 6 of survey measurements.
- 2.3 Surface area for the 2.5" ID piping is 608 cm<sup>2</sup> for each foot of piping, corresponding to a total 2.5" ID piping surface area of 3,648 cm<sup>2</sup> (0.36 m<sup>2</sup>) for the entire length of (6') of 2.5" 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 All measurement results 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.
- 5.3 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 205 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	2.5" Pipe
Total Number of Survey Measurements	6
Number of Measurements >MDC	6
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.108
Median	0.102
Standard Deviation	0.027
Maximum	0.157
Minimum	0.081

**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 EP Rx 205 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.108 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP Rx 205 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	Rx 205	Survey Location	-25 el. Quad B
Survey Date	02-Mar-06	2350-1 #	203488
Survey Time	1310	Detector-Sled #	44-62/212701-121
Pipe Size	2.5"	Detector Efficiency	0.00015
DCGL (dpm/100cm <sup>2</sup> )	240800	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	608
Pipe Area Incorporated by Survey Data (cm <sup>2</sup> )	0.36	Field BKG (cpm)	4.7
Routine Survey	X	Field MDCR (cpm)	10.4
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	4,099
Survey Measurement Results			
Total Number of Survey Measurements		6	
Number of Measurements >MDC		6	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.108	
Median		0.102	
Standard Deviation		0.027	
Maximum		0.157	
Minimum		0.081	
Survey Technician(s)	Rosenhagen		
Survey Unit Classification		1	
TBD 06-004 Piping Group		2	
SR-13 Radionuclide Distribution Sample		EP 2-1	
Measured Nuclide		Co60	
Area Factor/EMC Used		No	
Pass/Fail FSS		Pass	
MREM/YR Contribution		<1	
COMMENTS: ACTIVITY VALUES NOT BACKGROUND CORRECTED			
RP Engineer   Date		Dal Rouball 6-21-07	

**EP Rx 205**  
**2.5" Pipe**  
**TBD 06-004 Group 2**

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	17	17	113,333	18,640	9,674	155	110	9	541	0.081
2	24	24	160,000	26,316	13,658	218	155	13	763	0.114
3	22	22	146,667	24,123	12,520	200	142	12	700	0.105
4	19	19	126,667	20,833	10,813	173	123	10	604	0.090
5	33	33	220,000	36,184	18,780	300	213	18	1,049	0.157
6	21	21	140,000	23,026	11,951	191	136	11	668	0.100
									MEAN	0.108
									MEDIAN	0.102
									STD DEV	0.027
									MAX	0.157
									MIN	0.081

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



Pipe Interior Radiological Survey Form

Date: 3.2.06 Time: 1310 Q440 Access R  
 Pipe ID#: RX 205 Pipe Diameter: 2.5" Access Point Area: STAINLESS BOX  
 Building: RX Elevation: -25 Q440 B System: INSTRUMENT LINE  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-62 212701 / 121  
 Detector Cal Date: 17-Nov-05 Detector Cal Due Date: 17-Nov-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Instrument Cal Date: 17-Nov-05 Instrument Cal Due Date: 17-Nov-06

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

Background Value 4.7 cpm

MDCR<sub>static</sub> 10.4 cpm

Efficiency Factor for Pipe Diameter 0.00015 (from detector efficiency determination)

MDC<sub>static</sub> 4099 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: INITIAL SURVEY NOTE: POSITIONS #1 THRU 3 ARE IN BOX  
SACRIFYING DOWN TO HORIZONTAL PIPE NOTE: POSITIONS #4 THRU 6 ARE  
IN WITH RUNNING HORIZONTAL COMPLETE

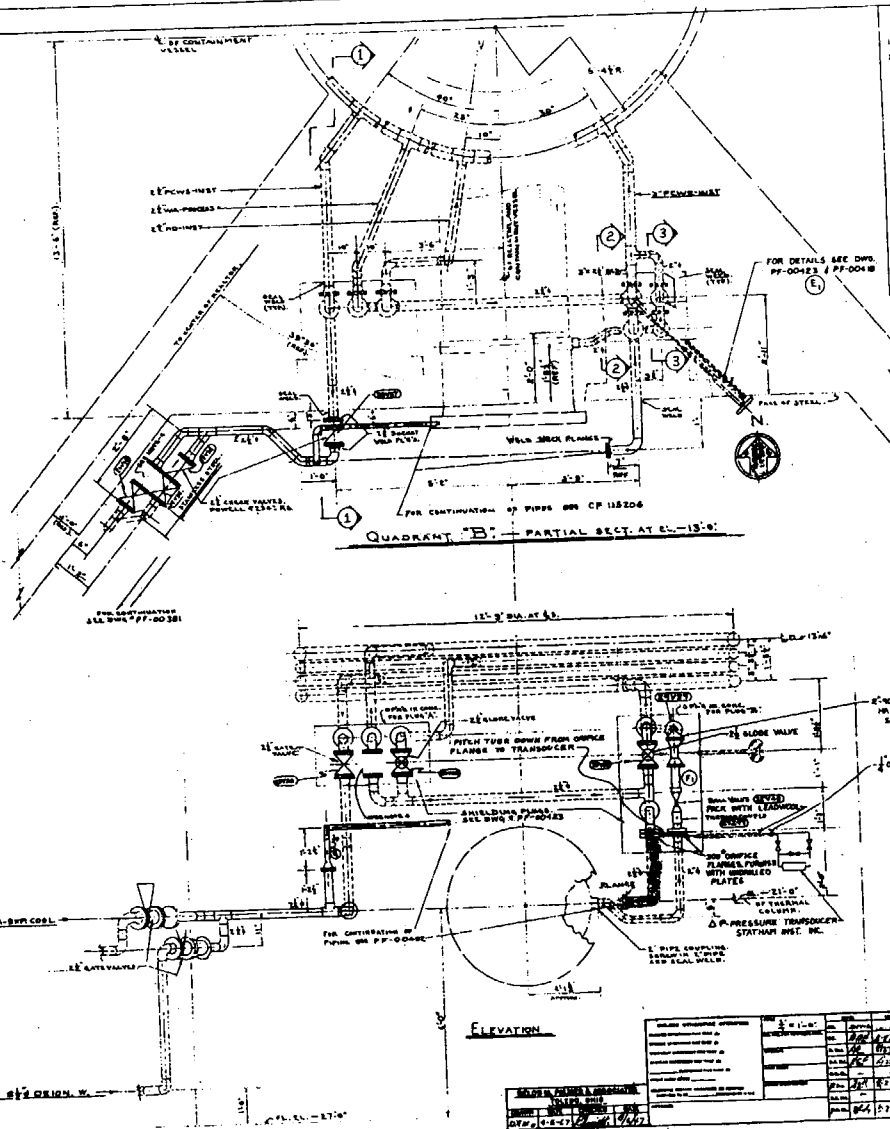
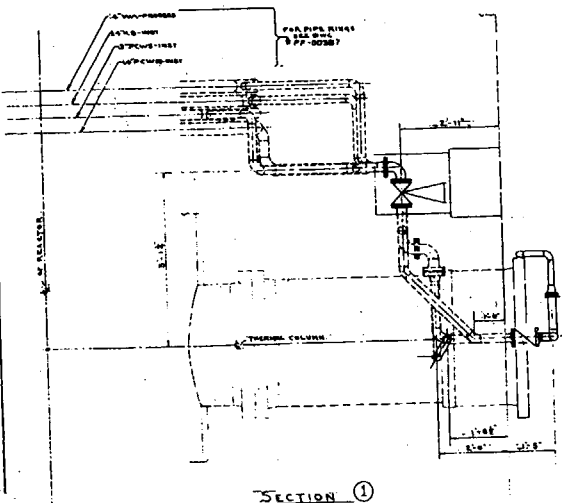
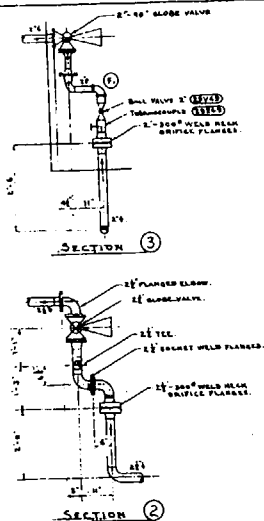
Technician Signature Jim Donly

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	2	34	17	n/a	n/a
2	2	2	48	24		
3	3	2	44	22		
4	1	2	38	19		
5	2	2	66	33		
6	3	2	42	21		
7						
8						
9						
10						

Package Page 1 of 2

REFERENCE COPY



# GENERAL NOTES

1. FOR SCHEDULE OF WORKS SEE "PF-00100"
2. STEEL WELD ALL PIPES WHERE THEY MEET STEEL STRUCTURES.
3. ALL PIPING SHALL BE SCHEDULE 40 STAINLESS STEEL. SEE SPEC AND VALVE SCHEDULES.
4. LINES BREAKED BY 2" JUMP FLANGES, SEALING BOTH LINE SECTIONS.

REFERENCE COPY

F	REMOVED EXISTING FLOW ON	
E	REMOVED EXISTING FLOW ON	
D	WAS 2" DIA. PIPE	
C	REMOVED EXISTING FLOW ON	
B	REMOVED EXISTING FLOW ON	
A	REMOVED EXISTING FLOW ON	

NASA PLUMBROOK REACTOR FAC. 1112  
REACTOR BUILDING  
PIPING - THERMAL COLUMN  
QUADRANT "B".  
PF.00392

Rx 205

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


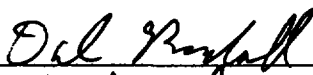
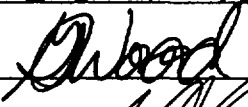
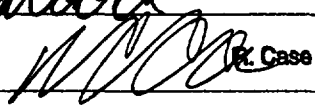
### DQA Check Sheet

Design #	EP Rx205	Revision #	Original						
Survey Unit #	EP Rx 205								
<b>Preliminary Data Review</b>									
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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			
<b>Graphical Data Review</b>									
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	
<b>Data Analysis</b>									
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?								X	
Comments:									
FSS/Characterization Engineer (print/sign)						<i>Dale Randolph</i>		Date	6-21-07
FSS/ Characterization Manager (print/sign)						<i>[Signature]</i> R. Case		Date	8/22/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP 1.32	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	EP 1.32			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit EP 1.32 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF). The survey unit consists of a piping run between an open flange in the -27 trench and drain openings in Quad D.</p> <p>2) EP 1.32 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.32 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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> <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; font-weight: bold;">COPY</span> </div>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-11-07	
Technical Reviewer (FSS/Characterization Engineer)			7-11-07	
FSS/Characterization Manager			8/23/07	

**1.0 History/Description**

- 1.1 EP 1.32 was the Quad D Drain. The subject pipe is the floor drain line from Quad "D" in the Containment Building to the -25 ft of the Rx Building in Pump Room #22. The function of this pipe was to convey water from two floor drains located in the southeastern most corner of Quad "D" in the Containment Building to the Hot Drain (HD) sump in Pump Room #22 on the Rx Building -25 ft.
- 1.2 EP 1.32 consists of 132 linear feet (') of 10 inch (") Inside Diameter (ID) piping starting in the -27 foot elevation trench and running to Quad D. In Quad D the piping reduces to 6" at two locations throughout the run of piping. There was 14' of 6" piping surveyed in this pipe run. The total piping for EP 1.32 is 146'.

**2.0 Survey Design Information**

- 2.1 EP 1.32 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 10" and 6" ID pipe was accessible for survey. The accessible 10" and 6" ID pipe was surveyed by static measurement at one foot increments, for a total of 146 survey measurements.
- 2.3 Surface area for the 10" ID piping is 2,432 cm<sup>2</sup> for each foot of piping, corresponding to a total 10" ID piping surface area of 321,024 cm<sup>2</sup> (32.1 m<sup>2</sup>) for the entire length of (132') of 10" piping.
- 2.4 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 20,426 cm<sup>2</sup> (2.0 m<sup>2</sup>) for the entire length (14') of 6" piping.
- 2.5 Total surface area for both the 10" and 6" piping that constitutes EP 1.32 is 34.1 m<sup>2</sup>.

**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 All measurement results 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.

FSS Design # EP 1.32	Revision # Original	Page 3 of 3
Survey Unit: 1.32		

5.3 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 1.32 passes FSS.

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

#### 5.5 Statistical Summary Table

Statistical Parameter	10" Pipe	6" Pipe
Total Number of Survey Measurements	132	14
Number of Measurements >MDC	127	12
Number of Measurements Above 50% of DCGL	0	0
Number of Measurements Above DCGL	0	0
Mean	0.05	0.002
Median	0.04	0.002
Standard Deviation	0.04	0.001
Maximum	0.24	0.004
Minimum	0.01	0.000

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 EP 1.32 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.048 mrem/yr based on the average of the actual gross counts measured.

#### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.32 & Spreadsheet



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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.32	Survey Location	-27 TRENCH
Survey Date	6-29-06/6-30-06	2350-1 #	189094
Survey Time	0845/0834	Detector-Sled #	LVS1-107
Pipe Size	10"	Detector Efficiency	0.0001
DCGL (dpm/100cm <sup>2</sup> )	240,800	Pipe Area Incorporated by Detector Efficiency (ln cm <sup>2</sup> )	2432
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	420.932.1	Field BKG (cpm)	17.0/16.6
Routine Survey	X	Field MDCR (cpm)	17.22/17.05
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	4320/4320

### Survey Measurement Results

Total Number of Survey Measurements	132
Number of Measurements >MDC	127
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.05
Median	0.04
Standard Deviation	0.04
Maximum	0.24
Minimum	0.01

Survey Technician(s)	STOCK FOWLER
----------------------	-----------------

Survey Unit Classification	1
TBD 06-004 Piping Group	2
SR-13 Radionuclide Distribution Sample	EP 2-1
Measured Nuclide	Co60
Area Factor/EMC Used	No
Pass/Fail FSS	Pass
MREM/YR Contribution	<1

COMMENTS: Activity values are not background corrected.  
Measurements #1-8 correspond to positions #87-94 on Survey Form dated 6/30/06  
& measurements #9-14 correspond to positions #1-6 on Survey Form dated 6/29/06.

RP Engineer | Date

*Paul R. Hall* 6-11-07

**EP 1.32**  
**TBD 06-004 Group 2**

Measurement #	ncpm	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	16	16	213,333	8,772	4,553	73	52	4	254	0.04
2	10	10	133,333	5,482	2,845	46	32	3	159	0.02
3	13	13	173,333	7,127	3,699	59	42	3	207	0.03
4	15	15	200,000	8,224	4,268	68	49	4	238	0.04
5	18	18	240,000	9,868	5,122	82	58	5	286	0.04
6	18	18	240,000	9,868	5,122	82	58	5	286	0.04
7	17	17	226,667	9,320	4,837	77	55	5	270	0.04
8	12	12	160,000	6,579	3,414	55	39	3	191	0.03
9	5	5	66,667	2,741	1,423	23	16	1	79	0.01
10	11	11	146,667	6,031	3,130	50	36	3	175	0.03
11	12	12	160,000	6,579	3,414	55	39	3	191	0.03
12	10	10	133,333	5,482	2,845	46	32	3	159	0.02
13	11	11	146,667	6,031	3,130	50	36	3	175	0.03
14	10	10	133,333	5,482	2,845	46	32	3	159	0.02
15	10	10	133,333	5,482	2,845	46	32	3	159	0.02
16	13	13	173,333	7,127	3,699	59	42	3	207	0.03
17	12	12	160,000	6,579	3,414	55	39	3	191	0.03
18	19	19	253,333	10,417	5,406	86	61	5	302	0.05
19	11	11	146,667	6,031	3,130	50	36	3	175	0.03
20	13	13	173,333	7,127	3,699	59	42	3	207	0.03
21	15	15	200,000	8,224	4,268	68	49	4	238	0.04
22	6	6	80,000	3,289	1,707	27	19	2	95	0.01
23	9	9	120,000	4,934	2,561	41	29	2	143	0.02
24	12	12	160,000	6,579	3,414	55	39	3	191	0.03
25	9	9	120,000	4,934	2,561	41	29	2	143	0.02
26	9	9	120,000	4,934	2,561	41	29	2	143	0.02
27	6	6	80,000	3,289	1,707	27	19	2	95	0.01
28	10	10	133,333	5,482	2,845	46	32	3	159	0.02
29	6	6	80,000	3,289	1,707	27	19	2	95	0.01
30	8	8	106,667	4,386	2,276	36	26	2	127	0.02
31	17	17	226,667	9,320	4,837	77	55	5	270	0.04
32	5	5	66,667	2,741	1,423	23	16	1	79	0.01
33	12	12	160,000	6,579	3,414	55	39	3	191	0.03
34	14	14	186,667	7,675	3,984	64	45	4	223	0.03
35	11	11	146,667	6,031	3,130	50	36	3	175	0.03
36	7	7	93,333	3,838	1,992	32	23	2	111	0.02
37	12	12	160,000	6,579	3,414	55	39	3	191	0.03
38	8	8	106,667	4,386	2,276	36	26	2	127	0.02

**EP 1.32**  
**TBD 06-004 Group 2**

Measurement #	ncpm	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-84 activity (dpm/100cm2)	Ag-108m activity (dpm/100cm2)	Unity
39	9	9	120,000	4,934	2,561	41	29	2	143	0.02
40	15	15	200,000	8,224	4,268	68	49	4	238	0.04
41	9	9	120,000	4,934	2,561	41	29	2	143	0.02
42	29	29	386,667	15,899	8,252	132	94	8	461	0.07
43	59	59	786,667	32,346	16,788	268	191	16	938	0.14
44	99	99	1,320,000	54,276	28,169	450	320	27	1,574	0.24
45	97	97	1,293,333	53,180	27,600	441	314	26	1,542	0.23
46	61	61	813,333	33,443	17,357	278	197	16	970	0.15
47	63	63	840,000	34,539	17,926	287	204	17	1,002	0.15
48	57	57	760,000	31,250	16,219	259	184	15	906	0.14
49	53	53	706,667	29,057	15,081	241	171	14	843	0.13
50	48	48	640,000	26,316	13,658	218	155	13	763	0.11
51	29	29	386,667	15,899	8,252	132	94	8	461	0.07
52	36	36	480,000	19,737	10,243	164	116	10	572	0.09
53	31	31	413,333	16,996	8,821	141	100	8	493	0.07
54	42	42	560,000	23,026	11,951	191	136	11	668	0.10
55	23	23	306,667	12,610	6,544	105	74	6	366	0.05
56	34	34	453,333	18,640	9,674	155	110	9	541	0.08
57	16	16	213,333	8,772	4,553	73	52	4	254	0.04
58	16	16	213,333	8,772	4,553	73	52	4	254	0.04
59	12	12	160,000	6,579	3,414	55	39	3	191	0.03
60	16	16	213,333	8,772	4,553	73	52	4	254	0.04
61	29	29	386,667	15,899	8,252	132	94	8	461	0.07
62	18	18	240,000	9,868	5,122	82	58	5	286	0.04
63	14	14	186,667	7,675	3,984	64	45	4	223	0.03
64	12	12	160,000	6,579	3,414	55	39	3	191	0.03
65	13	13	173,333	7,127	3,699	59	42	3	207	0.03
66	10	10	133,333	5,482	2,845	46	32	3	159	0.02
67	27	27	360,000	14,803	7,683	123	87	7	429	0.06
68	32	32	426,667	17,544	9,105	146	104	9	509	0.08
69	30	30	400,000	16,447	8,536	137	97	8	477	0.07
70	19	19	253,333	10,417	5,406	86	61	5	302	0.05
71	20	20	266,667	10,965	5,691	91	65	5	318	0.05
72	21	21	280,000	11,513	5,975	96	68	6	334	0.05
73	18	18	240,000	9,868	5,122	82	58	5	286	0.04
74	14	14	186,667	7,675	3,984	64	45	4	223	0.03
75	11	11	146,667	6,031	3,130	50	36	3	175	0.03
76	14	14	186,667	7,675	3,984	64	45	4	223	0.03

**EP 1.32**  
**TBD 06-004 Group 2**

Measurement #	ncpm	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
77	12	12	160,000	6,579	3,414	55	39	3	191	0.03
78	14	14	186,667	7,675	3,984	64	45	4	223	0.03
79	10	10	133,333	5,482	2,845	46	32	3	159	0.02
80	14	14	186,667	7,675	3,984	64	45	4	223	0.03
81	23	23	306,667	12,610	6,544	105	74	6	366	0.05
82	34	34	453,333	18,640	9,674	155	110	9	541	0.08
83	19	19	253,333	10,417	5,406	86	61	5	302	0.05
84	13	13	173,333	7,127	3,699	59	42	3	207	0.03
85	19	19	253,333	10,417	5,406	86	61	5	302	0.05
86	39	39	520,000	21,382	11,097	177	126	10	620	0.09
87	16	16	213,333	8,772	4,553	73	52	4	254	0.04
88	17	17	226,667	9,320	4,837	77	55	5	270	0.04
89	13	13	173,333	7,127	3,699	59	42	3	207	0.03
90	20	20	266,667	10,965	5,691	91	65	5	318	0.05
91	26	26	346,667	14,254	7,398	118	84	7	413	0.06
92	22	22	293,333	12,061	6,260	100	71	6	350	0.05
93	24	24	320,000	13,158	6,829	109	78	6	382	0.06
94	24	24	320,000	13,158	6,829	109	78	6	382	0.06
95	26	26	346,667	14,254	7,398	118	84	7	413	0.06
96	40	40	533,333	21,930	11,382	182	129	11	636	0.10
97	45	45	600,000	24,671	12,804	205	146	12	715	0.11
98	36	36	480,000	19,737	10,243	164	116	10	572	0.09
99	31	31	413,333	16,996	8,821	141	100	8	493	0.07
100	39	39	520,000	21,382	11,097	177	126	10	620	0.09
101	23	23	306,667	12,610	6,544	105	74	6	366	0.05

**EP 1.32**  
**TBD 06-004 Group 2**

Measurement #	ncpm	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
102	30	30	400,000	16,447	8,536	137	97	8	477	0.07
103	42	42	560,000	23,026	11,951	191	136	11	668	0.10
104	65	65	866,667	35,636	18,495	296	210	17	1,033	0.15
105	48	48	640,000	26,316	13,658	218	155	13	763	0.11
106	33	33	440,000	18,092	9,390	150	107	9	525	0.08
107	33	33	440,000	18,092	9,390	150	107	9	525	0.08
108	26	26	346,667	14,254	7,398	118	84	7	413	0.06
109	46	46	613,333	25,219	13,089	209	149	12	731	0.11
110	16	16	213,333	8,772	4,553	73	52	4	254	0.04
111	16	16	213,333	8,772	4,553	73	52	4	254	0.04
112	11	11	146,667	6,031	3,130	50	36	3	175	0.03
113	13	13	173,333	7,127	3,699	59	42	3	207	0.03
114	14	14	186,667	7,675	3,984	64	45	4	223	0.03
115	8	8	106,667	4,386	2,276	36	26	2	127	0.02
116	15	15	200,000	8,224	4,268	68	49	4	238	0.04
116	16	16	213,333	8,772	4,553	73	52	4	254	0.04
117	10	10	133,333	5,482	2,845	46	32	3	159	0.02
118	16	16	213,333	8,772	4,553	73	52	4	254	0.04
119	13	13	173,333	7,127	3,699	59	42	3	207	0.03
120	11	11	146,667	6,031	3,130	50	36	3	175	0.03
121	12	12	160,000	6,579	3,414	55	39	3	191	0.03
122	19	19	253,333	10,417	5,406	86	61	5	302	0.05
123	23	23	306,667	12,610	6,544	105	74	6	366	0.05
124	22	22	293,333	12,061	6,260	100	71	6	350	0.05
125	19	19	253,333	10,417	5,406	86	61	5	302	0.05
126	16	16	213,333	8,772	4,553	73	52	4	254	0.04
127	27	27	360,000	14,803	7,683	123	87	7	429	0.06
128	34	34	453,333	18,640	9,674	155	110	9	541	0.08
129	24	24	320,000	13,158	6,829	109	78	6	382	0.06
130	27	27	360,000	14,803	7,683	123	87	7	429	0.06
131	23	23	306,667	12,610	6,544	105	74	6	366	0.05
132	35	35	466,667	19,189	9,959	159	113	9	556	0.08
Bkgd 0										
										MEAN 0.05
										MEDIAN 0.04
										STD DEV 0.04
										MAX 0.24
										MIN 0.01



## BSI EP/BP SURVEY REPORT

Pipe ID	1.32		Survey Location	-27 TRENCH
Survey Date	6-29-06/6-30-06		2350-1 #	189094
Survey Time	0845/0834		Detector-Sled #	LVS1-107
Pipe Size	6"		Detector Efficiency	0.002
DCGL (dpm/100cm2)	240,800		Pipe Area Incorporated by Detector Efficiency (ln cm2)	1459
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	2.0		Field BKG (cpm)	17.0/16.6
Routine Survey	X		Field MDCR (counts) <i>cpm</i>	17.22/17.05
QA Survey			Nominal MDC (dpm/100cm2)	333/333
Survey Measurement Results				
Total Number of Survey Measurements			14	
Number of Measurements >MDC			12	
Number of Measurements Above 50% DCGL			0	
Number of Measurements Above DCGL			0	
Mean			0.002	
Median			0.002	
Standard Deviation			0.001	
Maximum			0.004	
Minimum			0.000	
Survey Technician(s)		STOCK		
Survey Unit Classification			1	
TBD 06-004 Piping Group			2	
SR-13 Radionuclide Distribution Sample			EP 2-1	
Measured Nuclide			Co60	
Area Factor/EMC Used			No	
Pass/Fail FSS			Pass	
MREM/YR Contribution			<1	
COMMENTS: Activity values are not background corrected. Measurements #1-8 correspond to positions #87-94 on Survey Form dated 6/30/06 & measurements #9-14 correspond to positions #1-6 on Survey Form dated 6/29/06.				
RP Engineer   Date		<i>Del Randall</i> 6-11-07		

**EP 1.32**  
**TBD 06-004 Group 2**

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	14	14	7,000	480	249	4	3	0	14	0.002
2	3	3	1,500	103	53	1	1	0	3	0.000
3	3	3	1,500	103	53	1	1	0	3	0.000
4	15	15	7,500	514	267	4	3	0	15	0.002
5	12	12	6,000	411	213	3	2	0	12	0.002
6	18	18	9,000	617	320	5	4	0	18	0.003
7	18	18	9,000	617	320	5	4	0	18	0.003
8	11	11	5,500	377	196	3	2	0	11	0.002
9	13	13	6,500	446	231	4	3	0	13	0.002
10	15	15	7,500	514	267	4	3	0	15	0.002
11	21	21	10,500	720	374	6	4	0	21	0.003
12	29	29	14,500	994	516	8	6	0	29	0.004
13	17	17	8,500	583	302	5	3	0	17	0.003
14	14	14	7,000	480	249	4	3	0	14	0.002
									MEAN	0.002
									MEDIAN	0.002
									STD DEV	0.001
									MAX	0.004
									MIN	0.000



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

## Pipe Interior Radiological Survey Form

Date: 6/30/06 Time: 0834  
 Pipe ID#: 1.32 Pipe Diameter: 10" 4 6" Access Point Area: -27' TRENCH  
 Building: Rx BLDG Elevation: -27' System: QUAD D DRAIN

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey ☒ Other ☒  
 Gross \_\_\_\_\_ Co60 ☒ Cs \_\_\_\_\_

Detector ID# / Sled ID# BICRON IMG1 LVS-1 / 107

Detector Cal Date: 12/20/05 Detector Cal Due Date: 12/20/06

Instrument: 2350-1 Instrument ID #: 189094

Instrument Cal Date: 3/15/06 Instrument Cal Due Date: 3/15/07

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

Background Value 16.6 cpm

MDCR<sub>static</sub> 17.05 cpm 0.000075

Efficiency Factor for Pipe Diameter 0.00075 (from detector efficiency determination)

MDC<sub>static</sub> 4320\* 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: CONTINUATION SURVEY; POSITIONS #1 → #86 IS 10" ID PIPE.

POSITIONS #87 → #94 IS 1.32A AND IS 6" ID PIPE

\* values for 10" pipe; eff = 0.002, MDC = 333 for 10" PIPE

Technician Signature [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	2	16	16	n/a	n/a
2	2	2	10	10		
3	3	2	13	13		
4	4	2	15	15		
5	5	2	18	18		
6	6	2	18	18		
7	7	2	17	17		
8	8	2	12	12		
9	9	2	5	5		
10	10	2	11	11		

REFERENCE COPY

Package Page 1 of 6

Attachment 3, Page 1

## Pipe Interior Radiological Survey Form (Continuation Form)

Date: 6/30/06 Pipe ID#: 1.32 Pipe Diameter: 10" Access Point Area: -27' TRENCH  
 Building: Rx Bldg Elevation: -27' System: QUAD D DRAIN

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	<u>1</u>	<u>12</u>	<u>12</u>	<u>n/a</u>	<u>n/a</u>
12	12		<u>10</u>	<u>10</u>		
13	13		<u>11</u>	<u>11</u>		
14	14		<u>10</u>	<u>10</u>		
15	15		<u>10</u>	<u>10</u>		
16	16		<u>13</u>	<u>13</u>		
17	17		<u>12</u>	<u>12</u>		
18	18		<u>19</u>	<u>19</u>		
19	19		<u>11</u>	<u>11</u>		
20	20		<u>13</u>	<u>13</u>		
21	21		<u>15</u>	<u>15</u>		
22	22		<u>6</u>	<u>6</u>		
23	23		<u>9</u>	<u>9</u>		
24	24		<u>12</u>	<u>12</u>		
25	25		<u>9</u>	<u>9</u>		
26	26		<u>9</u>	<u>9</u>		
27	27		<u>6</u>	<u>6</u>		
28	28		<u>10</u>	<u>10</u>		
29	29		<u>6</u>	<u>6</u>		
30	30		<u>8</u>	<u>8</u>		
31	31		<u>17</u>	<u>17</u>		
32	32		<u>5</u>	<u>5</u>		
33	33		<u>12</u>	<u>12</u>		
34	34		<u>14</u>	<u>14</u>		
35	35		<u>11</u>	<u>11</u>		
36	36		<u>7</u>	<u>7</u>		
37	37		<u>12</u>	<u>12</u>		
38	38		<u>8</u>	<u>8</u>		
39	39		<u>9</u>	<u>9</u>		
40	40		<u>15</u>	<u>15</u>		
41	41		<u>9</u>	<u>9</u>		
42	42		<u>29</u>	<u>29</u>		
43	43		<u>59</u>	<u>59</u>		
44	44		<u>99</u>	<u>99</u>		
45	45		<u>97</u>	<u>97</u>		

Package Page 2 of 6

REFERENCE COPY

## Pipe Interior Radiological Survey Form (Continuation Form)

Date: 6/30/06 Pipe ID#: 1.32 Pipe Diameter: 10" Access Point Area: -27'  
 Building: R4 BLDG Elevation: -27' System: QUAD D DRAIN

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
46	46	1	61	61	N/A	N/A
47	47		63	63		
48	48		57	57		
49	49		53	53		
50	50		48	48		
51	51		29	29		
52	52		36	36		
53	53		31	31		
54	54		42	42		
55	55		23	23		
56	56		34	34		
57	57		16	16		
58	58		16	16		
59	59		12	12		
60	60		16	16		
61	61		29	29		
62	62		18	18		
63	63		14	14		
64	64		12	12		
65	65		13	13		
66	66		10	10		
67	67		27	27		
68	68		32	32		
69	69		30	30		
70	70		19	19		
71	71		20	20		
72	72		21	21		
73	73		18	18		
74	74		14	14		
75	75		11	11		
76	76		14	14		
77	77		12	12		
78	78		14	14		
79	79		10	10		
80	80		14	14		

Package Page 3 of 6

REFERENCE COPY

Pipe Interior Radiological Survey Form (Continuation Form)

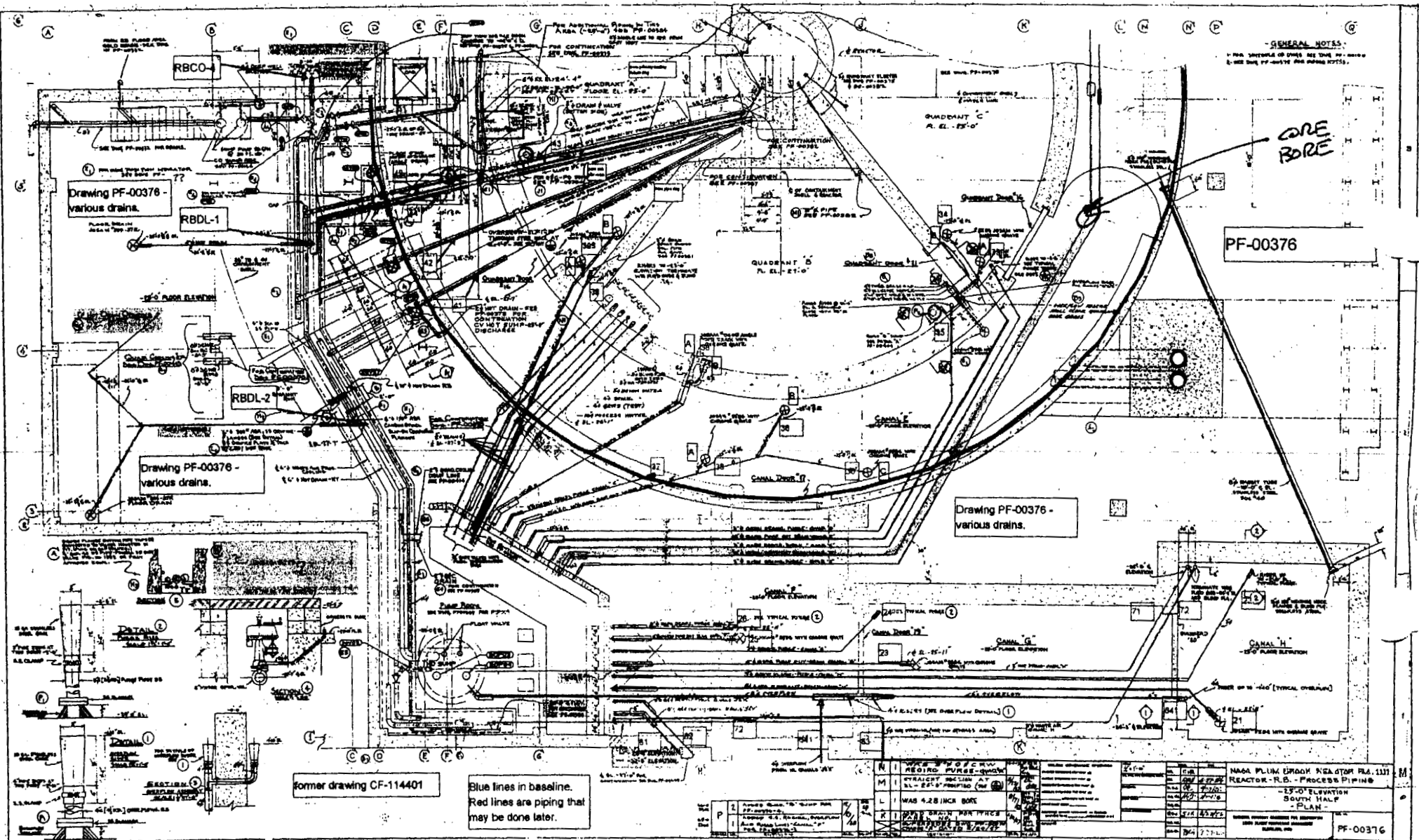
Date: 6/30/06  
 Pipe ID#: 1.32 Pipe Diameter: 10" + 6" Access Point Area: -27' TRENCH  
 Building: Rx BLDG Elevation: -27' System: QUAD D DRAIN

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
81	81	1	23	23	n/a	n/a
82	82		34	34		
83	83		19	19		
84	84		13	13		
85	85		19	19		
86	86		39	39		
87	87		14	14		
88	88		3	3		
89	89		3	3		
90	90		15	15		
91	91		12	12		
92	92		18	18		
93	93		18	18		
94	94		11	11		
<div style="position: relative; height: 100px;"> <span style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); font-size: 2em;">N</span> <span style="position: absolute; top: 60%; left: 50%; transform: translate(-50%, -50%); font-size: 2em;">A</span> </div>						

Package Page 4 of 6

REFERENCE COPY

- PIPE SURVEYED  
1.32

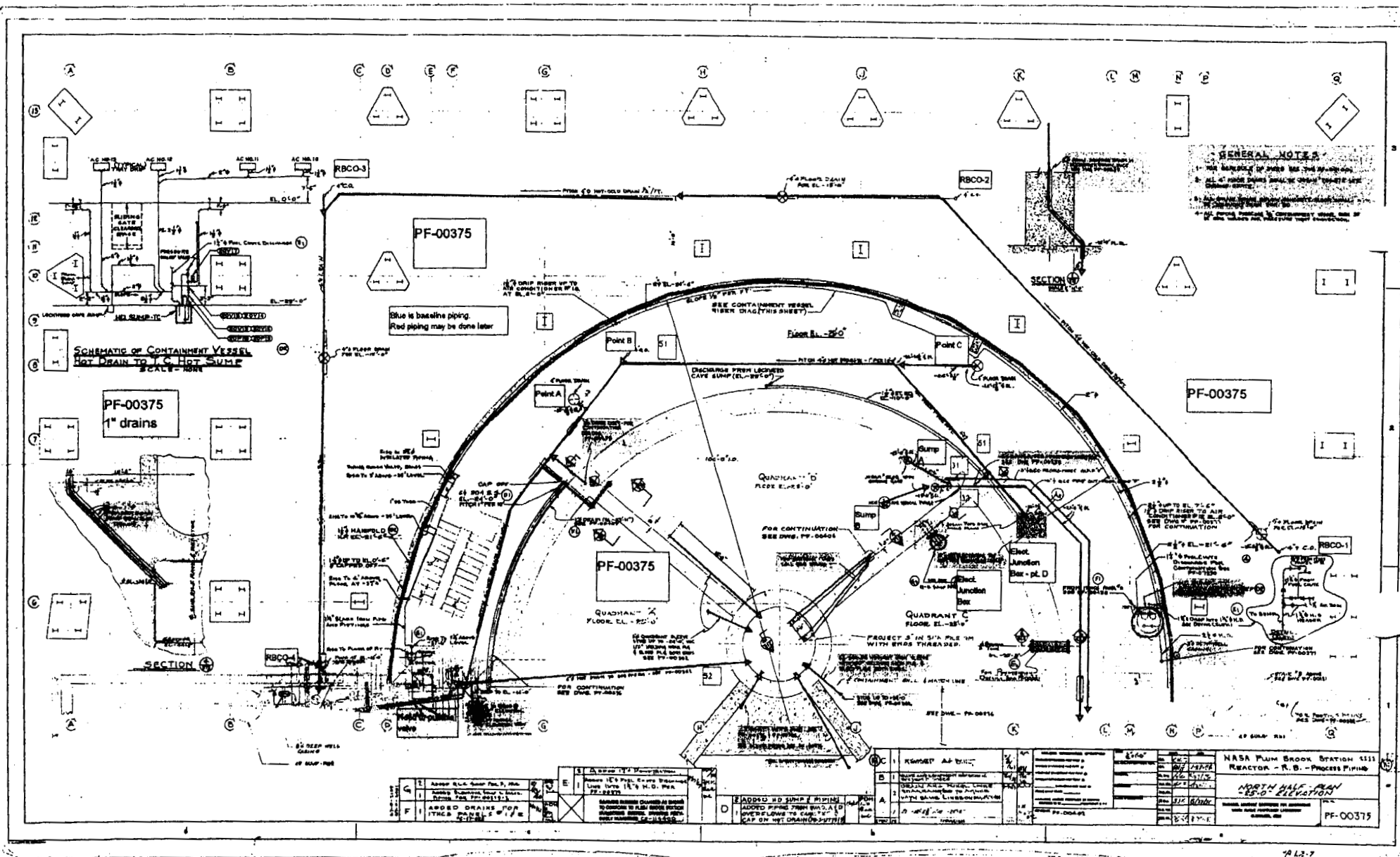


PAGE

5 of 6

REFERENCE COPY

PIPE SURVEYED  
1.32 A



Pipe Interior Radiological Survey Form

Date: 6/29/06 Time: 0845  
Pipe ID#: 1.32 Pipe Diameter: 6" + 10" Access Point Area: QUAD D  
Building: CV Elevation: -25' System: DRAINS

Type of Survey Investigation        Characterization        Final Survey ✓ Other ✓  
Gross        Co60 ✓ Cs       

Detector ID# / Sled ID# BICRON IMG1 LVS-11 107  
Detector Cal Date: 12/20/05 Detector Cal Due Date: 12/20/06  
Instrument: 2350-1 Instrument ID #: 189094  
Instrument Cal Date: 3/15/06 Instrument Cal Due Date: 3/15/07

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

Background Value 17.0 cpm

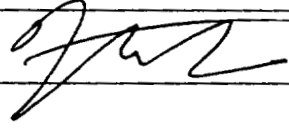
MDCR<sub>static</sub> 17.22 cpm

Efficiency Factor for Pipe Diameter 0.000075\* (from detector efficiency determination)

MDC<sub>static</sub> 4320\* 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: POSITION #1 - #6 IS 6" ID PIPE; #7 TO #53 IS 10" ID PIPE  
\*values for 10" pipe; eff = 0.002, MDC = 333 for 10" pipe

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	13	13	n/a	n/a
2	2	1	15	15	↓	↓
3	3	1	21	21	↓	↓
4	4	1	29	29	↓	↓
5	5	1	17	17	↓	↓
6	6	1	14	14	↓	↓
7	7	1	16	16	↓	↓
8	8	1	17	17	↓	↓
9	9	1	13	13	↓	↓
10	10	1	20	20	↓	↓

REFERENCE COPY

Package Page 1 of 4

Attachment 3, Page 1



Pipe Interior Radiological Survey Form (Continuation Form)

Date: 6/29/06  
 Pipe ID#: 1.32 Pipe Diameter: 6" - 10" Access Point Area: Pump D  
 Building: CV Elevation: -25' System: DRAINS

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	26	26	N/A	N/A
12	12		22	22		
13	13		24	24		
14	14		24	24		
15	15		26	26		
16	16		40	40		
17	17		45	45		
18	18		36	36		
19	19		31	31		
20	20		39	39		
21	21		23	23		
22	22		30	30		
23	23		42	42		
24	24		65	65		
25	25		48	48		
26	26		33	33		
27	27		33	33		
28	28		26	26		
29	29		46	46		
30	30		16	16		
31	31		16	16		
32	32		11	11		
33	33		13	13		
34	34		14	14		
35	35		8	8		
36	36		15	15		
37	37		16	16		
38	38		10	10		
39	39		16	16		
40	40		13	13		
41	41		11	11		
42	42		12	12		
43	43		19	19		
44	44		23	23		
45	45		22	22		

Package Page 2 of 4

REFERENCE COPY





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

---


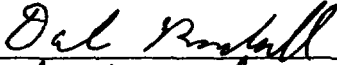

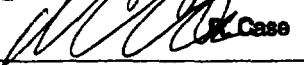
### DQA Check Sheet

Design #	EP 1.32	Revision #	Original						
Survey Unit #	EP 1.32								
<b>Preliminary Data Review</b>									
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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			
<b>Graphical Data Review</b>									
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	
<b>Data Analysis</b>									
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?								X	
Comments:									
FSS/Characterization Engineer (print/sign)						<i>Dale R. Case</i>		Date	6-11-07
FSS/ Characterization Manager (print/sign)						<i>R. Case</i>		Date	8/23/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-Rx126	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	Rx126			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit Rx126 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP RX126 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP Rx126 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: center;"> <b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-11-07	
Technical Reviewer (FSS/Characterization Engineer)			7-9-07	
FSS/Characterization Manager			8/23/07	

**1.0 History/Description**

- 1.1 EP Rx126 is a Quad B Drain. The subject piping described in this report is integral to the drain system for the Reactor Building. The piping that constitutes EP Rx126 addressed in this report service floor and equipment drains on the -27 foot of the Reactor Building. The purpose of the system is to convey waste water from the various drain openings to the drain trench located at Reactor Building -27 foot elevation.
- 1.2 EP Rx126 consists of 21 linear feet (') of 4 inch (") Inside Diameter (ID) piping starting in the -27 foot elevation trench and running to Quad B. The total piping for EP Rx126 is 21'.

**2.0 Survey Design Information**

- 2.1 EP Rx126 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 4" ID pipe was accessible for survey. The accessible 4" ID pipe was surveyed by static measurement at one foot increments, for a total of 21 survey measurements.
- 2.3 Surface area for the 4" ID piping is  $972.9 \text{ cm}^2$  for each foot of piping, corresponding to a total 4" ID piping surface area of  $20,430 \text{ cm}^2$  ( $2.0 \text{ m}^2$ ) for the entire length of (21') of 4" 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 All measurement results 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.
- 5.3 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 Rx126 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

- 5.5 Statistical Summary Table



### 5.5 Statistical Summary Table

Statistical Parameter	4" Pipe
Total Number of Survey Measurements	21
Number of Measurements >MDC	0
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.022
Median	0.022
Standard Deviation	0.006
Maximum	0.031
Minimum	0.009

**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 EP Rx126 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.022 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP Rx126 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	Rx126		Survey Location	-27 TRENCH
Survey Date	11-Jan-06		2350-1 #	134738
Survey Time	1245		Detector-Sled #	LVS1-DOG BONE 101
Pipe Size	4"		Detector Efficiency	0.0002
DCGL (dpm/100cm2)	240,800		Pipe Area Incorporated by Detector Efficiency (ln cm2)	973
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	2.0		Field BKG (cpm)	22.2
Routine Survey	X		Field MDCR (cpm)	19.3
QA Survey			Nominal MDC (dpm/100cm2)	9189

### Survey Measurement Results

Total Number of Survey Measurements	21
Number of Measurements >MDC	0
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.022
Median	0.022
Standard Deviation	0.006
Maximum	0.031
Minimum	0.009

Survey Technician(s)	Rosenhagen
----------------------	------------

Survey Unit Classification	1
TBD 06-004 Piping Group	2
SR-13 Radionuclide Distribution Sample	EP 2-1
Measured Nuclide	Co60
Area Factor/EMC Used	No
Pass/Fail FSS	Pass
MREM/YR Contribution	<1

COMMENTS: Activity values are not background corrected.

RP Engineer | Date

*Paul Randall* 6-11-07

**EP Rx126**  
**TBD 06-004 Group 2**

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	9	9	45,000	4,625	2,401	38	27	2	134	0.020
2	10	10	50,000	5,139	2,667	43	30	3	149	0.022
3	8	8	40,000	4,111	2,134	34	24	2	119	0.018
4	11	11	55,000	5,653	2,934	47	33	3	164	0.025
5	7	7	35,000	3,597	1,867	30	21	2	104	0.016
6	12	12	60,000	6,167	3,201	51	36	3	179	0.027
7	8	8	40,000	4,111	2,134	34	24	2	119	0.018
8	14	14	70,000	7,195	3,734	60	42	4	209	0.031
9	12	12	60,000	6,167	3,201	51	36	3	179	0.027
10	11	11	55,000	5,653	2,934	47	33	3	164	0.025
11	8	8	40,000	4,111	2,134	34	24	2	119	0.018
12	9	9	45,000	4,625	2,401	38	27	2	134	0.020
13	13	13	65,000	6,681	3,467	55	39	3	194	0.029
14	10	10	50,000	5,139	2,667	43	30	3	149	0.022
15	10	10	50,000	5,139	2,667	43	30	3	149	0.022
16	13	13	65,000	6,681	3,467	55	39	3	194	0.029
17	13	13	65,000	6,681	3,467	55	39	3	194	0.029
18	11	11	55,000	5,653	2,934	47	33	3	164	0.025
19	4	4	20,000	2,056	1,067	17	12	1	60	0.009
20	8	8	40,000	4,111	2,134	34	24	2	119	0.018
21	5	5	25,000	2,570	1,334	21	15	1	75	0.011
									MEAN	0.022
									MEDIAN	0.022
									STD DEV	0.006
									MAX	0.031
									MIN	0.009

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

# Pipe Interior Radiological Survey Form

Date: 1-11-06 Time: 1245  
 Building: RX Elevation -25 Access Point QUAD B  
 System: SCWR Pipe Diameter: 4" Area:  Pipe ID RX 126  
 Type of Survey Investigation Characterization Final Survey #  Other X  
 Sled Size DOG BONE 101 inch  
 Detector: BICRON 1M61 Detector ID #: LVS-1  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06  
 Instrument: 2350-1 Instrument ID #: 134738  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06

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

Background Value 22.8 cpm  
 MDCR<sub>static</sub> 19.3 cpm  
 Efficiency Factor for Pipe 0.0002 (taken from detector <sup>efficiency determination</sup> ~~calibration certificate~~)  
 Diameter 9189 dpm/100cm<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: INITIAL SURVEY

COMPLETE

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-11-06 Time: 1245

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	1	9	9	n/a	n/a
2	2	1	10	10		
3	3	1	8	8		
4	4	1	11	11		
5	5	1	7	7		
6	6	1	12	12		
7	7	1	8	8		
8	8	1	14	14		
9	9	1	12	12		
10	10	1	11	11		

Package Page 1 of 3

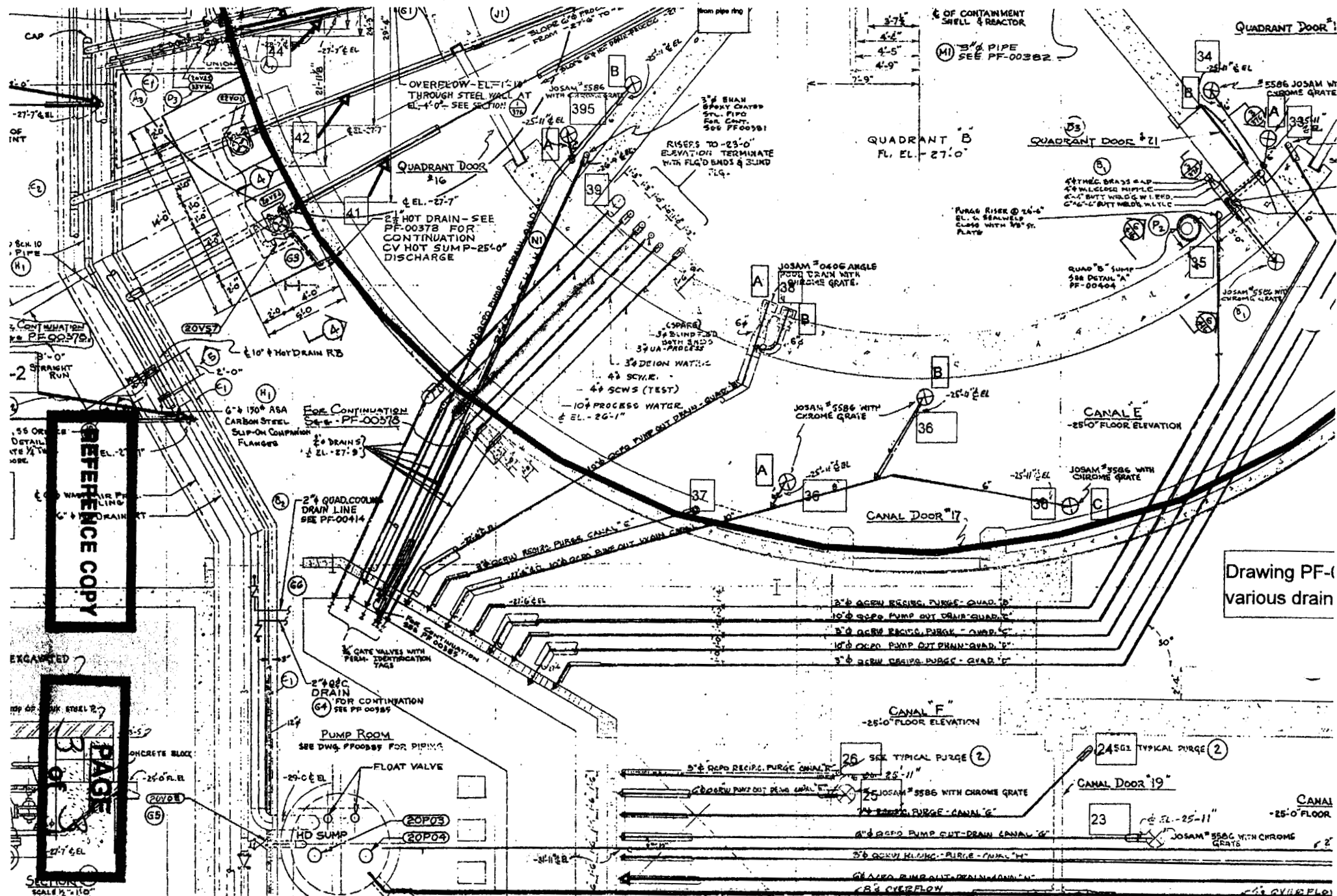
Pipe Interior Radiological Survey Form (Continuation Form)

RX 126 QUAD B

1-11-06

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	<del>8</del>	<del>8</del>	n/a	n/a
12	12	1	9	9	↓	↓
13	13	1	13	13		
14	14	1	10	10		
15	15	1	10	10		
16	16	1	13	13		
17	17	1	13	13		
18	18	1	11	11		
19	19	1	4	4		
20	20	1	<del>8</del>	<del>8</del>		
21	21	1	5	5		
n/a						

Package Page 2 of 3



= PIPE SURVEY

21

ID R X 12 &

1-11-06



**SECTION 7**  
**ATTACHMENT 3**  
**\_\_\_\_|\_\_\_\_ PAGE(S)**

### DQA Check Sheet

Design #	EP Rx126	Revision #	Original			
Survey Unit #	EP Rx126					
<b>Preliminary Data Review</b>						
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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)				<i>Eric Randall Marshall</i>		Date 6-11-07
FSS/ Characterization Manager (print/sign)				<i>[Signature]</i> R. Case		Date 8/23/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.23	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.23			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.23 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.23 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.23 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: center;"><b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer	<i>Dal Runkell</i>		6-12-07	
Technical Reviewer (FSS/Characterization Engineer)	<i>Wood</i>		7-12-07	
FSS/Characterization Manager	<i>[Signature]</i>		8/23/07	

Form  
CS-09/1  
Rev 0

## Survey Unit: Rx155

**1.0 History/Description**

- 1.1 The subject pipe is the floor drain line from Canal "G" to the -25 ft of the Rx Building in Pump Room #22. The function of this pipe was to convey water from a floor drain located in the southwestern most corner of Canal "G" to the HD sump in Pump Room #22 on the Rx Building -25 ft, where the pipe is currently breached.
- 1.2 EP 1.23 consists of 42 linear feet (') of 6 inch (") Inside Diameter (ID) piping from the breach point in Pump Room #22 to the floor drain in Canal "G". The pipe section is relatively straight with no bends.

**2.0 Survey Design Information**

- 2.1 EP 1.23 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 6" ID pipe was accessible for survey. The accessible 6" ID pipe was surveyed by static measurement at one foot increments, for a total of 42 survey measurements.
- 2.3 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 61,278 cm<sup>2</sup> (6.1 m<sup>2</sup>) for the entire length of (42') of 6" 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 All measurement results 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.
- 5.3 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 1.23 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

Survey Unit: Rx155

### 5.5 Statistical Summary Table

Statistical Parameter	6" Pipe
Total Number of Survey Measurements	42
Number of Measurements >MDC	33
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.002
Median	0.002
Standard Deviation	0.002
Maximum	0.009
Minimum	0.001

**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 EP 1.23 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.002 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP 1.23 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.23	Survey Location	-27 TRENCH
Survey Date	04-Jan-06	2350-1 #	134708
Survey Time	1020	Detector-Sled #	BICRON 1MG1
Pipe Size	6"	Detector Efficiency	0.002
DCGL (dpm/100cm <sup>2</sup> )	240800	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	1459
Pipe Area Incorporated by Survey Data (in m <sup>2</sup> )	6.1	Field BKG (cpm)	18
Routine Survey	X	Field MDCR (cpm)	22
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	333
Survey Measurement Results			
Total Number of Survey Measurements		42	
Number of Measurements >MDC		33	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.002	
Median		0.002	
Standard Deviation		0.002	
Maximum		0.009	
Minimum		0.001	
Survey Technician(s)	ROSENHAGEN		
Survey Unit Classification		1	
TBD 06-004 Piping Group		2	
SR-13 Radionuclide Distribution Sample		EP 2-1	
Measured Nuclide		Co60	
Area Factor/EMC Used		No	
Pass/Fail FSS		Pass	
MREM/YR Contribution		<1	
COMMENTS: ACTIVITY VALUES NOT BACKGROUND CORRECTED			
RP Engineer   Date	<i>Paul Hunsberr</i> 6-12-07		



**EP 1.23**  
**TBD 06-004 Group 2**

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)	Unlity
1	63	63	31,500	2,159	1,121	18	13	1	63	0.009
2	36	36	18,000	1,234	640	10	7	1	36	0.005
3	42	42	21,000	1,439	747	12	8	1	42	0.006
4	13	13	6,500	446	231	4	3	0	13	0.002
5	14	14	7,000	480	249	4	3	0	14	0.002
6	14	14	7,000	480	249	4	3	0	14	0.002
7	17	17	8,500	583	302	5	3	0	17	0.003
8	14	14	7,000	480	249	4	3	0	14	0.002
9	14	14	7,000	480	249	4	3	0	14	0.002
10	9	9	4,500	308	160	3	2	0	9	0.001
11	13	13	6,500	446	231	4	3	0	13	0.002
12	21	21	10,500	720	374	6	4	0	21	0.003
13	15	15	7,500	514	267	4	3	0	15	0.002
14	12	12	6,000	411	213	3	2	0	12	0.002
15	12	12	6,000	411	213	5	3	0	12	0.003
16	17	17	8,500	583	302	3	2	0	17	0.002
17	12	12	6,000	411	213	3	2	0	12	0.002
18	11	11	5,500	377	196	3	2	0	11	0.002
19	7	7	3,500	240	125	2	1	0	7	0.001
20	11	11	5,500	377	196	3	2	0	11	0.002
21	6	6	3,000	206	107	2	1	0	6	0.001
22	12	12	6,000	411	213	3	2	0	12	0.002
23	15	15	7,500	514	267	4	3	0	15	0.002
24	11	11	5,500	377	196	3	2	0	11	0.002
25	12	12	6,000	411	213	3	2	0	12	0.002
26	13	13	6,500	446	231	4	3	0	13	0.002
27	6	6	3,000	206	107	2	1	0	6	0.001
28	14	14	7,000	480	249	4	3	0	14	0.002
29	12	12	6,000	411	213	3	2	0	12	0.002
30	14	14	7,000	480	249	4	3	0	14	0.002
31	12	12	6,000	411	213	3	2	0	12	0.002
32	7	7	3,500	240	125	2	1	0	7	0.001
33	12	12	6,000	411	213	3	2	0	12	0.002
34	6	6	3,000	206	107	2	1	0	6	0.001
35	13	13	6,500	446	231	4	3	0	13	0.002

**EP 1.23**  
**TBD 06-004 Group 2**

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
35	14	14	7,000	480	249	4	3	0	14	0.002
36	10	10	5,000	343	178	3	2	0	10	0.001
37	8	8	4,000	274	142	2	2	0	8	0.001
38	9	9	4,500	308	160	3	2	0	9	0.001
39	8	8	4,000	274	142	2	2	0	8	0.001
40	14	14	7,000	480	249	4	3	0	14	0.002
41	12	12	6,000	411	213	3	2	0	12	0.002
42	16	16	8,000	548	285	5	3	0	16	0.002
									MEAN	0.002
									MEDIAN	0.002
									STD DEV	0.002
									MAX	0.009
									MIN	0.001

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

# Pipe Interior Radiological Survey Form

Date: 1-4-06 Time: 1020  
 Building: REACTOR BLDG Elevation: -25 Access Point Area: -22 TASNCH  
 System: CANAL G Pipe Diameter: 1/2" Pipe ID #: 1.23  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 6"-107 inch  
 Detector: BICROM 1M61 Detector ID #: LV5-1  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06  
 Instrument: 2350-1 Instrument ID #: 134708  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06

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

Background Value 18 cpm

MDCR<sub>static</sub> 22 cpm

Efficiency Factor for Pipe Diameter 0.002

(taken from detector efficiency determination calibration certificate) gn

MDC<sub>static</sub> 333 dpm/100cm<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: INITIAL SURVEY

SSP / COMPLETE

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-4-06 Time: 1026

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1ft	1	63	43	n/a	n/a
2	2ft	1	36	36		
3	3ft	1	42	42		
4	4ft	1	13	13		
5	5ft	1	14	14		
6	6ft	1	14	14		
7	7ft	1	17	17		
8	8ft	1	14	14		
9	9ft	1	14	14		
10	10ft	1	9	9		

Package Page 1 of 2

REFERENCE COPY

# Pipe Interior Radiological Survey Form (Continuation Form)

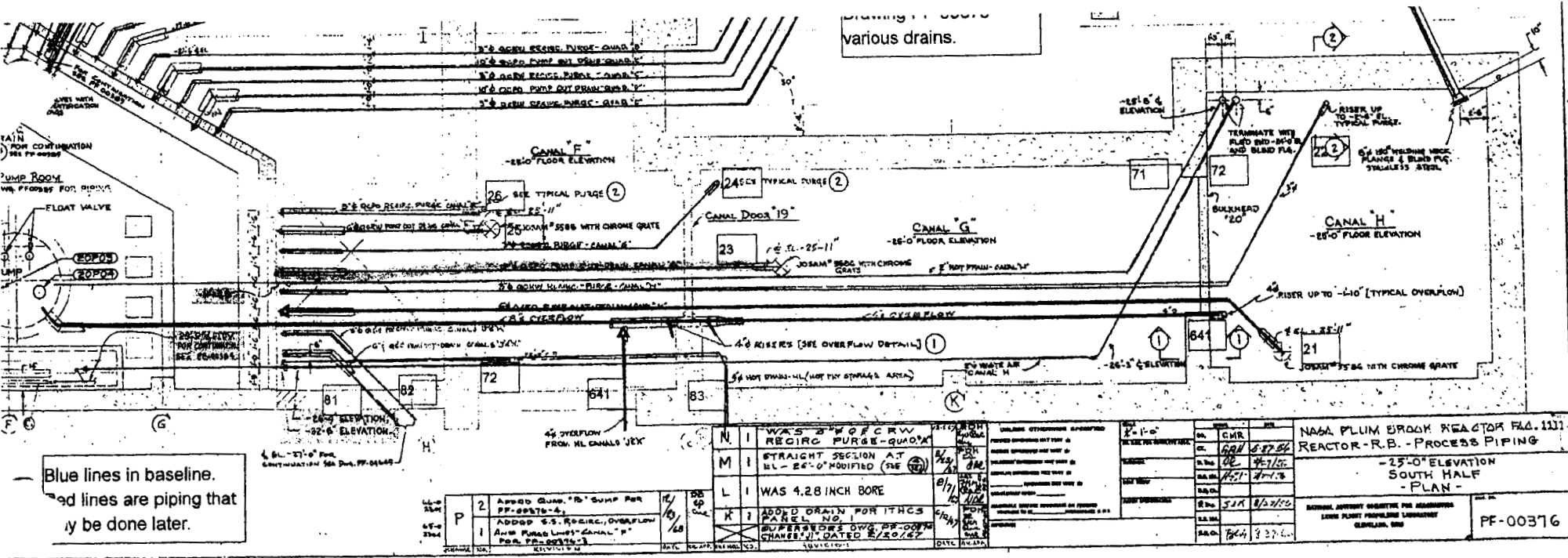
1.23

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	13	13	n/a	n/a
12	12	1	21	21		
13	13	1	15	15		
14	14	1	12	12		
15	15	1	17	17		
16	16	1	12	12		
17	17	1	11	11		
18	18	1	7	7		
19	19	1	11	11		
20	20	1	6	6		
21	21	1	12	12		
22	22	1	15	15		
23	23	1	11	11		
24	24	1	12	12		
25	25	1	13	13		
26	26	1	6	6		
27	27	1	14	14		
28	28	1	12	12		
29	29	1	14	14		
30	30	1	12	12		
31	31	1	7	7		
32	32	1	12	12		
33	33	1	6	6		
34	34	1	13	13		
35	35	1	14	14		
36	36	1	10	10		
37	37	1	8	8		
38	38	1	9	9		
39	39	1	8	8		
40	40	1	14	14		
41	41	1	12	12		
42	42	1	16	16		
n/a						

Package Page 2 of 2

REFERENCE COPY

**REFERENCE COPY**



ID # 1.23

1-4-06

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

### DQA Check Sheet




Design #	EP 1.23	Revision #	Original				
Survey Unit #	EP 1.23						
<b>Preliminary Data Review</b>							
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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			
<b>Graphical Data Review</b>							
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	
<b>Data Analysis</b>							
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?						X	
Comments:							
FSS/Characterization Engineer (print/sign)				<i>Dale Randolph</i>		Date	6-12-07
FSS/ Characterization Manager (print/sign)				<i>R. Case</i>		Date	8/23/07

Form  
CS-09/2  
Rev 0



**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP 1.395	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	EP 1.395			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit EP 1.395 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF). The survey unit consists of a piping run between the drain from Quad "A" in the Containment Building to the -25 ft of the Rx Building in Pump Room #22.</p> <p>2) EP 1.395 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.395 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: center;"><b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-11-07	
Technical Reviewer (FSS/Characterization Engineer)			7-11-07	
FSS/Characterization Manager	 R. Case		8/23/07	

Form  
CS-09/1  
Rev 0

Survey Unit: 1.395

## 1.0 History/Description

- 1.1 EP 1.395 was the Quad A Drain.
- 1.2 The subject pipe is the drain from Quad "A" in the Containment Building to the -25 ft of the Rx Building in Pump Room #22. The function of this pipe was to convey water from Quad "A" in the Containment Building to the HD sump in Pump Room #22 on the Rx Building -25 ft, where the pipe is currently breached.
- 1.3 EP 1.395 consists of 36 linear feet (') of 10 inch (") Inside Diameter (ID) piping and 9' of 6" ID piping from the breach point starting in Pump Room #22 to the floor drain in Quad "A", involving one slight bend of approximately 10°. The total piping for EP 1.395 is 45'.

## 2.0 Survey Design Information

- 2.1 EP 1.395 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 10" and 6" ID pipe was accessible for survey. The accessible 10" and 6" ID pipe was surveyed by static measurement at one foot increments, for a total of 45 survey measurements.
- 2.3 Surface area for the 10" ID piping is 2,432 cm<sup>2</sup> for each foot of piping, corresponding to a total 10" ID piping surface area of 87,552 cm<sup>2</sup> (8.8 m<sup>2</sup>) for the entire length of (36') of 10" piping.
- 2.4 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 13,131 cm<sup>2</sup> (1.3 m<sup>2</sup>) for the entire length (9') of 6" piping.
- 2.5 Total surface area for both the 10" and 6" piping that constitutes EP 1.395 is 10.1 m<sup>2</sup>.

## 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 All measurement results 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.

Survey Unit: 1.395

- 5.3 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

5.4 Statistical Summary Table

Statistical Parameter	10" Pipe	6" Pipe
Total Number of Survey Measurements	36	9
Number of Measurements >MDC	0	0
Number of Measurements Above 50% of DCGL	0	0
Number of Measurements Above DCGL	0	0
Mean	0.013	0.002
Median	0.011	0.002
Standard Deviation	0.004	0.000
Maximum	0.026	0.002
Minimum	0.008	0.001

- 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 EP 1.395 to be less than 1 mrem/yr. The dose contribution is estimated to be less than 0.011 mrem/yr based on the average of the actual gross counts measured.

7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.395 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.395	Survey Location	-27 TRENCH	
Survey Date	12-7-06/12-8-06/12-23-06	2350-1 #	203488/134738	
Survey Time	1345/1030/1020	Detector-Sled #	BICRON G3/G3/1MG1	
Pipe Size	10"/6"	Detector Efficiency	0.003	0.002
DCGL (dpm/100cm <sup>2</sup> )	240800	Pipe Area Incorporated by Detector Efficiency (ln cm <sup>2</sup> )	2432	1459
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	10.1	BKG (cpm)	496/418/17.6	
Routine Survey	X	MDCR (cpm)	79.8/73.5/17.4	
QA Survey		MDC (dpm/100cm <sup>2</sup> )	13177/13177/333	
Survey Measurement Results			10" PIPE	6" PIPE
Total Number of Survey Measurements			36	9
Number of Measurements >MDC			0	0
Number of Measurements Above 50% DCGL			0	0
Number of Measurements Above DCGL			0	0
Mean			0.013	0.002
Median			0.011	0.002
Standard Deviation			0.004	0.000
Maximum			0.026	0.002
Minimum			0.008	0.001
Survey Technician(s)	ROSENHAGEN			
Survey Unit Classification			1	
TBD 06-004 Piping Group			2	
SR-13 Radionuclide Distribution Sample			EP 2-1	
Measured Nuclide			Co60	
Area Factor/EMC Used			No	
Pass/Fail FSS			Pass	
MREM/YR Contribution			<1	
COMMENTS: ACTIVITY VALUES NOT BACKGROUND CORRECTED				
RP Engineer   Date		Orel Grubish 6-11-07		

**EP 1.395**  
**10" Pipe**  
**TBD 06-004 Group 2**

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	443	443	147,667	6,072	3,151	50	36	3	176	0.026
2	337	337	112,333	4,619	2,397	38	27	2	134	0.020
3	261	261	87,000	3,577	1,857	30	21	2	104	0.016
4	261	261	87,000	3,577	1,857	30	21	2	104	0.016
5	234	234	78,000	3,207	1,665	27	19	2	93	0.014
6	277	277	92,333	3,797	1,970	32	22	2	110	0.016
7	254	254	84,667	3,481	1,807	29	21	2	101	0.015
8	264	264	88,000	3,618	1,878	30	21	2	105	0.016
9	275	275	91,667	3,769	1,956	31	22	2	109	0.016
10	237	237	79,000	3,248	1,686	27	19	2	94	0.014
11	291	291	97,000	3,988	2,070	33	24	2	116	0.017
12	296	296	98,667	4,057	2,106	34	24	2	118	0.018
13	270	270	90,000	3,701	1,921	31	22	2	107	0.016
14	231	231	77,000	3,166	1,643	26	19	2	92	0.014
15	184	184	61,333	2,522	1,309	21	15	1	73	0.011
16	135	135	45,000	1,850	960	15	11	1	54	0.008
17	145	145	48,333	1,987	1,031	16	12	1	58	0.009
18	172	172	57,333	2,357	1,224	20	14	1	68	0.010
19	155	155	51,667	2,124	1,103	18	13	1	62	0.009
20	178	178	59,333	2,440	1,266	20	14	1	71	0.011
21	160	160	53,333	2,193	1,138	18	13	1	64	0.010
22	179	179	59,667	2,453	1,273	20	14	1	71	0.011
23	188	188	62,667	2,577	1,337	21	15	1	75	0.011
24	151	151	50,333	2,070	1,074	17	12	1	60	0.009
25	151	151	50,333	2,070	1,074	17	12	1	60	0.009
26	157	157	52,333	2,152	1,117	18	13	1	62	0.009
27	150	150	50,000	2,056	1,067	17	12	1	60	0.009
28	167	167	55,667	2,289	1,188	19	14	1	66	0.010
29	186	186	62,000	2,549	1,323	21	15	1	74	0.011
30	152	152	50,667	2,083	1,081	17	12	1	60	0.009
31	193	193	64,333	2,645	1,373	22	16	1	77	0.011
32	155	155	51,667	2,124	1,103	18	13	1	62	0.009

**EP 1.395**  
**10" Pipe**  
**TBD 06-004 Group 2**

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
33	170	170	56,667	2,330	1,209	19	14	1	68	0.010
34	179	179	59,667	2,453	1,273	20	14	1	71	0.011
35	176	176	58,667	2,412	1,252	20	14	1	70	0.010
36	166	166	55,333	2,275	1,181	19	13	1	66	0.010
									MEAN	0.013
									MEDIAN	0.011
									STD DEV	0.004
									MAX	0.026
									MIN	0.008



EP 1.395  
6" Pipe  
TBD 06-004 Group 2

Measurement #	gcpm	ncpm	Co-60 activity (total dpm)	Co-60 activity (dpm/100cm <sup>2</sup> )	Cs-137 activity (dpm/100cm <sup>2</sup> )	Eu-152 activity (dpm/100cm <sup>2</sup> )	Eu-154 activity (dpm/100cm <sup>2</sup> )	Nb-94 activity (dpm/100cm <sup>2</sup> )	Ag-108m activity (dpm/100cm <sup>2</sup> )	Unity
1	12	12	6,000	411	213	3	2	0	12	0.002
2	15	15	7,500	514	267	4	3	0	15	0.002
3	12	12	6,000	411	213	3	2	0	12	0.002
4	15	15	7,500	514	267	4	3	0	15	0.002
5	7	7	3,500	240	125	2	1	0	7	0.001
6	13	13	6,500	446	231	4	3	0	13	0.002
7	13	13	6,500	446	231	4	3	0	13	0.002
8	10	10	5,000	343	178	3	2	0	10	0.001
9	8	8	4,000	274	142	2	2	0	8	0.001
									MEAN	0.002
									MEDIAN	0.002
									STD DEV	0.000
									MAX	0.002
									MIN	0.001

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

# Pipe Interior Radiological Survey Form

Date: 12-7-05 Time: 1345  
 Building: Rx Bldg Elevation: -25 Access Point Area: TRENCH  
 System: QUAD A / PUMP OUT DRAIN Pipe Diameter: 10" Pipe ID # 1.395  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 10 inch  
 Detector: G3/BICRON Detector ID #: A689X-111  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 494 cpm  
 MDCR<sub>static</sub> 79.8 cpm  
 Efficiency Factor for Pipe Diameter 0.003 (taken from detector efficiency determination calibration certificate)  
 MDC<sub>static</sub> 13177 dpm/100cm<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: INITIAL SURVEY

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 12-7-05 Time: 1345

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	1	443	443	-53	n/a
2	2	1	337	337	-159	
3	3	1	261	261	-235	
4	4	1	261	261	-235	
5	5	1	234	234	-262	
6	6	1	277	277	-219	
7	7	1	254	254	-242	
8	8	1	264	264	-232	
9	9	1	275	275	-221	
10	10	1	237	237	-259	

Package Page 1 of 2

**Pipe Interior Radiological Survey Form (Continuation Form)**

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	291	291	-205	n/a
12	12	1	296	296	-200	
13	13	1	270	270	-226	
14	14	1	231	231	-265	
15	15	1	184	184	-317	
16	16	1	135	135	-361	
17	17	1	145	145	-351	
18	18	1	172	172	-324	
19	19	1	155	155	-341	
20	20	1	178	178	-318	
21	21	1	160	160	-336	
22	22	1	179	179	-317	
23	23	1	188	188	-308	
24	24	1	151	151	-345	
25	25	1	151	151	-345	
26	26	1	157	157	-339	
27	27	1	150	150	-346	
28	28	1	167	167	-329	
29	29	1	186	186	-310	
30	30	1	152	152	-344	
31	31	1	193	193	-303	
32	32	1	155	155	-341	
33	33	1	170	170	-326	
34	34	1	179	179	-317	
35	35	1	176	176	-320	
n/a						

Package Page 2 of 2



# Pipe Interior Radiological Survey Form

Date: 12-8-05 Time: 1030  
 Building: RX BLDG Elevation: -25 Access Point Area: TRENCH  
 System: QUAD A / PUMP OUT DRAIN Pipe Diameter: 10" Pipe ID #: 1.395  
 Type of Survey Investigation Characterization Final Survey Other \_\_\_\_\_  
 Sled Size 10 inch  
 Detector: G3/DICRON Detector ID #: A689X-111  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 418 cpm

MDCR<sub>static</sub> 73.5 cpm

Efficiency Factor for Pipe Diameter 0.003

(taken from detector ~~calibration certificate~~ *efficiency determination*) *ju*

MDC<sub>static</sub> 13177 dpm/100cm<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: CONTINUATION OF PIPE SURVEY FROM 35'

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 12-8-05 Time: 1030

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	36	1	166	166	-252	n/a
2						
3						
4						
5						
6						
7						
8						
9						
10						

Package Page 1 of 1



# **Pipe Interior Radiological Survey Form**

Date: 12.23.05 Time: 1020  
 Building: REACTOR Elevation: -25 Access Point Area: QUAD A  
 System: QUAD A DRAIN Pipe Diameter: 10" Pipe ID # 1-395 A+B  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 6" inch  
 Detector: BICRON (M6) Detector ID #: LV5-1-107  
 Cal Date: 20-DEC-05 Cal Due Date: 20-DEC-06  
 Instrument: 2350-1 Instrument ID #: 134738  
 Cal Date: 20-DEC-05 Cal Due Date: 20-DEC-06

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

Background Value 17.4 cpm  
 MDCR<sub>static</sub> 17.4 cpm  
 Efficiency Factor for Pipe Diameter 0.002 (taken from detector ~~calibration certificate~~ <sup>efficiency determination</sup>)  
 MDC<sub>static</sub> 333 dpm/100cm<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: POSITION 1 & 2 is HOLE A  
POSITION 4-10 is HOLE B

MSP / <sup>gm</sup> CONTAMINATION  
COMPLETELY  
DONE

## **Pipe Interior Radiological Survey**

Radiological Survey Commenced: Date: 12.23.05 Time: 1020

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1ft	1	12	12	n/a	n/a
2	2ft	1	15	15		
3	n/a	n/a	n/a	n/a		
4	1ft	1	12	12		
5	2ft	1	15	15		
6	3ft	1	7	7		
7	4ft	1	13	13		
8	5ft	1	13	13		
9	6ft	1	10	10		
10	7ft	1	8	8		

Package Page 1 of 1





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

### DQA Check Sheet

Design #	EP 1.395	Revision #	Original	
Survey Unit #	EP 1.395			

#### 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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?			X

Comments:

FSS/Characterization Engineer (print/sign)	<i>Dale Randall</i> <i>R. Case</i>	Date	6-11-07
FSS/ Characterization Manager (print/sign)		Date	8/28/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.12A-3	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.12A-3			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.12A-3 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.12A-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.</p> <p>3) Surveys in EP 1.12A-3 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 3-8 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 style="text-align: center;"><b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer	<i>Old Pembell</i>		8-17-07	
Technical Reviewer (FSS/Characterization Engineer)	<i>Wood</i>		8-21-07	
FSS/Characterization Manager	<i>Mr R. Case</i>		8/22/07	

Form  
CS-09/1  
Rev 0

Survey Unit: 1.12A-3

**1.0 History/Description**

1.1 The subject pipe system is the 3" diameter pipe associated with the Reactor Coolant System.

1.2 EP 1.12A-3 consists of approximately 48 feet of pipe.

**2.0 Survey Design Information**

2.1 EP 1.12A-3 was surveyed IAW Procedure #BSI/LVS-002.

2.2 100% of the 3" ID pipe was accessible for survey. The accessible 3" ID pipe was surveyed by static measurement at one foot increments, for a total of 48 survey measurements.

2.3 Surface area for the 3" ID piping is 730 cm<sup>2</sup> for each foot of piping, corresponding to a total 3" ID piping surface area of 35,024 cm<sup>2</sup> (3.5 m<sup>2</sup>) for the entire length of (48') of 3" 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 All measurement results 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.

5.3 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 1.12A-3 passes FSS.

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

### 5.5 Statistical Summary Table

Statistical Parameter	3" Pipe
Total Number of Survey Measurements	48
Number of Measurements >MDC	48
Number of Measurements Above 50% of DCGL	2
Number of Measurements Above DCGL	0
Mean	0.1835
Median	0.1399
Standard Deviation	0.1399
Maximum	0.8647
Minimum	0.0654

**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 EP 1.12A-3 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.184 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.12A-3 & Spreadsheet

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





## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.12A-3	Survey Location	-25 el. Quad C
Survey Date	01-Mar-06	2350-1 #	203488
Survey Time	12:50	Detector-Sled #	1MG1 LVS/101
Pipe Size	3"	Detector Efficiency	0.00045
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	730
Pipe Area Incorporated by Survey Date (m <sup>2</sup> )	3.5	Field BKG (cpm)	21.7
Routine Survey	X	Field MDCR (cpm)	19
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	2,399
Survey Measurement Results			
Total Number of Survey Measurements			48
Number of Measurements >MDC			48
Number of Measurements Above 50% DCGL			2
Number of Measurements Above DCGL			0
Mean			0.1835
Median			0.1399
Standard Deviation			0.1399
Maximum			0.8647
Minimum			0.0654
Survey Technician(s)		ROSENHAGEN	
Survey Unit Classification			1
TBD 06-004 Piping Group			1
SR-13 Radionuclide Distribution Sample			EP 3-8
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>Doc Randall</i> 8-17-07	

**EP 1.12A-3**  
**3" 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	36	36	80,000	10,964	435	10,401	2,765	320	76	0.065
2	47	47	104,444	14,314	567	13,578	3,610	418	100	0.085
3	48	48	106,667	14,619	579	13,867	3,687	427	102	0.087
4	81	81	180,000	24,669	978	23,401	6,221	720	172	0.147
5	63	63	140,000	19,187	760	18,201	4,839	560	134	0.114
6	88	88	195,556	26,801	1,062	25,424	6,759	782	187	0.160
7	75	75	166,667	22,842	905	21,668	5,760	667	159	0.136
8	66	66	146,667	20,101	797	19,068	5,069	587	140	0.120
9	81	81	180,000	24,669	978	23,401	6,221	720	172	0.147
10	84	84	186,667	25,583	1,014	24,268	6,451	747	178	0.153
11	115	115	255,556	35,024	1,388	33,224	8,832	1,022	244	0.209
12	123	123	273,333	37,460	1,485	35,535	9,447	1,093	261	0.223
13	79	79	175,556	24,060	954	22,823	6,067	702	168	0.144
14	106	106	235,556	32,283	1,280	30,624	8,141	942	225	0.193
15	315	315	700,000	95,935	3,802	91,005	24,193	2,800	669	0.572
16	118	118	262,222	35,938	1,424	34,091	9,063	1,049	250	0.214
17	237	237	526,667	72,180	2,861	68,470	18,202	2,106	503	0.431
18	140	140	311,111	42,638	1,690	40,447	10,752	1,244	297	0.254
19	164	164	364,444	49,947	1,980	47,380	12,596	1,458	348	0.298
20	78	78	173,333	23,755	942	22,535	5,991	693	166	0.142
21	61	61	135,556	18,578	736	17,623	4,685	542	129	0.111
22	93	93	206,667	28,324	1,123	26,868	7,143	827	197	0.169
23	58	58	128,889	17,664	700	16,756	4,455	515	123	0.105
24	218	218	484,444	66,393	2,631	62,981	16,743	1,937	463	0.396
25	53	53	117,778	16,141	640	15,312	4,071	471	112	0.096
26	63	63	140,000	19,187	760	18,201	4,839	560	134	0.114
27	100	100	222,222	30,456	1,207	28,890	7,680	889	212	0.182
28	64	64	142,222	19,492	773	18,490	4,915	569	136	0.116
29	62	62	137,778	18,882	748	17,912	4,762	551	132	0.113
30	88	88	195,556	26,801	1,062	25,424	6,759	782	187	0.160
31	105	105	233,333	31,978	1,267	30,335	8,064	933	223	0.191
32	476	476	1,057,778	144,969	5,746	137,518	36,558	4,230	1,010	0.865

**EP 1.12A-3**  
**3" 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
33	109	109	242,222	33,197	1,316	31,491	8,371	969	231	0.198
34	59	59	131,111	17,969	712	17,045	4,531	524	125	0.107
35	44	44	97,778	13,400	531	12,712	3,379	391	93	0.080
36	76	76	168,889	23,146	917	21,957	5,837	675	161	0.138
37	57	57	126,667	17,360	688	16,468	4,378	507	121	0.104
38	69	69	153,333	21,014	833	19,934	5,299	613	146	0.125
39	72	72	160,000	21,928	869	20,801	5,530	640	153	0.131
40	205	205	455,556	62,434	2,475	59,225	15,744	1,822	435	0.372
41	75	75	166,667	22,842	905	21,668	5,760	667	159	0.136
42	82	82	182,222	24,974	990	23,690	6,298	729	174	0.149
43	67	67	148,889	20,405	809	19,357	5,146	595	142	0.122
44	69	69	153,333	21,014	833	19,934	5,299	613	146	0.125
45	72	72	160,000	21,928	869	20,801	5,530	640	153	0.131
46	59	59	131,111	17,969	712	17,045	4,531	524	125	0.107
47	66	66	146,667	20,101	797	19,068	5,069	587	140	0.120
48	82	82	182,222	24,974	990	23,690	6,298	729	174	0.149
									MEAN	0.183
									MEDIAN	0.140
									STD DEV	0.140
									MAX	0.865
									MIN	0.065

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

## Pipe Interior Radiological Survey Form

Date: 3-1-06 Time: 1250  
 Pipe ID#: 1.12A Pipe Diameter: 3" Access Point Area: QUAD C VESSEL WALL  
 Building: RX Elevation: -25 QUAD C System: RIG HEADER  
 Type of Survey Investigation        Characterization        Final Survey X Other ✓ PRIMARY COOLING WATER SUPPLY  
 Gross        Co60 ✓ Cs         
 Detector ID# / Sled ID# Bicron IM61 / LV5-11 101  
 Detector Cal Date: 20-DEC-05 Detector Cal Due Date: 20-DEC-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Instrument Cal Date: 17-NOV-05 Instrument Cal Due Date: 17-NOV-06

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

Background Value 21.7 cpm

MDCR<sub>static</sub> 19 cpm

Efficiency Factor for Pipe Diameter 0.00045 (from detector efficiency determination)

MDC<sub>static</sub> 2399 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: INITIAL SURVEY

Technician Signature *[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	36	36	n/a	n/a
2	2	↓	47	47	↓	↓
3	3		48	48		
4	4		81	81		
5	5		63	63		
6	6		88	88		
7	7		75	75		
8	8		66	66		
9	9		81	81		
10	10		84	84		

Package Page 1 of 4

REFERENCE COPY

## Pipe Interior Radiological Survey Form (Continuation Form)

Date: 3-1-06 Pipe ID#: 1-12 Pipe Diameter: 3" Access Point Area: QUAD C  
 Building: RX Elevation: -25 QUAD C System: 15ft up vessel WALL  
Ring Header

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	115	115	n/a	n/a
12	12	↓	123	123	↓	↓
13	13		79	79		
14	14		106	106		
15	15		315	315		
16	16		118	118		
17	17		237	237		
18	18		140	140		
19	19		164	164		
20	20		78	78		
21	21		61	61		
22	22		93	93		
23	23		58	58		
24	24		218	218		
25	25		53	53		
26	26		63	63		
27	27		100	100		
28	28		64	64		
29	29		62	62		
30	30		88	88		
31	31		105	105		
32	32		476	476		
33	33		109	109		
34	34		59	59		
35	35		44	44		
36	36		76	76		
37	37		57	57		
38	38		69	69		
39	39		72	72		
40	40		205	205		
41	41		75	75		
42	42		82	82		
43	43		67	67		
44	44		69	69		
45	45	✓	72	72	↓	↓

Package Page 2 of 4

REFERENCE COPY

## Pipe Interior Radiological Survey Form (Continuation Form)

Date: 3-1-06 Pipe ID#: 1012 Pipe Diameter: 3" Access Point Area: QUAD C  
Building: Rx Elevation: -25 QUAD C System: 15ft up vessel  
Ring Header

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
46	46	1	59	59	n/a	n/a
47	47	1	66	66	↓	↓
48	48	1	82	82	↓	↓
n/a						

Package Page 3 of 4

**REFERENCE COPY**

Attachment 3, Page 2





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

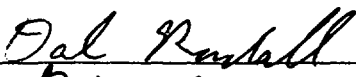


### DQA Check Sheet

Design #	EP 1.12A-3	Revision #	Original			
Survey Unit #	EP 1.12A-3					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)				<i>Dale Randolph Dal Ruskall</i>		Date 8-17-07
FSS/ Characterization Manager (print/sign)				<i>[Signature]</i> B. Case		Date 8/22/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-1.21	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.21			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.21 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.21 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.21 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: right; font-size: 2em; font-weight: bold;">COPY</p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-11-07	
Technical Reviewer (FSS/Characterization Engineer)			7-11-07	
FSS/Characterization Manager			8/22/07	

Form  
CS-09/1  
Rev 0

## Survey Unit: 1.21

**1.0 History/Description**

- 1.1 The subject pipe is the floor drain line from Canal "H" to the -25 ft of the Rx Building in Pump Room #22. The function of this pipe was to convey water from a floor drain located in the southwestern most corner of Canal "H" to the HD sump in Pump Room #22 on the Rx Building -25 ft.
- 1.2 EP 1.21 consists of 80 linear feet (') of 6 inch (") Inside Diameter (ID) piping from the breach point in Pump Room #22 to the floor drain in Canal "H", involving one elbow of approximately 45°.

**2.0 Survey Design Information**

- 2.1 EP 1.21 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 6" ID pipe was accessible for survey. The accessible 6" ID pipe was surveyed by static measurement at one foot increments, for a total of 80 survey measurements.
- 2.3 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 116,720 cm<sup>2</sup> (11.6 m<sup>2</sup>) for the entire length of (80') of 6" 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 All measurement results 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.
- 5.3 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 1.21 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	6" Pipe
Total Number of Survey Measurements	80
Number of Measurements >MDC	52
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.002
Median	0.002
Standard Deviation	0.001
Maximum	0.004
Minimum	0.001

**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 EP 1.21 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.002 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.21 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.21	Survey Location	-27 TRENCH
Survey Date	1-4-06/1-5-06/3-9-06	2350-1 #	134708/134738/203488
Survey Time	1310/1010/0900	Detector-Sled #	BICRON 1MG1
Pipe Size	6"	Detector Efficiency	0.002
DCGL (dpm/100cm2)	240800	Pipe Area Incorporated by Detector Efficiency (ln cm2)	1459
Pipe Area Incorporated by Survey Data (sq ft)	11.6	Field BKG (cpm)	20.8/19.2/19.5
Routine Survey	X	Field MDCR (cpm)	18.5/22.1/18.2
QA Survey		Nominal MDC (dpm/100cm2)	333
Survey Measurement Results			
Total Number of Survey Measurements		80	
Number of Measurements >MDC		52	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.002	
Median		0.002	
Standard Deviation		0.001	
Maximum		0.004	
Minimum		0.001	
Survey Technician(s)		ROSENHAGEN	
Survey Unit Classification		1	
TBD 06-004 Piping Group		2	
SR-13 Radionuclide Distribution Sample		EP 2-1	
Measured Nuclide		Co60	
Area Factor/EMC Used		No	
Pass/Fail FSS		Pass	
MREM/YR Contribution		<1	
COMMENTS: ACTIVITY VALUES NOT BACKGROUND CORRECTED			
RP Engineer   Date		Dale Marshall 6-11-07	



**EP 1.21**  
**TBD 06-004 Group 2**

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	24	24	12,000	822	427	7	5	0	24	0.004
2	21	21	10,500	720	374	6	4	0	21	0.003
3	8	8	4,000	274	142	2	2	0	8	0.001
4	9	9	4,500	308	160	3	2	0	9	0.001
5	11	11	5,500	377	196	3	2	0	11	0.002
6	14	14	7,000	480	249	4	3	0	14	0.002
7	10	10	5,000	343	178	3	2	0	10	0.001
8	11	11	5,500	377	196	3	2	0	11	0.002
9	13	13	6,500	446	231	4	3	0	13	0.002
10	10	10	5,000	343	178	3	2	0	10	0.001
11	17	17	8,500	583	302	5	3	0	17	0.003
12	17	17	8,500	583	302	5	3	0	17	0.003
13	6	6	3,000	206	107	2	1	0	6	0.001
14	12	12	6,000	411	213	3	2	0	12	0.002
15	10	10	5,000	343	178	3	2	0	10	0.001
16	8	8	4,000	274	142	2	2	0	8	0.001
17	12	12	6,000	411	213	3	2	0	12	0.002
18	7	7	3,500	240	125	2	1	0	7	0.001
19	11	11	5,500	377	196	3	2	0	11	0.002
20	8	8	4,000	274	142	2	2	0	8	0.001
21	9	9	4,500	308	160	3	2	0	9	0.001
22	5	5	2,500	171	89	1	1	0	5	0.001
23	12	12	6,000	411	213	3	2	0	12	0.002
24	13	13	6,500	446	231	4	3	0	13	0.002
25	6	6	3,000	206	107	2	1	0	6	0.001
26	12	12	6,000	411	213	3	2	0	12	0.002
27	14	14	7,000	480	249	4	3	0	14	0.002
28	6	6	3,000	206	107	2	1	0	6	0.001
29	11	11	5,500	377	196	3	2	0	11	0.002
30	12	12	6,000	411	213	3	2	0	12	0.002
31	9	9	4,500	308	160	3	2	0	9	0.001
32	14	14	7,000	480	249	4	3	0	14	0.002
33	10	10	5,000	343	178	3	2	0	10	0.001
34	12	12	6,000	411	213	3	2	0	12	0.002

**EP 1.21**  
**TBD 06-004 Group 2**

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
35	13	13	6,500	446	231	4	3	0	13	0.002
36	17	17	8,500	583	302	5	3	0	17	0.003
37	12	12	6,000	411	213	3	2	0	12	0.002
38	13	13	6,500	446	231	4	3	0	13	0.002
39	9	9	4,500	308	160	3	2	0	9	0.001
40	13	13	6,500	446	231	4	3	0	13	0.002
41	10	10	5,000	343	178	3	2	0	10	0.001
42	8	8	4,000	274	142	2	2	0	8	0.001
43	11	11	5,500	377	196	3	2	0	11	0.002
44	12	12	6,000	411	213	3	2	0	12	0.002
45	6	6	3,000	206	107	2	1	0	6	0.001
46	11	11	5,500	377	196	3	2	0	11	0.002
47	12	12	6,000	411	213	3	2	0	12	0.002
48	11	11	5,500	377	196	3	2	0	11	0.002
49	12	12	6,000	411	213	3	2	0	12	0.002
50	12	12	6,000	411	213	3	2	0	12	0.002
51	10	10	5,000	343	178	3	2	0	10	0.001
52	7	7	3,500	240	125	2	1	0	7	0.001
53	14	14	7,000	480	249	4	3	0	14	0.002
54	9	9	4,500	308	160	3	2	0	9	0.001
55	13	13	6,500	446	231	4	3	0	13	0.002
56	6	6	3,000	206	107	2	1	0	6	0.001
57	6	6	3,000	206	107	2	1	0	6	0.001
58	9	9	4,500	308	160	3	2	0	9	0.001
59	7	7	3,500	240	125	2	1	0	7	0.001
60	10	10	5,000	343	178	3	2	0	10	0.001
61	8	8	4,000	274	142	2	2	0	8	0.001
62	10	10	5,000	343	178	3	2	0	10	0.001
63	6	6	3,000	206	107	2	1	0	6	0.001
64	14	14	7,000	480	249	4	3	0	14	0.002
65	10	10	5,000	343	178	3	2	0	10	0.001
66	12	12	6,000	411	213	3	2	0	12	0.002
67	10	10	5,000	343	178	3	2	0	10	0.001
68	6	6	3,000	206	107	2	1	0	6	0.001

**EP 1.21**  
**TBD 06-004 Group 2**

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
69	16	16	8,000	548	285	5	3	0	16	0.002
70	8	8	4,000	274	142	2	2	0	8	0.001
71	7	7	3,500	240	125	2	1	0	7	0.001
72	9	9	4,500	308	160	3	2	0	9	0.001
73	9	9	4,500	308	160	3	2	0	9	0.001
74	11	11	5,500	377	196	3	2	0	11	0.002
75	12	12	6,000	411	213	3	2	0	12	0.002
76	11	11	5,500	377	196	3	2	0	11	0.002
77	10	10	5,000	343	178	3	2	0	10	0.001
78	18	18	9,000	617	320	5	4	0	18	0.003
79	14	14	7,000	480	249	4	3	0	14	0.002
80	8	8	4,000	274	142	2	2	0	8	0.001
									MEAN	0.002
									MEDIAN	0.002
									STD DEV	0.001
									MAX	0.004
									MIN	0.001

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

# Pipe Interior Radiological Survey Form

Date: 13 1.4.06 Time: 13.10  
 Building: REACTOR Elevation: -25 Access Point Area: -27 TAEWCH  
 System: CANAL & DRAIN Pipe Diameter: 6" Pipe ID #: 1.21  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 6" inch  
 Detector: BICRON 1M61 Detector ID #: CVS-1-107  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06  
 Instrument: 2350-1 Instrument ID #: 104708  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06

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

Background Value 20.8 cpm  
 MDCR<sub>static</sub> 18.5 cpm  
 Efficiency Factor for Pipe Diameter 0.002 (taken from detector efficiency determination calibration certificate) gm  
 MDC<sub>static</sub> 333 dpm/100cm<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: INITIAL SURVEY: NOTE HAD TO STOP DUE TO  
STANDING WATER @ SOFT  
SSP / INITIAL NOT COMPLETE

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1.4.06 Time: 1310

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1 FT	1	24	24	112	112
2	2	1	21	21	1	1
3	3	1	8	8	1	1
4	4	1	9	9	1	1
5	5	1	11	11	1	1
6	6	1	14	14	1	1
7	7	1	10	10	1	1
8	8	1	11	11	1	1
9	9	1	13	13	1	1
10	10	1	10	10	1	1

Package Page 1 of 2

Pipe Interior Radiological Survey Form (Continuation Form)

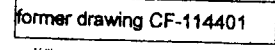
1-21

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	17	17	n/a	n/a
12	12		17	17		
13	13		6	6		
14	14		12	12		
15	15		10	10		
16	16		8	8		
17	17		12	12		
18	18		7	7		
19	19		11	11		
20	20		8	8		
21	21		9	9		
22	22		5	5		
23	23		12	12		
24	24		13	13		
25	25		6	6		
26	26		12	12		
27	27		14	14		
28	28		6	6		
29	29		11	11		
30	30		12	12		
31	31		9	9		
32	32		14	14		
33	33		10	10		
34	34		12	12		
35	35		13	13		
36	36		17	17		
37	37		12	12		
38	38		13	13		
39	39		9	9		
40	40		13	13		
41	41		10	10		
42	42		8	8		
43	43		11	11		
44	44		12	12		
45	45		6	6		
46	46		11	11		
47	47		12	12		

Package Page 2 of 2

REFERENCE COPY

**REFERENCE COPY**



Blue lines in baseline.  
Red lines are piping that  
may be done later.

1.5-04

= PIPE SURVEYING

1.0 AF 1.2.1

# Pipe Interior Radiological Survey Form

Date: 1.5.06 Time: 1010  
 Building: REACTOR Elevation: -25 Access Point Area: -27 TRENCH  
 System: CANAL H. DRAIN Pipe Diameter: 6" Pipe ID #: 1.21  
 Type of Survey Investigation Characterization Final Survey Other /  
 Sled Size 6" inch  
 Detector: BICRON 1M61 Detector ID #: LV5-1-107  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06  
 Instrument: 9350-1 Instrument ID #: 134738  
 Cal Date: 12-20-05 Cal Due Date: 12-20-06

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

Background Value 19.2 cpm  
 MDCR<sub>static</sub> 22.1 cpm  
 Efficiency Factor for Pipe Diameter 0.002 (taken from detector calibration certificate) *efficiency determination*  
 MDC<sub>static</sub> 333 dpm/100cm<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: CONTINUATION Survey

SSP / NOT  
COMPLETE

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1.5.06 Time: 1010

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	48	1	11	11	N/A	N/A
2	49	1	12	12		
3	50	1	12	12		
4	51	1	10	10		
5	52	1	9	9		
6	53	1	14	14		
7	54	1	9	9		
8	55	1	13	13		
9	56	1	6	6		
10	57	1	6	6		

Package Page 1 of 2



Pipe Interior Radiological Survey Form (Continuation Form)

1.21

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	58	1	9	9	N/A	N/A
12	59	1	7	7		
13	60	1	10	10		
14	61	1	8	8		
15	62	1	10	10		
16	63	1	6	6		
17	64	1	14	14		
18	65	1	10	10		
19	66	1	12	12		
20	67	1	10	10		
21	68	1	6	6		
22	69	1	16	16		
23	70	1	8	8		
24	71	1	7	7		
25	72	1	9	9		
26	73	1	9	9		
27	74	1	11	11		
28	75	1	12	12		
29	76	1	11	11		
30	77	1	10	10		
N/A						

REFERENCE COPY





### Pipe Interior Radiological Survey Form

Date: 3-9-06 Time: 0900  
 Pipe ID#: 1-21 Pipe Diameter: 6" Access Point Area: -25<sup>sq</sup> CANAL H  
 Building: RK Elevation: -25 System: CANAL H DRAIN  
 Type of Survey Investigation        Characterization        Final Survey X Other ✓  
 Gross        Co60 ✓ Cs         
 Detector ID# / Sled ID# BROOK 1161 / LVS-1 1 107  
 Detector Cal Date: 20-DEC-05 Detector Cal Due Date: 20-DEC-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Instrument Cal Date: NOV 17 - 05 Instrument Cal Due Date: NOV 17 - 06

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

Background Value 19.5 cpm  
 MDCR<sub>static</sub> 18.2 cpm  
 Efficiency Factor for Pipe Diameter 0.002 (from detector efficiency determination)  
 MDC<sub>static</sub> 333 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: CONTINUATION SURVEY

Technician Signature *[Signature]* complete

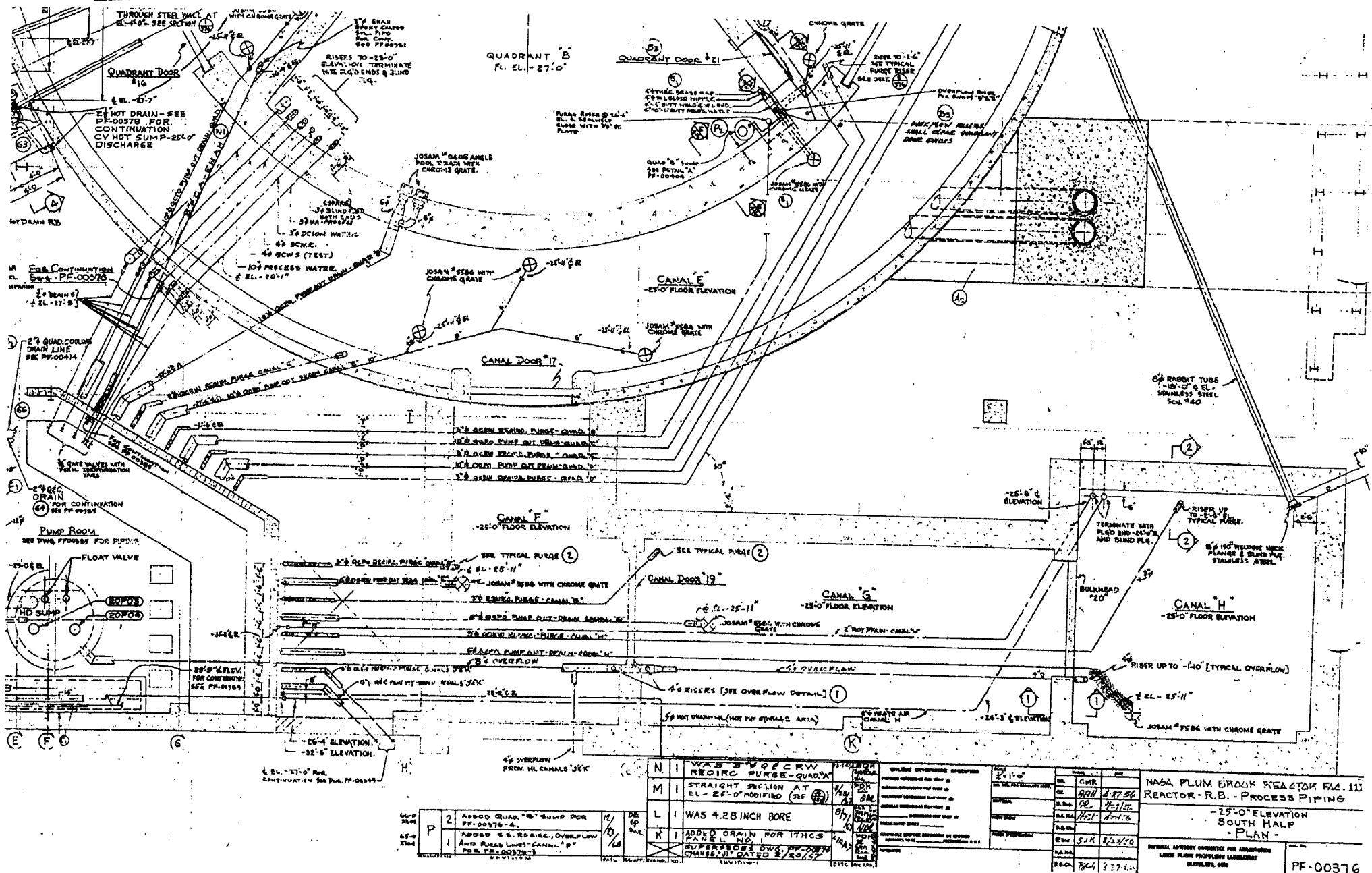
### Pipe Interior Radiological Survey

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	<u>1</u>	<u>1</u>	<u>18</u>	<u>18</u>	<u>n/a</u>	<u>n/a</u>
2	<u>2</u>	<u>1</u>	<u>14</u>	<u>14</u>		
3	<u>3</u>	<u>1</u>	<u>8</u>	<u>8</u>		
4						
5						
6						
7						
8						
9						
10						

Package Page 1 of 2

REFERENCE COPY

**REFERENCE COPY**



Pages  
2 of 2

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



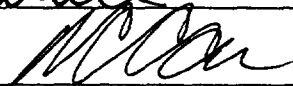
### DQA Check Sheet

Design #	EP 1.21	Revision #	Original			
Survey Unit #	EP 1.21					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)				<i>Dale Randall</i> <i>Dale Randall</i>		Date 6-11-07
FSS/ Characterization Manager (print/sign)				<i>R. Case</i> <i>R. Case</i>		Date 8/22/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP 1.34	<b>Revision #</b>	Original	<b>Page 1 of 2</b>
<b>Survey Unit #(s)</b>	EP 1.34			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit EP 1.34 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF). The survey unit consists of a piping run between an open flange in the -27 trench and drain openings in Quad C.</p> <p>2) EP 1.34 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.34 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: center;"><b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-11-07	
Technical Reviewer (FSS/Characterization Engineer)			7-11-07	
FSS/Characterization Manager			8/22/07	
	R. Case			

Form  
CS-09/1  
Rev 0



Survey Unit: 1.34

**1.0 History/Description**

- 1.1 EP 1.34 was the Quad C Drain.
- 1.2 EP 1.34 consists of 87 linear feet (') of 10 inch (") Inside Diameter (ID) piping starting in the -27 foot elevation trench and running to Quad C. In Quad C the piping reduces to 6" prior to ending in two floor drains. There is 3' of 6" piping downstream of one of these floor drains and 6' of 6" piping downstream of the other floor drain. The total piping for EP 1.34 is 96'.

**2.0 Survey Design Information**

- 2.1 EP 1.34 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 10" and 6" ID pipe was accessible for survey. The accessible 10" and 6" ID pipe was surveyed by static measurement at one foot increments, for a total of 96 survey measurements.
- 2.3 Surface area for the 10" ID piping is 2,432 cm<sup>2</sup> for each foot of piping, corresponding to a total 10" ID piping surface area of 211,584 cm<sup>2</sup> (21.2 m<sup>2</sup>) for the entire length of (87') of 10" piping.
- 2.4 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 13,131 cm<sup>2</sup> (1.3 m<sup>2</sup>) for the entire length (9') of 6" piping.
- 2.5 Total surface area for both the 10" and 6" piping that constitutes EP 1.34 is 22.5 m<sup>2</sup>.

**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 All measurement results 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.
- 5.3 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 1.34 passes FSS.

FSS Design # EP 1.34	Revision # Original	Page 3 of 3
Survey Unit: 1.34		

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

5.5 Statistical Summary Table

Statistical Parameter	10" Pipe	6" Pipe
Total Number of Survey Measurements	87	9
Number of Measurements >MDC	3	8
Number of Measurements Above 50% of DCGL	0	0
Number of Measurements Above DCGL	0	0
Mean	0.02	0.003
Median	0.02	0.003
Standard Deviation	0.01	0.001
Maximum	0.11	0.006
Minimum	0.01	0.001

- 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 EP 1.34 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.023 mrem/yr based on the average of the actual gross counts measured.

7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report  
Attachment 2 – Pipe Interior Radiological Survey Form  
Attachment 3 – DQA Worksheet  
Attachment 4 –Disc containing RR for EP 1.34 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.34		Survey Location	-27 TRENCH
Survey Date	25-Jan-07		2350-1 #	189094
Survey Time	0823		Detector-Sled #	LVS1-107
Pipe Size	6"		Detector Efficiency	0.002
DCGL (dpm/100cm <sup>2</sup> )	240800		Pipe Area Incorporated by Detector Efficiency (ln cm <sup>2</sup> )	1459
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	1.3		Field BKG (cpm)	4
Routine Survey	X		Field MDCR (cpm)	15
QA Survey			Nominal MDC (dpm/100cm <sup>2</sup> )	333

### Survey Measurement Results

Total Number of Survey Measurements	9
Number of Measurements >MDC	8
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.003
Median	0.003
Standard Deviation	0.001
Maximum	0.006
Minimum	0.001

Survey Technician(s)	STOCK
----------------------	-------

Survey Unit Classification	1
TBD 06-004 Piping Group	2
SR-13 Radionuclide Distribution Sample	EP 2-1
Measured Nuclide	Co60
Area Factor/EMC Used	No
Pass/Fail FSS	Pass
MREM/YR Contribution	<1

COMMENTS:  
ACTIVITY VALUES NOT BACKGROUND CORRECTED

RP Engineer   Date	<i>Dal Nussli</i> 6-11-07
--------------------	---------------------------

**EP 1.34**  
**TBD 06-004 Group 2**

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	40	40	20,000	1,371	711	11	8	1	40	0.006
2	10	10	5,000	343	178	3	2	0	10	0.001
3	17	17	8,500	583	302	5	3	0	17	0.003
4	21	21	10,500	720	374	6	4	0	21	0.003
5	19	19	9,500	651	338	5	4	0	19	0.003
6	16	16	8,000	548	285	5	3	0	16	0.002
7	5	5	2,500	171	89	1	1	0	5	0.001
8	25	25	12,500	857	445	7	5	0	25	0.004
9	15	15	7,500	514	267	4	3	0	15	0.002
Bkgd	0								MEAN	0.003
									MEDIAN	0.003
									STD DEV	0.001
									MAX	0.006
									MIN	0.001



## BSI EP/BP SURVEY REPORT

Pipe ID	1.34		Survey Location	-27 TRENCH
Survey Date	23-Jan-07		2350-1 #	189094
Survey Time	0845		Detector-Sled #	B566A-108
Pipe Size	10"		Detector Efficiency	0.003
DCGL (dpm/100cm <sup>2</sup> )	240800		Pipe Area Incorporated by Detector Efficiency (In cm <sup>2</sup> )	2432
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	21.2		Field BKG (cpm)	79
Routine Survey	X		Field MDCR <sup>(cpm)</sup> <sub>(counts)</sub>	34
QA Survey			Nominal MDC (dpm/100cm <sup>2</sup> )	11223

### Survey Measurement Results

Total Number of Survey Measurements	87
Number of Measurements >MDC	3
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.02
Median	0.02
Standard Deviation	0.01
Maximum	0.11
Minimum	0.01

Survey Technician(s)	STOCK
	FOWLER

Survey Unit Classification	1
TBD 05-006 Piping Group	2
SR-13 Radionuclide Distribution Sample	EP 2-1
Measured Nuclide	Co60
Area Factor/EMC Used	No
Pass/Fail FSS	Pass
MREM/YR Contribution	<1

COMMENTS:  
ACTIVITY VALUES NOT BACKGROUND CORRECTED

RP Engineer   Date	Dal Marshall 6-11-07
--------------------	----------------------

**EP 1.34**  
**TBD 06-004 Group 2**

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	384	384	128,000	5,263	2,732	44	31	3	153	0.02
2	411	411	137,000	5,633	2,924	47	33	3	163	0.02
3	637	637	212,333	8,731	4,531	72	52	4	253	0.04
4	590	590	196,667	8,087	4,197	67	48	4	235	0.04
5	291	291	97,000	3,988	2,070	33	24	2	116	0.02
6	257	257	85,667	3,522	1,828	29	21	2	102	0.02
7	214	214	71,333	2,933	1,522	24	17	1	85	0.01
8	240	240	80,000	3,289	1,707	27	19	2	95	0.01
9	221	221	73,667	3,029	1,572	25	18	1	88	0.01
10	194	194	64,667	2,659	1,380	22	16	1	77	0.01
11	224	224	74,667	3,070	1,593	25	18	2	89	0.01
12	249	249	83,000	3,413	1,771	28	20	2	99	0.01
13	236	236	78,667	3,235	1,679	27	19	2	94	0.01
14	200	200	66,667	2,741	1,423	23	16	1	79	0.01
15	216	216	72,000	2,961	1,537	25	17	1	86	0.01
16	188	188	62,667	2,577	1,337	21	15	1	75	0.01
17	207	207	69,000	2,837	1,472	24	17	1	82	0.01
18	265	265	88,333	3,632	1,885	30	21	2	105	0.02
19	225	225	75,000	3,084	1,601	26	18	2	89	0.01
20	209	209	69,667	2,865	1,487	24	17	1	83	0.01
21	226	226	75,333	3,098	1,608	26	18	2	90	0.01
22	212	212	70,667	2,906	1,508	24	17	1	84	0.01
23	202	202	67,333	2,769	1,437	23	16	1	80	0.01
24	239	239	79,667	3,276	1,700	27	19	2	95	0.01
25	308	308	102,667	4,221	2,191	35	25	2	122	0.02
26	303	303	101,000	4,153	2,155	34	25	2	120	0.02
27	271	271	90,333	3,714	1,928	31	22	2	108	0.02
28	248	248	82,667	3,399	1,764	28	20	2	99	0.01
29	259	259	86,333	3,550	1,842	29	21	2	103	0.02
30	391	391	130,333	5,359	2,781	44	32	3	155	0.02
31	327	327	109,000	4,482	2,326	37	26	2	130	0.02
32	320	320	106,667	4,386	2,276	36	26	2	127	0.02
33	312	312	104,000	4,276	2,219	35	25	2	124	0.02
34	394	394	131,333	5,400	2,803	45	32	3	157	0.02

**EP 1.34**  
**TBD 06-004 Group 2**

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
35	340	340	113,333	4,660	2,419	39	27	2	135	0.02
36	364	364	121,333	4,989	2,589	41	29	2	145	0.02
37	367	367	122,333	5,030	2,611	42	30	2	146	0.02
38	355	355	118,333	4,866	2,525	40	29	2	141	0.02
39	289	289	96,333	3,961	2,056	33	23	2	115	0.02
40	439	439	146,333	6,017	3,123	50	36	3	174	0.03
41	545	545	181,667	7,470	3,877	62	44	4	217	0.03
42	1141	1141	380,333	15,639	8,116	130	92	8	454	0.07
43	1808	1808	602,667	24,781	12,861	206	146	12	719	0.11
44	1164	1164	388,000	15,954	8,280	132	94	8	463	0.07
45	662	662	220,667	9,073	4,709	75	54	4	263	0.04
46	537	537	179,000	7,360	3,820	61	43	4	213	0.03
47	485	485	161,667	6,647	3,450	55	39	3	193	0.03
48	649	649	216,333	8,895	4,617	74	52	4	258	0.04
49	655	655	218,333	8,978	4,659	75	53	4	260	0.04
50	617	617	205,667	8,457	4,389	70	50	4	245	0.04
51	534	534	178,000	7,319	3,799	61	43	4	212	0.03
52	517	517	172,333	7,086	3,678	59	42	3	205	0.03
53	404	404	134,667	5,537	2,874	46	33	3	161	0.02
54	470	470	156,667	6,442	3,343	53	38	3	187	0.03
55	509	509	169,667	6,976	3,621	58	41	3	202	0.03
56	651	651	217,000	8,923	4,631	74	53	4	259	0.04
57	569	569	189,667	7,799	4,048	65	46	4	226	0.03
58	357	357	119,000	4,893	2,540	41	29	2	142	0.02
59	361	361	120,333	4,948	2,568	41	29	2	143	0.02
60	362	362	120,667	4,962	2,575	41	29	2	144	0.02
61	416	416	138,667	5,702	2,959	47	34	3	165	0.02
62	425	425	141,667	5,825	3,023	48	34	3	169	0.03
63	474	474	158,000	6,497	3,372	54	38	3	188	0.03
64	386	386	128,667	5,291	2,746	44	31	3	153	0.02
65	405	405	135,000	5,551	2,881	46	33	3	161	0.02
66	515	515	171,667	7,059	3,663	59	42	3	205	0.03
67	477	477	159,000	6,538	3,393	54	39	3	190	0.03
68	490	490	163,333	6,716	3,486	56	40	3	195	0.03



**EP 1.34**  
**TBD 06-004 Group 2**

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
69	432	432	144,000	5,921	3,073	49	35	3	172	0.03
70	488	488	162,667	6,689	3,471	56	39	3	194	0.03
71	419	419	139,667	5,743	2,981	48	34	3	167	0.02
72	460	460	153,333	6,305	3,272	52	37	3	183	0.03
73	411	411	137,000	5,633	2,924	47	33	3	163	0.02
74	394	394	131,333	5,400	2,803	45	32	3	157	0.02
75	364	364	121,333	4,989	2,589	41	29	2	145	0.02
76	413	413	137,667	5,661	2,938	47	33	3	164	0.02
77	383	383	127,667	5,249	2,724	44	31	3	152	0.02
78	407	407	135,667	5,578	2,895	46	33	3	162	0.02
79	401	401	133,667	5,496	2,853	46	32	3	159	0.02
80	393	393	131,000	5,387	2,796	45	32	3	156	0.02
81	464	464	154,667	6,360	3,301	53	38	3	184	0.03
82	339	339	113,000	4,646	2,411	39	27	2	135	0.02
83	392	392	130,667	5,373	2,788	45	32	3	156	0.02
84	421	421	140,333	5,770	2,995	48	34	3	167	0.03
85	370	370	123,333	5,071	2,632	42	30	2	147	0.02
86	360	360	120,000	4,934	2,561	41	29	2	143	0.02
87	767	767	255,667	10,513	5,456	87	62	5	305	0.05
Bkgd	0								MEAN	0.02
									MEDIAN	0.02
									STD DEV	0.01
									MAX	0.11
									MIN	0.01

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

**Pipe Interior Radiological Survey Form**

Date: 1/23/07 Time: 0845  
Pipe ID#: 1.34 Pipe Diameter: 10" + 6" Access Point Area: Rm 22 TRENCH  
Building: CV/R Elevation: -27' System: QUAD C DRAIN

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey ☒ Other ☒

Gross \_\_\_\_\_ Co60 ☒ Cs \_\_\_\_\_

Detector ID# / Sled ID# BICKON G-3 # B566A1 108

Detector Cal Date: 1/11/07 Detector Cal Due Date: 1/11/08

Instrument: 2350-1 Instrument ID #: 189094

Instrument Cal Date: 1/11/07 Instrument Cal Due Date: 1/11/08

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

Background Value 78.6 cpm

MDCR<sub>static</sub> 33.6 cpm

Efficiency Factor for Pipe Diameter 0.003 (from detector efficiency determination)

MDC<sub>static</sub> 11223 dpm/ 100 cm<sup>2</sup>

Is the MDC<sub>static</sub> acceptable? Yes No (if no, adjust sample count time and recalculate MDC<sub>static</sub>)

Comments: RESURVEY POST HYDRO EP2-1 PARTIAL

P# 42 + 43 PROBABLY AN ELBOW Position # 1 → 87 IS 10" ID

CAOS # 0295 gn

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	87	1	384	384	na	na
2	86		411	411		
3	85		637	637		
4	84		590	590		
5	83		291	291		
6	82		257	257		
7	81		214	214		
8	80		240	240		
9	79		221	221		
10	78		194	194		

Package Page 1 of 5

**REFERENCE COPY**

## Pipe Interior Radiological Survey Form (Continuation Form)

Date: -1/23/07  
 Pipe ID#: 1.34 Pipe Diameter: 10" + 6" Access Point Area: Rm 22-27'  
 Building: CV/RK Elevation: -27 System: Quad C Drain

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	77	1	224	224	n/a	n/a
12	76		249	249		
13	75		236	236		
14	74		200	200		
15	73		216	216		
16	72		188	188		
17	71		207	207		
18	70		265	265		
19	69		225	225		
20	68		209	209		
21	67		226	226		
22	66		212	212		
23	65		202	202		
24	64		239	239		
25	63		308	308		
26	62		303	303		
27	61		271	271		
28	60		248	248		
29	59		259	259		
30	58		391	391		
31	57		327	327		
32	56		320	320		
33	55		312	312		
34	54		394	394		
35	53		340	340		
36	52		364	364		
37	51		367	367		
38	50		355	355		
39	49		289	289		
40	48		439	439		
41	47		545	545		
42	46		1141	1141		
43	45		1808	1808		
44	44		1164	1164		
45	43		662	662		

Package Page 2 of 5

REFERENCE COPY

## Pipe Interior Radiological Survey Form (Continuation Form)

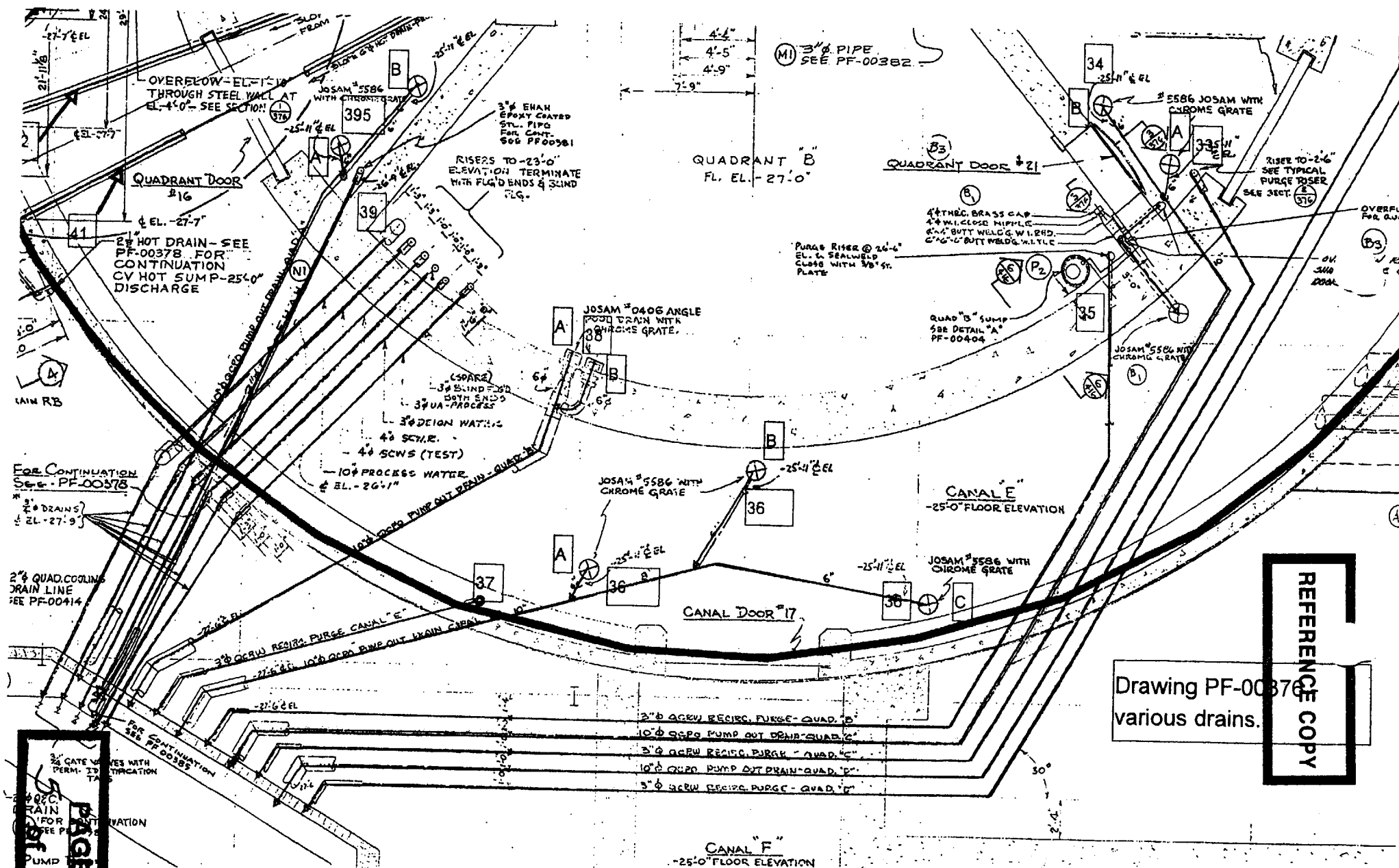
Date: 1/23/07  
 Pipe ID#: 1.34 Pipe Diameter: 10" x 6" Access Point Area: Rm 22 TRENCH  
 Building: CV/RX Elevation: -27' System: QUAD C DRAIN

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
46	42	1	537	537	n/a	n/a
47	41		485	485		
48	40		649	649		
49	39		655	655		
50	38		617	617		
51	37		534	534		
52	36		517	517		
53	35		404	404		
54	34		470	470		
55	33		509	509		
56	32		651	651		
57	31		569	569		
58	30		357	357		
59	29		361	361		
60	28		362	362		
61	27		416	416		
62	26		425	425		
63	25		474	474		
64	24		386	386		
65	23		405	405		
66	22		515	515		
67	21		477	477		
68	20		490	490		
69	19		432	432		
70	18		488	488		
71	17		419	419		
72	16		460	460		
73	15		411	411		
74	14		394	394		
75	13		364	364		
76	12		413	413		
77	11		383	383		
78	10		407	407		
79	9		401	401		
80	8		393	393		

Package Page 3 of 5

REFERENCE COPY



$$1.34 (10'')$$


Drawing PF-00376  
various drains.

REFERENCE COPY

RAIN  
FOR  
FREE P  
PUMP

Pipe Interior Radiological Survey Form

Date: 1/25/07 Time: 0823  
Pipe ID#: 1.34 Pipe Diameter: 10" - 6" Access Point Area: Quad C  
Building: CV Elevation: -25' System: DRAINS

Type of Survey Investigation          Characterization          Final Survey ✓ Other ✓  
Gross          Co60 ✓ Cs         

Detector ID# / Sled ID# IMG1 LVS-1 / 107  
Detector Cal Date: 1/11/07 Detector Cal Due Date: 1/11/08  
Instrument: 2350-1 Instrument ID #: 189094  
Instrument Cal Date: 1/11/07 Instrument Cal Due Date: 1/11/08

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

Background Value 3.4 cpm  
MDCR<sub>static</sub> 14.7 cpm  
Efficiency Factor for Pipe Diameter 0.002 (from detector efficiency determination)  
MDC<sub>static</sub> 333 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: POST HYDRO SURVEY EP2-1

Position 1 → 3 is 6" ID @ DROP A; Positions 4 → 9 is 6" ID; Drop B

CA 5 #0295 gw

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	40	40	N/A	N/A
2	2		10	10		
3	3		17	17		
4	1		21	21		
5	2		19	19		
6	3		16	16		
7	4		5	5		
8	5		25	25		
9	6	✓	15	15		
10	N/A		N/A	N/A		

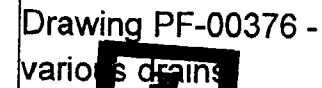
REFERENCE COPY

Package Page 1 of 2

Attachment 3, Page 1



(MI) 3" Ø PIPE  
SEE PF-00382



**REFERENCE COPY**

**PAGE**

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


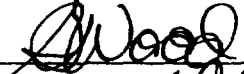

### DQA Check Sheet

Design #	EP 1.34	Revision #	Original					
Survey Unit #	EP 1.34							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)				Dale R. Case		Date		6-11-07
FSS/ Characterization Manager (print/sign)				R. Case		Date		8/22/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.83	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.83			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.83 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.83 is a Class 1, Group 3.2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.83 were performed using a scintillation detector optimized to measure gamma energies representative of Cs-137. Sample #EP 3-11 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 style="text-align: center;"><b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-29-07	
Technical Reviewer (FSS/Characterization Engineer)			7-9-07	
FSS/Characterization Manager			8/21/07	

Form  
CS-09/1  
Rev 0

Survey Unit: 1.83

**1.0 History/Description**

- 1.1 The subject pipe system is the 4" floor drain header servicing the Hot Dry Storage (HDS) pit in the Hot Lab. The header runs from the west side of the HDS pit and ties into the 4 inch off-gas header designated as ID #1.84. The purpose of the system was to act as a floor drain for the HDS to the hot sump on the -25 ft of the Reactor Building through the pipe header designated as pipe ID# 1.641.
- 1.2 EP 1.83 consists of 4" diameter piping that is approximately 60 feet in length.

**2.0 Survey Design Information**

- 2.1 EP 1.83 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 4" ID pipe was accessible for survey. The accessible 4" ID pipe was surveyed by static measurement at one foot increments, for a total of 58 survey measurements.
- 2.3 Surface area for the 4" ID piping is 973 cm<sup>2</sup> for each foot of piping, corresponding to a total 4" ID piping surface area of 56,430 cm<sup>2</sup> (5.6 m<sup>2</sup>) for the entire length of (approximately 58') of 4" 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 All measurement results 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.
- 5.3 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 1.83 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	4" Pipe
Total Number of Survey Measurements	58
Number of Measurements >MDC	51
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0043
Median	0.0046
Standard Deviation	0.0024
Maximum	0.0182
Minimum	0.0014

**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 EP 1.83 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.004 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP 1.83 & Spreadsheet

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





## BSI EP/BP SURVEY REPORT

Pipe ID	1.83	Survey Location	-27 TRENCH
Survey Date	10/09/06-3/13/07	2350-1 #	203488/189094
Survey Time	1400 / 1334	Detector-Sled #	44-159/238369-101 1MG1 LVS1 - 101
Pipe Size	4"	Detector Efficiency	0.00071/0.00053
DCGL (dpm/100cm <sup>2</sup> )	3.79E+06	Pipe Area Incorporated by Detector Efficiency (ln cm <sup>2</sup> )	973
Pipe Area Incorporated by Survey Data (in <sup>2</sup> )	5.64	Field BKG (cpm)	6.5/10.5
Routine Survey	X	Field MDCR (cpm)	11.8/ 14.2
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	2165/ 2698
Survey Measurement Results			
Total Number of Survey Measurements		58	
Number of Measurements >MDC		51	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0043	
Median		0.0046	
Standard Deviation		0.0024	
Maximum		0.0182	
Minimum		0.0014	
Survey Technician(s)	STOCK		
Survey Unit Classification		1	
TBD 06-004 Piping Group		3.2	
SR-13 Radionuclide Distribution Sample		EP 3-11	
Measured Nuclide		Cs-137	
Area Factor/EMC Used		No	
Pass/Fail FSS		Pass	
MREM/YR Contribution		<1	
COMMENTS: ACTIVITY VALUES NOT BACKGROUND CORRECTED			
RP Engineer   Date		Owl Rendell 6-27-07	

**EP 1.83**  
**4" Pipe**  
**TBD 06-004 Group 3.2**

Measurement #	gcpm	ncpm	Cs-137 activity (total dpm)	Cs-137 activity (dpm/100cm2)	Co-60 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	38	38	53,521	5,501	603	-	39	-	-	0.004
2	48	48	67,606	6,949	761	-	49	-	-	0.005
3	43	43	60,563	6,225	682	-	44	-	-	0.005
4	45	45	63,380	6,515	714	-	46	-	-	0.005
5	39	39	54,930	5,646	619	-	40	-	-	0.004
6	53	53	74,648	7,673	841	-	54	-	-	0.006
7	53	53	74,648	7,673	841	-	54	-	-	0.006
8	61	61	85,915	8,831	967	-	62	-	-	0.006
9	44	44	61,972	6,370	698	-	45	-	-	0.005
10	49	49	69,014	7,094	777	-	50	-	-	0.005
11	42	42	59,155	6,080	666	-	43	-	-	0.004
12	51	51	71,831	7,383	809	-	52	-	-	0.005
13	57	57	80,282	8,252	904	-	58	-	-	0.006
14	61	61	85,915	8,831	967	-	62	-	-	0.006
15	51	51	71,831	7,383	809	-	52	-	-	0.005
16	52	52	73,239	7,528	825	-	53	-	-	0.006
17	50	50	70,423	7,239	793	-	51	-	-	0.005
18	46	46	64,789	6,659	730	-	47	-	-	0.005
19	61	61	85,915	8,831	967	-	62	-	-	0.006
20	52	52	73,239	7,528	825	-	53	-	-	0.006
21	64	64	90,141	9,265	1,015	-	65	-	-	0.007
22	49	49	69,014	7,094	777	-	50	-	-	0.005
23	56	56	78,873	8,107	888	-	57	-	-	0.006
24	49	49	69,014	7,094	777	-	50	-	-	0.005
25	43	43	60,563	6,225	682	-	44	-	-	0.005
26	33	33	46,479	4,777	523	-	34	-	-	0.003
27	51	51	71,831	7,383	809	-	52	-	-	0.005
28	34	34	47,887	4,922	539	-	35	-	-	0.004
29	42	42	59,155	6,080	666	-	43	-	-	0.004
30	44	44	61,972	6,370	698	-	45	-	-	0.005
31	49	49	69,014	7,094	777	-	50	-	-	0.005
32	47	47	66,197	6,804	745	-	48	-	-	0.005

**EP 1.83**  
**4" Pipe**  
**TBD 06-004 Group 3.2**

Measurement #	gcpm	ncpm	Cs-137 activity (total dpm)	Cs-137 activity (dpm/100cm <sup>2</sup> )	Co-60 activity (dpm/100cm <sup>2</sup> )	Eu-152 activity (dpm/100cm <sup>2</sup> )	Eu-154 activity (dpm/100cm <sup>2</sup> )	Nb-94 activity (dpm/100cm <sup>2</sup> )	Ag-108m activity (dpm/100cm <sup>2</sup> )	Unity
33	56	56	78,873	8,107	888	-	57	-	-	0.006
34	45	45	63,380	6,515	714	-	46	-	-	0.005
35	44	44	61,972	6,370	698	-	45	-	-	0.005
36	15	15	28,302	2,909	319	-	20	-	-	0.002
37	16	16	30,189	3,103	340	-	22	-	-	0.002
38	15	15	28,302	2,909	319	-	20	-	-	0.002
39	10	10	18,868	1,939	212	-	14	-	-	0.001
40	22	22	41,509	4,267	467	-	30	-	-	0.003
41	26	26	49,057	5,042	552	-	35	-	-	0.004
42	11	11	20,755	2,133	234	-	15	-	-	0.002
43	18	18	33,962	3,491	382	-	25	-	-	0.003
44	12	12	22,642	2,327	255	-	16	-	-	0.002
45	14	14	26,415	2,715	297	-	19	-	-	0.002
46	13	13	24,528	2,521	276	-	18	-	-	0.002
47	15	15	28,302	2,909	319	-	20	-	-	0.002
48	10	10	18,868	1,939	212	-	14	-	-	0.001
49	128	128	241,509	24,824	2,720	-	174	-	-	0.018
50	24	24	45,283	4,655	510	-	33	-	-	0.003
51	12	12	22,642	2,327	255	-	16	-	-	0.002
52	28	28	52,830	5,430	595	-	38	-	-	0.004
53	15	15	28,302	2,909	319	-	20	-	-	0.002
54	13	13	24,528	2,521	276	-	18	-	-	0.002
55	19	19	35,849	3,685	404	-	26	-	-	0.003
56	18	18	33,962	3,491	382	-	25	-	-	0.003
57	20	20	37,736	3,879	425	-	27	-	-	0.003
58	14	14	26,415	2,715	297	-	19	-	-	0.002
									MEAN	0.004
									MEDIAN	0.005
									STD DEV	0.002
									MAX	0.018
									MIN	0.001

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

Pipe Interior Radiological Survey Form

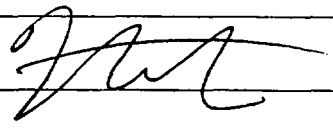
Date: 3/13/07 Time: 1334  
Pipe ID#: 1.83 Pipe Diameter: 4" Access Point Area: Rm 22 TRENCH  
Building: 8 Elevation: -27' System: HDS FLR DRNS

Type of Survey Investigation        Characterization        Final Survey X Other ✓  
Gross        Co60        Cs ✓

Detector ID# / Sled ID# 1MG1 LVS-1 / 101  
Detector Cal Date: 1/11/07 Detector Cal Due Date: 1/11/08  
Instrument: 2350-1 Instrument ID #: 189094  
Instrument Cal Date: 1/11/07 Instrument Cal Due Date: 1/11/08

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

Background Value 10.5 cpm  
MDCR<sub>static</sub> 14.2 cpm  
Efficiency Factor for Pipe Diameter 0.00053 (from detector efficiency determination)  
MDC<sub>static</sub> 2698 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: CA-05 # 0295 SURVEY EP3-12 PARTIAL

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	<u>7</u>	38	38	<u>n/a</u>	<u>n/a</u>
2	2	<u>7</u>	48	48	<u>7</u>	<u>7</u>
3	3	<u>7</u>	43	43	<u>7</u>	<u>7</u>
4	4	<u>7</u>	45	45	<u>7</u>	<u>7</u>
5	5	<u>7</u>	39	39	<u>7</u>	<u>7</u>
6	6	<u>7</u>	53	53	<u>7</u>	<u>7</u>
7	7	<u>7</u>	53	53	<u>7</u>	<u>7</u>
8	8	<u>7</u>	61	61	<u>7</u>	<u>7</u>
9	9	<u>7</u>	44	44	<u>7</u>	<u>7</u>
10	10	<u>7</u>	49	49	<u>7</u>	<u>7</u>

REFERENCE COPY

Package Page 1 of 3

Pipe Interior Radiological Survey Form (Continuation Form)

Date: 3/13/07  
Pipe ID#: 1.83 Pipe Diameter: 4" Access Point Area: Rm 22 TRENCH  
Building: R Elevation: -27' System: HDS FLR DROWS

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	42	42	n/a	n/a
12	12		51	51		
13	13		57	57		
14	14		61	61		
15	15		51	51		
16	16		52	52		
17	17		50	50		
18	18		46	46		
19	19		61	61		
20	20		52	52		
21	21		64	64		
22	22		49	49		
23	23		56	56		
24	24		49	49		
25	25		43	43		
26	26		33	33		
27	27		51	51		
28	28		34	34		
29	29		42	42		
30	30		44	44		
31	31		49	49		
32	32		47	47		
33	33		56	56		
34	34		45	45		
35	35		44	44		
N A						
N A						

Package Page 2 of 3

REFERENCE COPY

CANAL "F"  
-25'-0" FLOOR ELEVATION

**REFERENCE COPY**

NO. 2 ELEV.  
CONTINUATION  
PF-00385

ine.  
g that

**PAGE**  
**3 of 3**

4. EL. - 27'-0" FOR  
CONTINUATION SEE DWG. PF-04645.

26 SEE TYPICAL PURGE (2)

24 SEE TYPICAL

CANAL DOOR "19"

23

25 JOSAM # 5586 WITH CHROME GRATE  
3" R.C. PURGE - CANAL "G"

6"  $\phi$  QCPD PUMP OUT-DRAIN CANAL "G"

3"φ ASKED PLATES - FURGE - CANAL "H"

66 SEA BIRCH ALT. 10419 - COND. "L"

8" OVERFLOW

370 Q&A RECEIVER MURDER. C. NALS J&K

✓ GPC QEC HUMIDITY-DRYING CRACKS JETV.

72

641

83

## 4. RISES 15

4" HOT DRINK-HL:

4" OVERFLOW  
FROM HL CANALS "J&K"

N	1	WAS RECIF
M	1	STRAIG EL-26
L	1	WAS 4.2

66-0 2301	2	ADDED QUAD. "B" SUMP PGR RE-TEST 1	12/	DZ ED
--------------	---	---------------------------------------	-----	----------

Pipe Interior Radiological Survey Form

Date: 10/9/06 Time: 1400  
Pipe ID#: 1.83 Pipe Diameter: 4" Access Point Area: HOT DRY STORAGE  
Building: HOT LAB Elevation: -25' System: PLR DRAIN

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
Gross \_\_\_\_\_ Co60 \_\_\_\_\_ Cs ✓

Detector ID# / Sled ID# 44-159 238369 / 101  
Detector Cal Date: 9/5/06 Detector Cal Due Date: 9/5/07  
Instrument: 2350-1 Instrument ID #: 203488  
Instrument Cal Date: 7/5/06 Instrument Cal Due Date: 7/5/07

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

Background Value 6.5 cpm  
MDCR<sub>static</sub> 11.8 cpm  
Efficiency Factor for Pipe Diameter 0.00071 (from detector efficiency determination)  
MDC<sub>static</sub> 2165 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: INITIAL EP3-11 PARTIAL

Technician Signature [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	23	1	15	15	n/a	n/a
2	22		16	16		
3	21		15	15		
4	20		10	10		
5	19		22	22		
6	18		26	26		
7	17		11	11		
8	16		18	18		
9	15		12	12		
10	14	↓	14	14	↓	↓

REFERENCE COPY

Package Page 1 of 3

Attachment 3, Page 1



Pipe Interior Radiological Survey Form (Continuation Form)

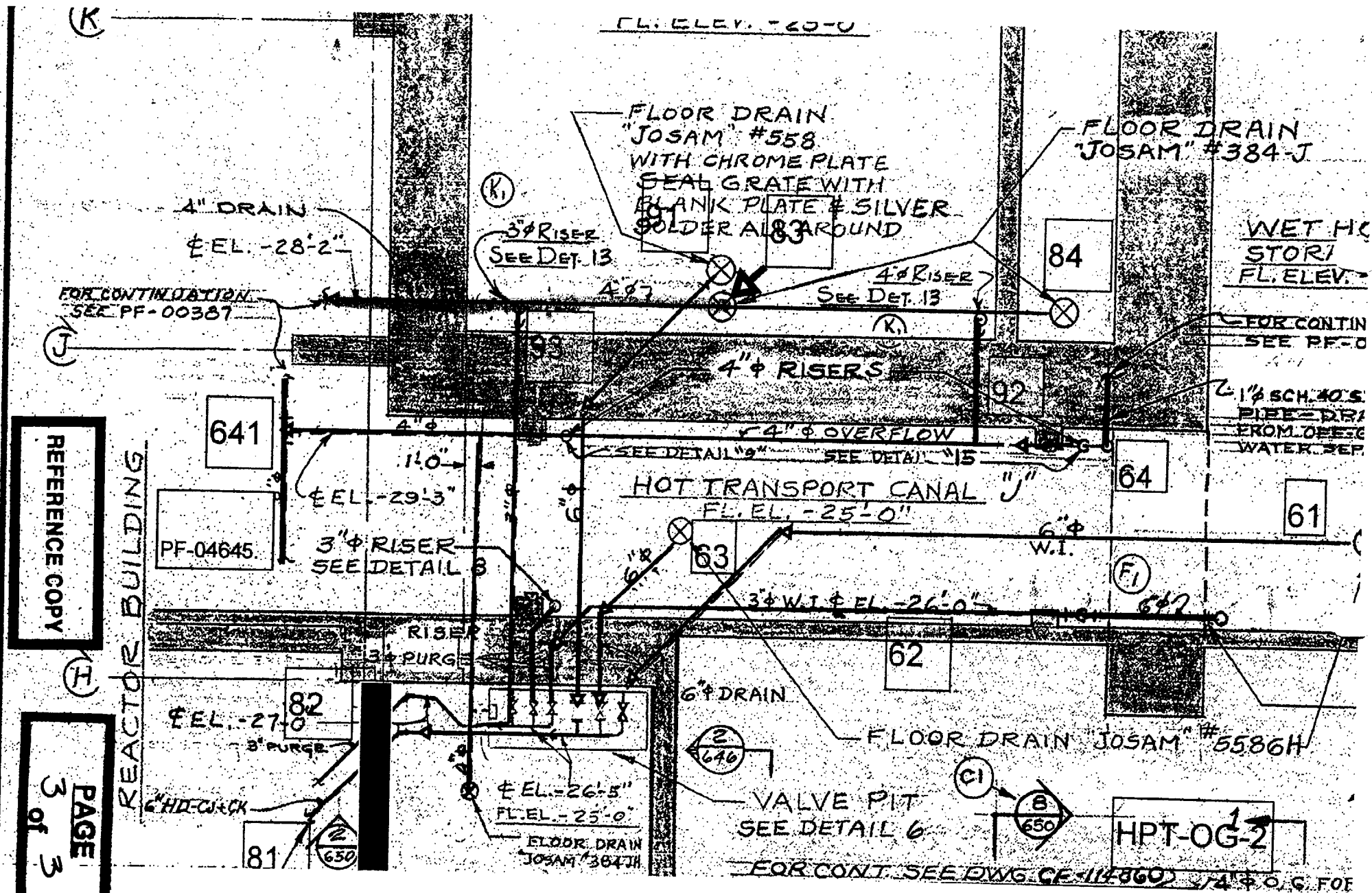
Date: 1-8-3 1/9/06  
 Pipe ID#: 1.83 Pipe Diameter: 4" Access Point Area: Hot Dry Storage  
 Building: Hot LAB Elevation: -2.5' System: FLR DRAINS

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	13	1	13	13	N/A	N/A
12	12	↓	15	15	↓	↓
13	"		10	10		
14	10		128	128		
15	9		24	24		
16	8		12	12		
17	7		28	28		
18	6		15	15		
19	5		13	13		
20	4		19	19		
21	3		18	18		
22	2		20	20		
23	1		14	14		
<div><div>N</div><div>A</div></div>						

Package Page 2 of 3

REFERENCE COPY

1.83



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

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.84	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.84			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.84 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.84 is a Class 1, Group 3.2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.84 were performed using a scintillation detector optimized to measure gamma energies representative of Cs-137. Sample #EP 3-11 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 style="text-align: right;"><b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer	<i>Del Penhall</i>		7-8-07	
Technical Reviewer (FSS/Characterization Engineer)	<i>Wood</i>		7-11-07	
FSS/Characterization Manager	<i>McCase</i>		8/21/07	

Form  
CS-09/1  
Rev 0

Survey Unit: 1.84

**1.0 History/Description**

- 1.1 The subject pipe system is the 4" floor drain line from the Off Gas Pit to the drain header that services Hot Dry Storage (HDS).
- 1.2 EP 1.84 consists of 4" diameter piping that is approximately 23 feet in length from the floor drain opening in the Off Gas Pit to the HDS header, involving one 90 degree elbow.

**2.0 Survey Design Information**

- 2.1 EP 1.84 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 4" ID pipe was accessible for survey. The accessible 4" ID pipe was surveyed by static measurement at one foot increments, for a total of 23 survey measurements.
- 2.3 Surface area for the 4" ID piping is  $973 \text{ cm}^2$  for each foot of piping, corresponding to a total 4" ID piping surface area of  $22,376 \text{ cm}^2$  ( $2.2 \text{ m}^2$ ) for the entire length of (approximately 23') of 4" 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 All measurement results 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.
- 5.3 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 1.84 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	4" Pipe
Total Number of Survey Measurements	23
Number of Measurements >MDC	13
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0016
Median	0.0016
Standard Deviation	0.0003
Maximum	0.0023
Minimum	0.0011

**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 EP 1.84 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.002 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.84 & Spreadsheet

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





## BSI EP/BP SURVEY REPORT

Pipe ID	1.84	Survey Location	Hot Lab Off Gas drain
Survey Date	09-Oct-06	2350-1 #	203488
Survey Time	11:03	Detector-Sled #	44-159/238369-101
Pipe Size	4"	Detector Efficiency	0.00071
DCGL (dpm/100cm <sup>2</sup> )	3.79E+06	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	973
Pipe Area Incorporated by Survey Data (in m <sup>2</sup> )	2.24	Field BKG (cpm)	6.5
Routine Survey	X	Field MDCR (cpm)	11.8
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	2,165
Survey Measurement Results			
Total Number of Survey Measurements		23	
Number of Measurements >MDC		13	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0016	
Median		0.0016	
Standard Deviation		0.0003	
Maximum		0.0023	
Minimum		0.0011	
Survey Technician(s)	STOCK		
Survey Unit Classification		1	
TBD 06-004 Piping Group		3.2	
SR-13 Radionuclide Distribution Sample		EP 3-11	
Measured Nuclide		Cs-137	
Area Factor/EMC Used		No	
Pass/Fail FSS		Pass	
MREM/YR Contribution		<1	
COMMENTS:			
ACTIVITY VALUES NOT BACKGROUND CORRECTED			
RP Engineer   Date		Dale Nowell 7-7-07	

**EP 1.84**  
**4" Pipe**  
**TBD 06-004 Group 3.2**

Measurement #	gcpm	ncpm	Cs-137 activity (total dpm)	Cs-137 activity (dpm/100cm2)	Co-60 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	12	12	16,901	1,737	190	-	12	-	-	0.001
2	17	17	23,944	2,461	270	-	17	-	-	0.002
3	10	10	14,085	1,448	159	-	10	-	-	0.001
4	17	17	23,944	2,461	270	-	17	-	-	0.002
5	18	18	25,352	2,606	285	-	18	-	-	0.002
6	14	14	19,718	2,027	222	-	14	-	-	0.001
7	14	14	19,718	2,027	222	-	14	-	-	0.001
8	12	12	16,901	1,737	190	-	12	-	-	0.001
9	18	18	25,352	2,606	285	-	18	-	-	0.002
10	18	18	25,352	2,606	285	-	18	-	-	0.002
11	14	14	19,718	2,027	222	-	14	-	-	0.001
12	17	17	23,944	2,461	270	-	17	-	-	0.002
13	15	15	21,127	2,172	238	-	15	-	-	0.002
14	19	19	26,761	2,751	301	-	19	-	-	0.002
15	22	22	30,986	3,185	349	-	22	-	-	0.002
16	13	13	18,310	1,882	206	-	13	-	-	0.001
17	15	15	21,127	2,172	238	-	15	-	-	0.002
18	14	14	19,718	2,027	222	-	14	-	-	0.001
19	18	18	25,352	2,606	285	-	18	-	-	0.002
20	16	16	22,535	2,316	254	-	16	-	-	0.002
21	13	13	18,310	1,882	206	-	13	-	-	0.001
22	10	10	14,085	1,448	159	-	10	-	-	0.001
23	20	20	28,169	2,895	317	-	20	-	-	0.002
									MEAN	0.002
									MEDIAN	0.002
									STD DEV	0.000
									MAX	0.002
									MIN	0.001

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

Pipe Interior Radiological Survey Form

Date: 10/9/06 Time: 1103  
Pipe ID#: MI-83 1.84 Pipe Diameter: 4" Access Point Area: OFF GAS  
Building: HOT LAB Elevation: -25' System: FLR DRAIN

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
Gross \_\_\_\_\_ Co60 \_\_\_\_\_ Cs ✓

Detector ID# / Sled ID# 44-159 # 2383691 101  
Detector Cal Date: 9/5/06 Detector Cal Due Date: 9/5/07  
Instrument: 2350-1 Instrument ID #: 203488  
Instrument Cal Date: 7/5/06 Instrument Cal Due Date: 7/5/07

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

Background Value 6.5 cpm

MDCR<sub>static</sub> 11.8 cpm

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

MDC<sub>static</sub> 2165 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: INITIAL EP3-11 COMPLETE

Technician Signature [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	12	12	n/a	n/a
2	2		17	17		
3	3		10	10		
4	4		17	17		
5	5		18	18		
6	6		14	14		
7	7		14	14		
8	8		12	12		
9	9		18	18		
10	10	✓	18	18	✓	✓

Package Page 1 of 3

Pipe Interior Radiological Survey Form (Continuation Form)

Date: 10/9/06  
 Pipe ID#: Appt. 83 1.67 Pipe Diameter: 4"  
 Building: NOT LAB Elevation: -25'  
 Access Point Area: OFF GAS  
 System: PLR DRAIN

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	14	14	N/A	N/A
12	12		17	17		
13	13		15	15		
14	14		19	19		
15	15		22	22		
16	16		13	13		
17	17		15	15		
18	18		14	14		
19	19		18	18		
20	20		16	16		
21	21		13	13		
22	22		10	10		
23	23		20	20		
<div style="text-align: center;"> <p>N</p> <p>A</p> </div>						

~~1.83~~ 1.84

FOR CONTINUATION  
SEE PF-00387

**PAGE**

FLOOR DRAIN  
"JOSAM" #558  
WITH CHROME PLATE  
SEAL GRATE WITH  
BLANK PLATE & SILVER  
SOLDER ALL AROUND

FLOOR DRAIN  
"JOSAM" #384-J

WET H  
STORAG  
FL. ELEV.

FOR CONTIN  
SEE PAGE

2 1" SCH. 40 S.  
PIPE - DR  
FROM OFF-G  
WATER SEP

HOT TRANSPORT CANAL "J"  
FL. EL. - 25'-0"

64  
W.I.

62

FLOOR DRAIN "JOSAM" # 5586H

— VALVE PIT  
SEE DETAIL C

HPT-OG-2

FOR CONT SEE DWG CF-114869) 1480 S FOR

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

### DQA Check Sheet

Design #	EP 1.84	Revision #	Original					
Survey Unit #	EP 1.84							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 ( <i>S</i> + for Sign Test or <i>W</i> <sub>r</sub> for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)						<i>Dale Ray</i> / <i>Dale Ray</i> <div style="display: flex; justify-content: space-between;"> <span></span> <span>R. Case</span> </div>		
FSS/ Characterization Manager (print/sign)						<div style="display: flex; justify-content: space-between;"> <span></span> <span></span> </div>		

Form  
CS-09/2  
Rev 0



**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

Survey Unit Release Record				
<b>Design #</b>	EP-1.52	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.52			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.52 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.52 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 1.52 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>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer	<i>Del. Ruffell</i>		6-20-07	
Technical Reviewer (FSS/Characterization Engineer)	<i>Wood</i>		7-11-07	
FSS/Characterization Manager	<i>[Signature] R. Case</i>		8/16/07	

Form  
CS-09/1  
Rev 0



**COPY**

## Survey Unit: 1.52

**1.0 History/Description**

- 1.1 The subject pipe is the drain line from the dry annulus inside the CV to the drain trench on the Rx Building -25 foot elevation. The function of this pipe was to convey water from the dry annulus to the drain trench on the Rx building -25ft., where the pipe is currently breached.
- 1.2 EP 1.52 consists of 6" diameter piping that is approximately 50 feet in length from the breach point in the pipe trench to the CV, including two elbows of approximately 45 degrees.

**2.0 Survey Design Information**

- 2.1 EP 1.52 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 6" ID pipe was accessible for survey. The accessible 4" ID pipe was surveyed by static measurement at one foot increments, for a total of 49 survey measurements.
- 2.3 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 71,491 cm<sup>2</sup> (7.1 m<sup>2</sup>) for the entire length of (approximately 49') of 6" 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 All measurement results 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.
- 5.3 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 1.52 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

FSS Design # EP 1.52	Revision # Original	Page 3 of 3
Survey Unit: 1.52		

## 5.5 Statistical Summary Table

Statistical Parameter	6" Pipe
Total Number of Survey Measurements	49
Number of Measurements >MDC	29
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0285
Median	0.0225
Standard Deviation	0.0208
Maximum	0.1288
Minimum	0.0102

**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 EP 1.52 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.029 mrem/yr based on the average of the actual gross counts measured.

## 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.52 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.52	Survey Location	CV -37el.
Survey Date	2/14/06, 2/15/06, 5/12/06	2350-1 #	203488
Survey Time	1313 / 0830 / 0830	Detector-Sled #	44-159/238369-101 1MG1 LVS1 - 106
Pipe Size	6"	Detector Efficiency	0.0002/0.0001
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (In cm <sup>2</sup> )	1459
Pipe Area Incorporated by Survey Data (in <sup>2</sup> )	7.1491	Field BKG (cpm)	5.1/5.3/13.4
Routine Survey	X	Field MDCR (cpm)	10.7/ 10.9/15.6
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	3393/ 5401
Survey Measurement Results			
Total Number of Survey Measurements		49	
Number of Measurements >MDC		29	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0285	
Median		0.0225	
Standard Deviation		0.0208	
Maximum		0.1288	
Minimum		0.0102	
Survey Technician(s)	DEBRAUX / STOCK		
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		Ocl Randall 6-29-07	

**EP 1.52**  
**6" 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	11	11	55,000	3,770	149	3,576	951	110	26	0.022
2	8	8	40,000	2,742	109	2,601	691	80	19	0.016
3	10	10	50,000	3,427	136	3,251	864	100	24	0.020
4	15	15	75,000	5,141	204	4,876	1,296	150	36	0.031
5	14	14	70,000	4,798	190	4,551	1,210	140	33	0.029
6	11	11	55,000	3,770	149	3,576	951	110	26	0.022
7	9	9	45,000	3,084	122	2,926	778	90	21	0.018
8	9	9	45,000	3,084	122	2,926	778	90	21	0.018
9	11	11	55,000	3,770	149	3,576	951	110	26	0.022
10	9	9	45,000	3,084	122	2,926	778	90	21	0.018
11	15	15	75,000	5,141	204	4,876	1,296	150	36	0.031
12	13	13	65,000	4,455	177	4,226	1,123	130	31	0.027
13	7	7	35,000	2,399	95	2,276	605	70	17	0.014
14	12	12	60,000	4,112	163	3,901	1,037	120	29	0.025
15	9	9	45,000	3,084	122	2,926	778	90	21	0.018
16	11	11	55,000	3,770	149	3,576	951	110	26	0.022
17	5	5	25,000	1,714	68	1,625	432	50	12	0.010
18	12	12	60,000	4,112	163	3,901	1,037	120	29	0.025
19	9	9	45,000	3,084	122	2,926	778	90	21	0.018
20	6	6	30,000	2,056	81	1,951	519	60	14	0.012
21	7	7	35,000	2,399	95	2,276	605	70	17	0.014
22	6	6	30,000	2,056	81	1,951	519	60	14	0.012
23	10	10	50,000	3,427	136	3,251	864	100	24	0.020
24	20	20	100,000	6,854	272	6,502	1,728	200	48	0.041
25	8	8	40,000	2,742	109	2,601	691	80	19	0.016
26	17	17	85,000	5,826	231	5,526	1,469	170	41	0.035
27	15	15	75,000	5,141	204	4,876	1,296	150	36	0.031
28	9	9	45,000	3,084	122	2,926	778	90	21	0.018
29	12	12	60,000	4,112	163	3,901	1,037	120	29	0.025
30	8	8	40,000	2,742	109	2,601	691	80	19	0.016
31	9	9	45,000	3,084	122	2,926	778	90	21	0.018
32	5	5	25,000	1,714	68	1,625	432	50	12	0.010

**EP 1.52**  
**6" 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
33	9	9	45,000	3,084	122	2,926	778	90	21	0.018
34	6	6	30,000	2,056	81	1,951	519	60	14	0.012
35	10	10	50,000	3,427	136	3,251	864	100	24	0.020
36	8	8	40,000	2,742	109	2,601	691	80	19	0.016
37	26	26	130,000	8,910	353	8,452	2,247	260	62	0.053
38	12	12	60,000	4,112	163	3,901	1,037	120	29	0.025
39	5	5	25,000	1,714	68	1,625	432	50	12	0.010
40	12	12	60,000	4,112	163	3,901	1,037	120	29	0.025
41	13	13	65,000	4,455	177	4,226	1,123	130	31	0.027
42	20	20	100,000	6,854	272	6,502	1,728	200	48	0.041
43	30	30	150,000	10,281	407	9,753	2,593	300	72	0.061
44	63	63	315,000	21,590	856	20,481	5,445	630	150	0.129
45	8	8	80,000	5,483	217	5,201	1,383	160	38	0.033
46	15	15	150,000	10,281	407	9,753	2,593	300	72	0.061
47	15	15	150,000	10,281	407	9,753	2,593	300	72	0.061
48	14	14	140,000	9,596	380	9,102	2,420	280	67	0.057
49	17	17	170,000	11,652	462	11,053	2,938	340	81	0.069
									MEAN	0.029
									MEDIAN	0.022
									STD DEV	0.021
									MAX	0.129
									MIN	0.010



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

Pipe Interior Radiological Survey Form

Date: 12-14-06 Time: 1313  
 Pipe ID#: RX 1.52 Pipe Diameter: 6" Access Point Area: CORRIDOR  
 Building: RX Elevation: -38 System: Hot Water Arteries To SPR  
 Type of Survey Investigation        Characterization        Final Survey X Other X  
 Gross        Co60 ✓ Cs         
 Detector ID# / Sled ID# BKRON/MGI/LVS-1 / 106  
 Detector Cal Date: 12-20-05 Detector Cal Due Date: 12-20-06  
 Instrument: 23507 Instrument ID #: 203488  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 5.1 cpm  
 MDCR<sub>static</sub> 10.8 cpm  
 Efficiency Factor for Pipe Diameter 0.0001 (from detector efficiency determination)  
 MDC<sub>static</sub> 5401 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: INITIAL SURVEY

Technician Signature C. OCBRAUN

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	11	11	N/A	N/A
2	2	1	8	8		
3	3	1	10	10		
4	4	1	15	15		
5	5	1	14	14		
6	6	1	11	11		
7						
8						
9						
10						

Package Page 1 of 2

REFERENCE COPY

Attachment 3, Page 1



**Pipe Interior Radiological Survey Form**

Date: 2-15-06 Time: 0830  
 Pipe ID#: Rx 152 Pipe Diameter: 6" Access Point Area: SPR CORRIDOR  
 Building: Rx Elevation: -38' System: HOT DRAIN  
 Type of Survey Investigation        Characterization        Final Survey X Other X  
 Gross        Co60 ✓ Cs         
 Detector ID# / Sled ID# BICRON / MG-1 / LVS-1 / 106  
 Detector Cal Date: 20-Dec-05 Detector Cal Due Date: 20-Dec-06  
 Instrument: 2350-1 Instrument ID #: 203498  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 5.3 cpm  
 MDCR<sub>static</sub> 10.9 cpm  
 Efficiency Factor for Pipe Diameter 0.0001 (from detector efficiency determination)  
 MDC<sub>static</sub> 5401 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: CONTINUATION SURVEY COMPLETE

Technician Signature C. DERBAUX

**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	7	1	9	9	n/a	n/a
2	8	1	9	9		
3	9	1	11	11		
4	10	1	9	9		
5	11	02:1	15	15		
6	12	1	13	13		
7	13	1	7	7		
8	14	1	12	12		
9	15	1	9	9		
10	16	1	11	11		

Package Page 1 of 3

REFERENCE COPY

Attachment 3, Page 1

Pipe Interior Radiological Survey Form (Continuation Form)

Date: 2-15-06  
Pipe ID#: RX 1.52 Pipe Diameter: 6" Access Point Area: SPR CORRIDOR  
Building: RX Elevation: -38' System: WCDRAIN

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	17	1	5	5	n/a	n/a
12	18	1	12	12		
13	19	1	9	9		
14	20	1	6	6		
15	21	1	7	7		
16	22	1	6	6		
17	23	1	10	10		
18	24	1	20	20		
19	25	1	8	8		
20	26	1	17	17		
21	27	1	15	15		
22	28	1	9	9		
23	29	1	12	12		
24	30	1	8	8		
25	31	1	9	9		
26	32	1	5	5		
27	33	1	9	9		
28	34	1	6	6		
29	35	1	10	10		
30	36	1	8	8		
31	37	1	26	26		
32	38	1	12	12		
33	39	1	5	5		
34	40	1	12	12		
35	41	1	13	13		
36	42	1	20	20		
37	43	1	30	30		
38	44	1	63	63		
n/a						
a						

Package Page 2 of 3

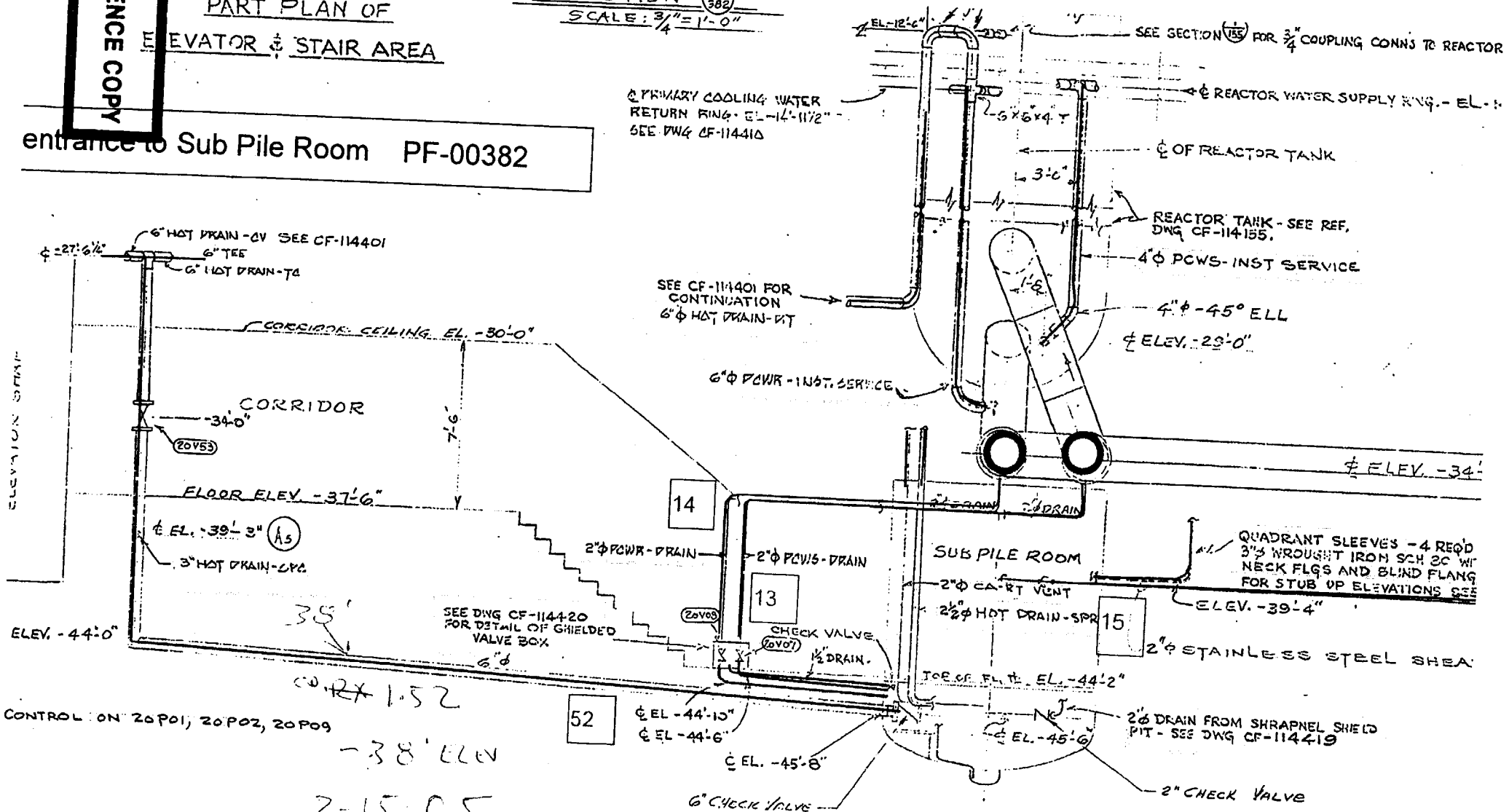
REFERENCE COPY

REFERENCE COPY

PART PLAN OF  
ELEVATOR & STAIR AREA

entrance to Sub Pile Room PF-00382

SECTION 382  
SCALE:  $\frac{3}{4}'' = 1'-0''$



CONTROL ON 20P01, 20P02, 20P09

-38' ELEV

2-15-05

1583

# Pipe Interior Radiological Survey Form

Date: 5/12/06 Time: 0830  
 Pipe ID#: 1.52 Pipe Diameter: 6" Access Point Area: CV-37'  
 Building: CV Elevation: -37' System: FLR DENS

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_

Detector ID# / Sled ID# 44-159 238369 / 101

Detector Cal Date: 3/6/06 Detector Cal Due Date: 3/6/07

Instrument: 2350-1 Instrument ID #: 203488

Instrument Cal Date: 11/17/05 Instrument Cal Due Date: 11/17/06

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

Background Value 13.4 cpm

MDCR<sub>static</sub> 15.6 cpm

Efficiency Factor for Pipe Diameter 0.0002 (from detector efficiency determination)

MDC<sub>static</sub> 3393 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: INITIAL SURVEY OF SECTION EP3-9 COMPLETE

Technician Signature [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	9	8	N/A	N/A
2	2	1	15	15	↓	↓
3	3	1	15	15	↓	↓
4	4	1	14	14	↓	↓
5	5	1	17	17	↓	↓
6	6	1			↓	↓
7	7	1			↓	↓
8	8	1			↓	↓
9	9	1			↓	↓
10	10	1			↓	↓

REFERENCE COPY

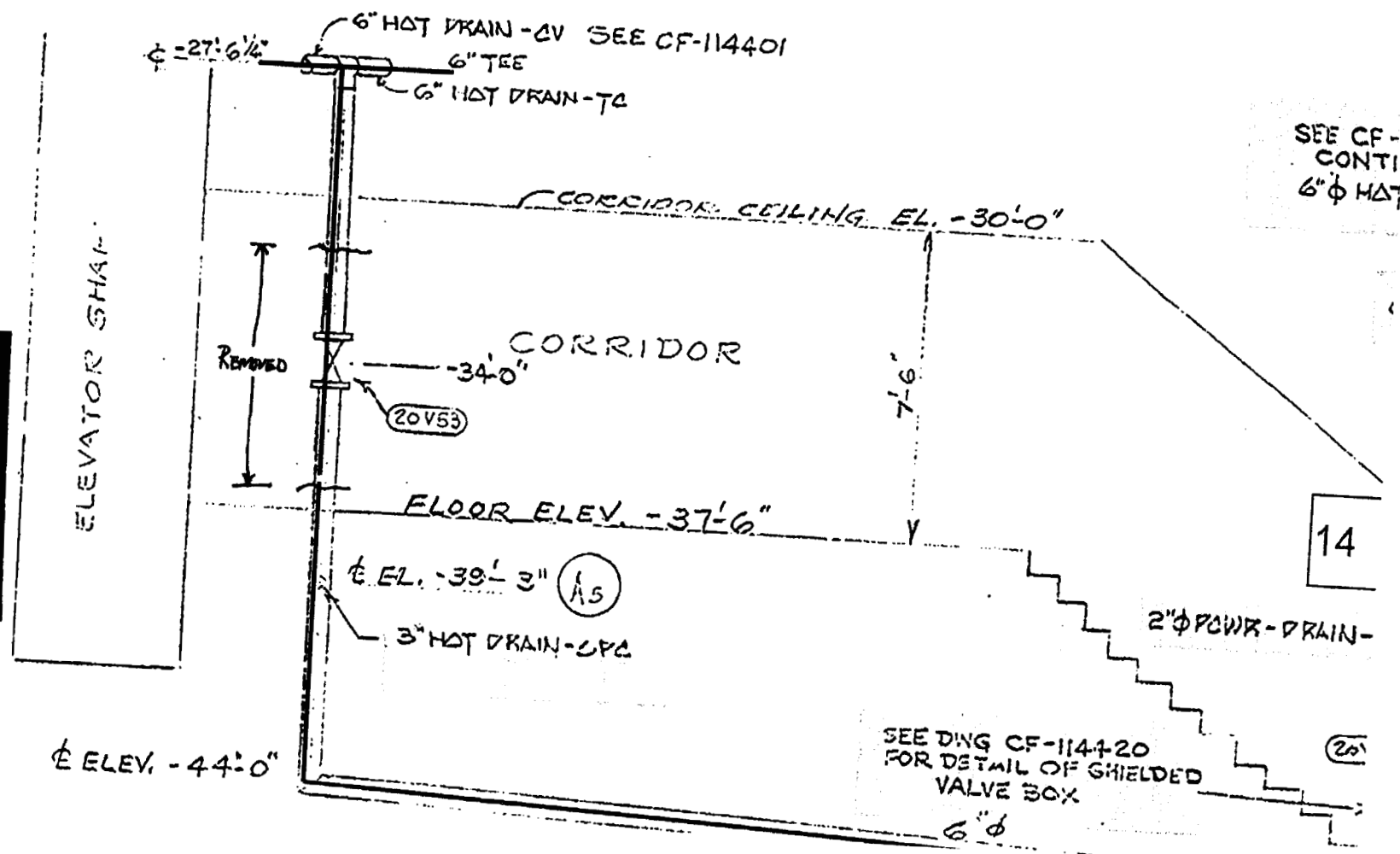
Package Page 1 of 2

Attachment 3, Page 1

LE: NONE

entrance to Sub Pile Room PF-00382

SEE VWG CT-1



= PIPE SURVEYED 1.52

**REFERENCE COPY**

-REACTOR

2  
YES SHALL BE  
BE FULLY EQUAL.

**PAGE**  
232



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


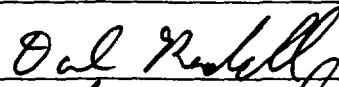


### DQA Check Sheet

Design #	EP 1.52	Revision #	Original			
Survey Unit #	EP 1.52					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)		<i>Dale Raymond / Dale Randall</i>			Date	6-30-07
FSS/ Characterization Manager (print/sign)		<i>[Signature]</i> R. Case			Date	8/16/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-1.22	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.22			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.22 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.22 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.22 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #CS050330-0003 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> <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; font-weight: bold;">COPY</span> </div>			
<b>Approval Signatures</b>				<b>Date:</b>
FSS/Characterization Engineer			6-30-07	
Technical Reviewer (FSS/Characterization Engineer)			7-3-07	
FSS/Characterization Manager	 <span style="float: right; font-size: small;">R. Case</span>		9/10/07	

Form  
CS-09/1  
Rev 0

## Survey Unit: 1.22

**1.0 History/Description**

- 1.1 The subject pipe system is the 3" purge line for canal "H". The function of this pipe was to convey water from the 3" risers in Canal H to the HD sump in Pump Room#22 on the Rx building -25ft., where the pipe is currently breached.
- 1.2 EP 1.22 consists of 3" diameter piping that is approximately 90 feet in length from the pump room to the riser in Canal H. The pipe section has four mitered elbows of ranging between 45 and 90 degrees.

**2.0 Survey Design Information**

- 2.1 EP 1.22 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 3" ID pipe was accessible for survey. The accessible 3" ID pipe was surveyed by static measurement at one foot increments, for a total of 90 survey measurements.
- 2.3 Surface area for the 3" ID piping is  $730 \text{ cm}^2$  for each foot of piping, corresponding to a total 3" ID piping surface area of  $65,700 \text{ cm}^2$  ( $6.6 \text{ m}^2$ ) for the entire length of (approximately 90') of 3" 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 All measurement results 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.
- 5.3 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 1.22 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	3" Pipe
Total Number of Survey Measurements	90
Number of Measurements >MDC	12
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0099
Median	0.0092
Standard Deviation	0.0042
Maximum	0.0242
Minimum	0.0030

**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 EP 1.22 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.010 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP 1.22 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.22	Survey Location	Canal H purge -27el.
Survey Date	12/21/05, 1/05/06, 1/09/06, 3/09/06	2350-1 #	212223, 203488
Survey Time	0915 / 1345 / 0815 / 0910	Detector-Sled #	204402-101,212701- 121, 204402-121, 1MG1 LVS1 - 101
Pipe Size	3"	Detector Efficiency	0.0002/0.00013/ 0.0002/0.00045
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (ln cm2)	730
Pipe Area Incorporated by Survey Data (m2)	6.6	Field BKG (cpm)	5.9/5.5/6.1/19.5
Routine Survey	X	Field MDCR (cpm)	11.3/ 11 /11.5 / 18.2
QA Survey		Nominal MDC (dpm/100cm2)	6726/2779/6726/ 2399

### Survey Measurement Results

Total Number of Survey Measurements	90
Number of Measurements >MDC	12
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0099
Median	0.0092
Standard Deviation	0.0042
Maximum	0.0242
Minimum	0.0030

Survey Technician(s)	Rosenhagen
----------------------	------------

Survey Unit Classification	1
TBD 06-004 Piping Group	2
SR-13 Radionuclide Distribution Sample	CS050330-0003
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>Doc Penhall 6-30-07</i>
--------------------	----------------------------



**EP 1.18**  
**3" Pipe**  
**TBD 06-004 Group 2**

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	2.7	2.7	13,500	1,849	959	15	11	1	53	0.008
2	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
3	3	3	23,077	3,161	1,639	26	19	2	91	0.014
4	2.3	2.3	17,692	2,424	1,257	20	14	1	70	0.011
5	4.6	4.6	35,385	4,847	2,513	40	28	2	140	0.021
6	5.3	5.3	40,769	5,585	2,896	46	33	3	161	0.024
7	4.6	4.6	35,385	4,847	2,513	40	28	2	140	0.021
8	5	5	38,462	5,269	2,732	44	31	3	152	0.023
9	2.6	2.6	20,000	2,740	1,421	23	16	1	79	0.012
10	5	5	38,462	5,269	2,732	44	31	3	152	0.023
11	3.6	3.6	27,692	3,793	1,967	31	22	2	109	0.016
12	2	2	15,385	2,107	1,093	17	12	1	61	0.009
13	2.3	2.3	17,692	2,424	1,257	20	14	1	70	0.011
14	3.3	3.3	25,385	3,477	1,803	29	20	2	100	0.015
15	3	3	23,077	3,161	1,639	26	19	2	91	0.014
16	3.3	3.3	25,385	3,477	1,803	29	20	2	100	0.015
17	2	2	10,000	1,370	710	11	8	1	39	0.006
18	3	3	15,000	2,055	1,065	17	12	1	59	0.009
19	5	5	25,000	3,425	1,776	28	20	2	99	0.015
20	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
21	2	2	10,000	1,370	710	11	8	1	39	0.006
22	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
23	3	3	15,000	2,055	1,065	17	12	1	59	0.009
24	4.6	4.6	23,000	3,151	1,634	26	18	2	91	0.014
25	5.6	5.6	28,000	3,836	1,989	32	22	2	110	0.017
26	4	4	20,000	2,740	1,421	23	16	1	79	0.012
27	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
28	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
29	4	4	20,000	2,740	1,421	23	16	1	79	0.012
30	1.3	1.3	6,500	890	462	7	5	0	26	0.004
31	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
32	3	3	15,000	2,055	1,065	17	12	1	59	0.009

**EP 1.18**  
**3" Pipe**  
**TBD 06-004 Group 2**

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
33	2	2	10,000	1,370	710	11	8	1	39	0.006
34	3.6	3.6	18,000	2,466	1,279	20	14	1	71	0.011
35	1.6	1.6	8,000	1,096	568	9	6	1	32	0.005
36	2	2	10,000	1,370	710	11	8	1	39	0.006
37	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
38	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
39	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
40	1	1	5,000	685	355	6	4	0	20	0.003
41	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
42	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
43	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
44	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
45	2	2	10,000	1,370	710	11	8	1	39	0.006
46	3	3	15,000	2,055	1,065	17	12	1	59	0.009
47	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
48	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
49	3.6	3.6	18,000	2,466	1,279	20	14	1	71	0.011
50	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
51	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
52	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
53	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
54	4	4	20,000	2,740	1,421	23	16	1	79	0.012
55	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
56	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
57	1.6	1.6	8,000	1,096	568	9	6	1	32	0.005
58	2	2	10,000	1,370	710	11	8	1	39	0.006
59	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
60	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
61	1.3	1.3	6,500	890	462	7	5	0	26	0.004
62	4	4	20,000	2,740	1,421	23	16	1	79	0.012
63	4	4	20,000	2,740	1,421	23	16	1	79	0.012

**EP 1.18**  
**3" Pipe**  
**TBD 06-004 Group 2**

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
64	2	2	10,000	1,370	710	11	8	1	39	0.006
65	3	3	15,000	2,055	1,065	17	12	1	59	0.009
66	1.6	1.6	8,000	1,096	568	9	6	1	32	0.005
67	3.6	3.6	18,000	2,466	1,279	20	14	1	71	0.011
68	3.6	3.6	18,000	2,466	1,279	20	14	1	71	0.011
69	2	2	10,000	1,370	710	11	8	1	39	0.006
70	3.6	3.6	18,000	2,466	1,279	20	14	1	71	0.011
71	3	3	15,000	2,055	1,065	17	12	1	59	0.009
72	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
73	3.6	3.6	18,000	2,466	1,279	20	14	1	71	0.011
74	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
75	3	3	15,000	2,055	1,065	17	12	1	59	0.009
76	1.6	1.6	8,000	1,096	568	9	6	1	32	0.005
77	3	3	15,000	2,055	1,065	17	12	1	59	0.009
78	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
79	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
80	3.6	3.6	18,000	2,466	1,279	20	14	1	71	0.011
81	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
82	3	3	15,000	2,055	1,065	17	12	1	59	0.009
83	5	5	25,000	3,425	1,776	28	20	2	99	0.015
84	4	4	20,000	2,740	1,421	23	16	1	79	0.012
85	2	2	10,000	1,370	710	11	8	1	39	0.006
86	6	6	13,333	1,826	947	15	11	1	53	0.008
87	7	7	15,556	2,131	1,105	18	12	1	61	0.009
88	9	9	20,000	2,740	1,421	23	16	1	79	0.012
89	7	7	15,556	2,131	1,105	18	12	1	61	0.009
90	8	8	17,778	2,435	1,263	20	14	1	70	0.011
									MEAN	0.010
									MEDIAN	0.009
									STD DEV	0.004

**EP 1.18**  
**3" Pipe**  
**TBD 06-004 Group 2**

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
									MAX	0.024
									MIN	0.003

**SECTION 7**  
**ATTACHMENT 2 •**  
11 **PAGE(S)**

# Pipe Interior Radiological Survey Form

Date: 12-21-05 Time: 0915  
 Building: RX Elevation: -25 Access Point Area: TRENCH  
 System: CANAL H - PURGE Pipe Diameter: 3" Pipe ID #: 1.22  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size Mr 3 inch  
 Detector: 44-62 Detector ID #: 204402-121  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.9 cpm  
 MDCR<sub>static</sub> 11.3 cpm  
 Efficiency Factor for Pipe Diameter 0.0002 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 6726 dpm/100cm<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: INITIAL SURVEY / SSP

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 12-21-05 Time: 0915

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	3	8	2.7	n/a	n/a
2	2	3	7	2.3		
3	n/a	n/a	n/a	n/a		
4						
5						
6						
7						
8						
9						
10						

Package Page 1 of 2



# Pipe Interior Radiological Survey Form

Date: 1-5-86 Time: 1345  
 Building: REACTION Elevation: -25 Access Point Area: -27 TRENCH  
 System: CANAL H. PURGE Pipe Diameter: 3" Pipe ID #: 1.22  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3" VINYL PAPER inch  
 Detector: BIGMAN 1MGT 44-67 Detector ID #: 8 ETS - 212701  
 Cal Date: 17-NOV-05 Cal Due Date: 17-NOV-06  
 Instrument: 2350-1 Instrument ID #: 217283  
 Cal Date: 17-NOV-05 Cal Due Date: 17-NOV-06

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

Background Value 5.5 cpm  
 MDCR<sub>static</sub> 11 cpm  
 Efficiency Factor for Pipe Diameter 0.00013 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 2779 dpm/100cm<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: CONTINUATION SURVEY

SSP / NOT COMPLETE

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-5-86 Time: 1345

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	3 ft	3	9	3	N/A	N/A
2	4	3	7	2.3		
3	5	3	14	4.6		
4	6	3	16	5.3		
5	7	3	14	4.6		
6	8	3	15	5		
7	9	3	8	2.6		
8	10	3	15	5		
9	11	3	11	3.6		
10	12	3	6	2		

Package Page 1 of 2



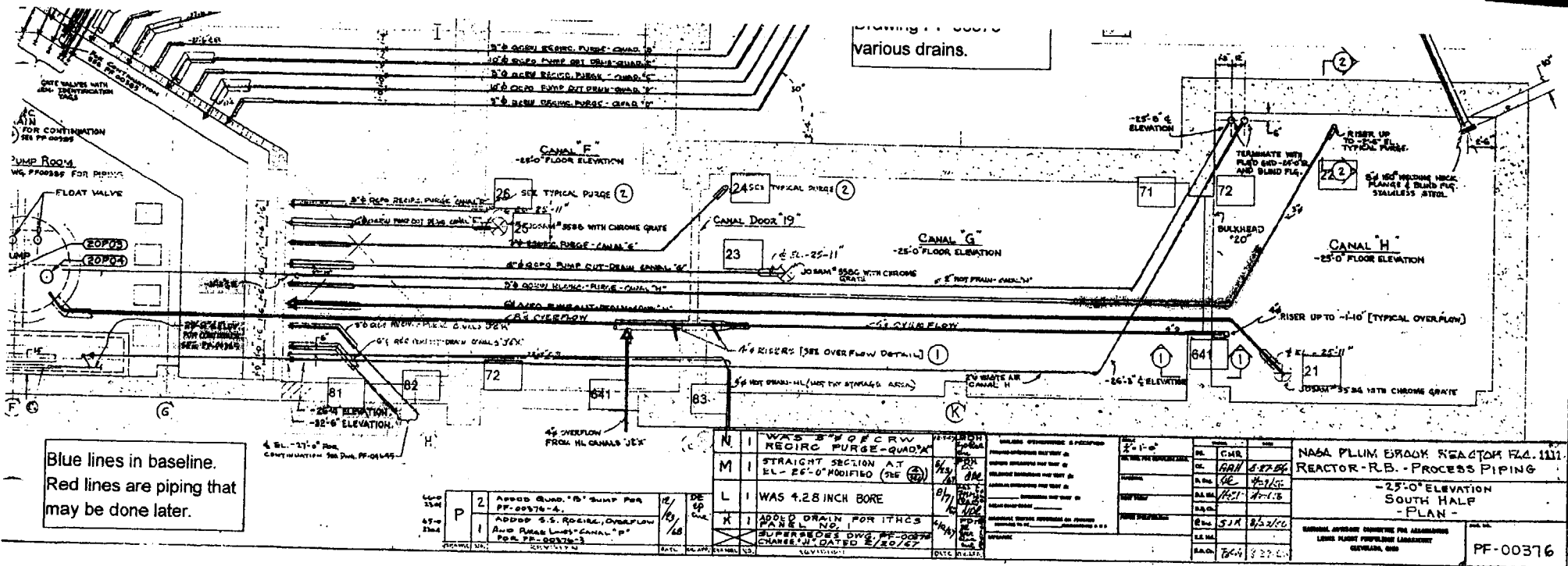
1.22

Package Page 2 of 2

**REFERENCE COPY**

REFERENCE COPY

PAGE 1 of 1



= PIPE SURVIVED

1-5-06

ID# 1.22

# Pipe Interior Radiological Survey Form

Date: 1.9.06 Time: 0815  
 Building: REACTOR Elevation: -25 Access Point Area: -27 TRENCH  
 System: CANAL H. PURGE Pipe Diameter: 3" Pipe ID #: 1.22  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3" VINYL SLED inch  
 Detector: 44-67 Detector ID #: 204402  
 Cal Date: 17-NOV-05 Cal Due Date: 17-NOV-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 17-NOV-05 Cal Due Date: 17-NOV-06

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

Background Value 6.1 cpm  
 MDCR<sub>static</sub> 11.5 cpm  
 Efficiency Factor for Pipe Diameter 0.0002 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 6726 dpm/100cm<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: CONTINUATION SURVEY

ISP / NOT COMPLETE

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1.9.06 Time: 0815

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	17	3	6	2	N/A	N/A
2	18	3	9	3		
3	19	3	15	5		
4	20	3	8	2.4		
5	21	3	6	2		
6	22	3	13	4.3		
7	23	3	9	3		
8	24	3	14	4.6		
9	25	3	17	5.6		
10	26	3	12	4		

Package Page 1 of 3

REFERENCE COPY

Pipe Interior Radiological Survey Form (Continuation Form)

1-9-06

1-22

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	27	3	10	3.3	NIQ	NIQ
12	28	3	10	3.3		
13	29	3	12	4		
14	30	3	4	1.3		
15	31	3	10	3.3		
16	32	3	9	3		
17	33	3	6	2		
18	34	3	11	3.6		
19	35	3	5	1.6		
20	36	3	6	2		
21	37	3	10	3.3		
22	38	3	13	4.3		
23	39	3	8	2.6		
24	40	3	3	1		
25	41	3	8	2.6		
26	42	3	7	2.3		
27	43	3	10	3.3		
28	44	3	8	2.6		
29	45	3	6	2		
30	46	3	9	3		
31	47	3	8	2.6		
32	48	3	7	2.3		
33	49	3	11	3.6		
34	50	3	8	2.6		
35	51	3	7	2.3		
36	52	3	8	2.6		
37	53	3	10	3.3		
38	54	3	12	4		
39	55	3	10	3.3		
40	56	3	10	3.3		
41	57	3	5	1.6		
42	58	3	6	2		
43	59	3	8	2.6		
44	60	3	8	2.6		
45	61	3	4	1.3		
46	62	3	12	4		
47	63	3	12	4		

Package Page 2 of 3

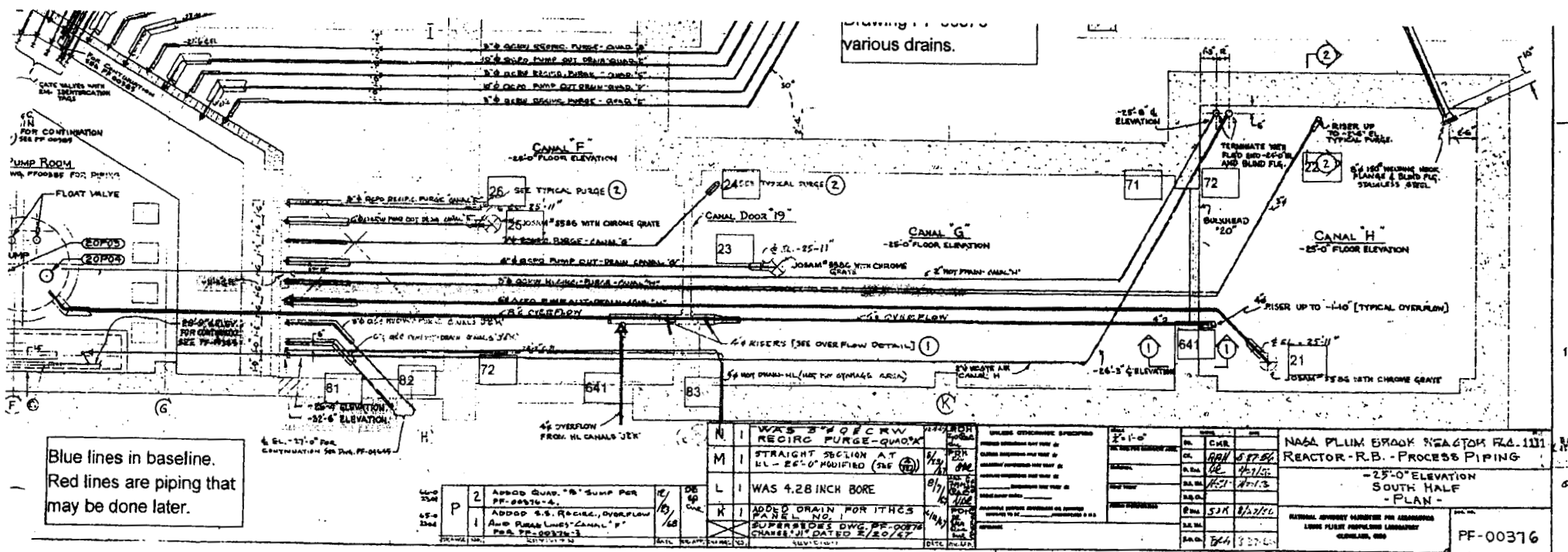
REFERENCE COPY

1.9-06 1.72

Package Page 3 of 3

REFERENCE COPY

PAGE 1 of 1



= PIPE SURVEYED

12-21-05 15:06  
1 9.06

1.D.#1.22

## Pipe Interior Radiological Survey Form

Date: 3-9-06 Time: 0910  
 Pipe ID#: 1-22 Pipe Diameter: 3" Access Point Area: -25 QUAD H  
 Building: RX Elevation: -25 System: CHUAL-H PAR GE  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# BICRON IMC1 / LVS-1 1 101  
 Detector Cal Date: 20-DEC-05 Detector Cal Due Date: 20-DEC-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Instrument Cal Date: 17-NOV-05 Instrument Cal Due Date: 17-NOV-06

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

Background Value 19.5 cpm

MDCR<sub>static</sub> 18.2 cpm

Efficiency Factor for Pipe Diameter 0.00045 (from detector efficiency determination)

MDC<sub>static</sub> 2399 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: CONTINUATION SURVEY

Technician Signature *Jim Ostry*

## 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	6	6	N/A	N/A
2	2	1.2	7	7		
3	3	1.3	9	9		
4	4	1.4	7	7		
5	5	1.5	8	8		
6	N/A	N/A	N/A	N/A		
7						
8						
9						
10						

Package Page 1 of 2

REFERENCE COPY





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


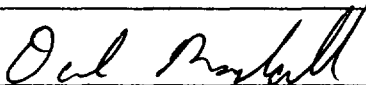

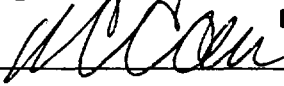
### DQA Check Sheet

Design #	EP 1.22	Revision #	Original						
Survey Unit #	EP 1.22								
<b>Preliminary Data Review</b>									
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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			
<b>Graphical Data Review</b>									
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	
<b>Data Analysis</b>									
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?								X	
Comments:									
FSS/Characterization Engineer (print/sign)						<i>Dale Randall</i>		Date	6-30-07
FSS/Characterization Manager (print/sign)						<i>R. Case</i>		Date	9/10/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-1.45A	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.45A			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.45A meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.45A 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 1.45A 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> <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; font-weight: bold;">COPY</span> </div>			
<b>Approval Signatures</b>				<b>Date:</b>
FSS/Characterization Engineer				9-7-07
Technical Reviewer (FSS/Characterization Engineer)				9-10-07
FSS/Characterization Manager	 R. Case			9/10/07

Form  
CS-09/1  
Rev 0

## Survey Unit: 1.45A

**1.0 History/Description**

- 1.1 The subject pipe system is the 2" vent pipe from the Reactor tank to the drain trench on the Rx Building -25 foot elevation. The function of this pipe was to convey water from the top of the Rx Tank to the drain trench on the Rx line located in Quad "B" of the Reactor Building -25' elevation.
- 1.2 EP 1.45A consists of approximately 7 feet of piping.

**2.0 Survey Design Information**

- 2.1 EP 1.45A was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2" ID pipe was accessible for survey. The accessible 2" ID pipe was surveyed by static measurement at one foot increments, for a total of 7 survey measurements.
- 2.3 Surface area for the 2" ID piping is 486 cm<sup>2</sup> for each foot of piping, corresponding to a total 2" ID piping surface area of 3,405 cm<sup>2</sup> (0.3 m<sup>2</sup>) for the entire length of (7') of 2" 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 All measurement results 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.
- 5.3 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 1.45A passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	2" Pipe
Total Number of Survey Measurements	7
Number of Measurements >MDC	5
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0539
Median	0.0542
Standard Deviation	0.0129
Maximum	0.0778
Minimum	0.0401

**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 EP 1.45A to be less than 1 mrem/yr. The dose contribution is estimated to be 0.054 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.45A & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.45A	Survey Location	-6 el. Cavity Vessel
Survey Date	27-Feb-06	2350-1 #	212223
Survey Time	08:10	Detector-Sled #	44-82 204402 / 121
Pipe Size	2"	Detector Efficiency	0.00026
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	486
Pipe Area Incorporated by Survey Data (in")	0.3	Field BKG (cpm)	5.3
Routine Survey	X	Field MDCR (cpm)	10.9
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	7,836
Survey Measurement Results			
Total Number of Survey Measurements			7
Number of Measurements >MDC			5
Number of Measurements Above 50% DCGL			0
Number of Measurements Above DCGL			0
Mean			0.0539
Median			0.0542
Standard Deviation			0.0129
Maximum			0.0778
Minimum			0.0401
Survey Technician(s)		ROSENHAGEN	
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 Roshall 9-7-07	



**EP 1.45A**  
**2" 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	13	13	50,000	10,279	407	9,751	2,592	300	72	0.061
2	10	10	38,462	7,907	313	7,500	1,994	231	55	0.047
3	11.5	11.5	44,231	9,093	360	8,625	2,293	265	63	0.054
4	11.5	11.5	44,231	9,093	360	8,625	2,293	265	63	0.054
5	8.5	8.5	32,692	6,721	266	6,375	1,695	196	47	0.040
6	9	9	34,615	7,116	282	6,750	1,795	208	50	0.042
7	16.5	16.5	63,462	13,046	517	12,376	3,290	381	91	0.078
									MEAN	0.054
									MEDIAN	0.054
									STD DEV	0.013
									MAX	0.078
									MIN	0.040

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

### Pipe Interior Radiological Survey Form

Date: 2-27-06 Time: 0810  
 Pipe ID#: 1.45A Pipe Diameter: 2" Access Point Area: CAVITY VESSEL  
 Building: RX Elevation: -6 System: CART  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-62 / 212701 / 121  
 Detector Cal Date: 17-Nov-05 Detector Cal Due Date: 17-Nov-06  
 Instrument: 2350 -1 Instrument ID #: 212223  
 Instrument Cal Date: 17-Nov-05 Instrument Cal Due Date: 17-Nov-06

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

Background Value 5.3 cpm

MDCR<sub>static</sub> 10.9 cpm

Efficiency Factor for Pipe Diameter 0.00026 (from detector efficiency determination)

MDC<sub>static</sub> 7836 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: INITIAL

NOTE: ~~MAP~~ NO MAP AVAILABLE

Technician Signature

*[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	2	24	N/A	N/A	N/A
2	2	2	20			
3	3	2	23			
4	4	2	23			
5	5	2	17			
6	6	2	18			
7	7	2	33			
8	N/A	N/A	N/A			
9	↓	↓	↓	↓	↓	↓
10	↓	↓	↓	↓	↓	↓

REFERENCE COPY

Package Page 1 of 1

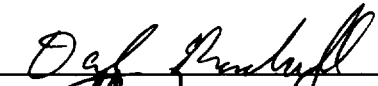
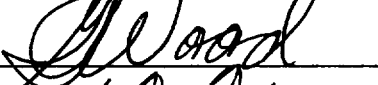

**SECTION 7**  
**ATTACHMENT 3**  
**/        PAGE(S)**

### DQA Check Sheet

Design #	EP 1.45A	Revision #	Original					
Survey Unit #	EP 1.45A							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)				<i>Dale Randall</i>		Date	9-7-07	
FSS/ Characterization Manager (print/sign)				<i>[Signature]</i>		Date	9/10/07	
				R. Case		Date		

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

Survey Unit Release Record				
Design #	EP-1.43-2.5" INST	Revision #	Original	Page 1 of 3
Survey Unit #(s)	1.43-2.5" INST			
Description	<p>1) Embedded Pipe (EP) Survey Unit 1.43-2.5" INST meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.43-2.5" INST 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 1.43-2.5" INST were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 3-1 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) The piping used in the construction of this system was a non-standard schedule that was nominally 2.5" in diameter. This caused difficulties with regard to the procurement of an identical pipe sample for detector geometry mock-up. As a result, the detector calibration efficiency was not acquired. To compensate for this, the instrument efficiency values applied to this Survey Unit were associated with 3" diameter piping. These values are conservative when applied to measurements made on the nominal 2.5" diameter piping.</p>			
Approval Signatures			Date:	
FSS/Characterization Engineer			8-26-07	
Technical Reviewer (FSS/Characterization Engineer)			9-3-07	
FSS/Characterization Manager	 R. Case		9/10/07	

FSS Design # EP 1.43-2.5" INST	Revision # Original	Page 2 of 3
Survey Unit: 1.43-2.5" INST		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 2.5" line located in Quad "B" of the Reactor building -12' elevation.
- 1.2 EP 1.43-2.5" INST consists of approximately 5 feet in length from the Reactor Building -25' elevation, Quad "B" to the Sub Pile Room.

## **2.0 Survey Design Information**

- 2.1 EP 1.43-2.5" INST was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2.5" ID pipe was accessible for survey. The accessible 2.5" ID pipe was surveyed by static measurement at one foot increments, for a total of 5 survey measurements.
- 2.3 Surface area for the 2.5" ID piping is 608 cm<sup>2</sup> for each foot of piping, corresponding to a total 2.5" ID piping surface area of 3,040 cm<sup>2</sup> (0.3 m<sup>2</sup>) for the entire length of (5') of 2.5" piping.

## **3.0 Survey Unit Measurement Locations/Data**

- 3.1 Pipe interior radiological survey forms are provided in Attachment 2 of this release record.
- 3.2 Although the measurements were performed on 2.5" diameter piping, instrument efficiencies for 3" diameter piping were applied, which is a conservative evaluation of the results.

## **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 All measurement results 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.
- 5.3 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 1.43-2.5" INST passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.



FSS Design # EP 1.43-2.5" INST	Revision # Original	Page 3 of 3
Survey Unit: 1.43-2.5" INST		

## 5.5 Statistical Summary Table

Statistical Parameter	2.5" Pipe
Total Number of Survey Measurements	5
Number of Measurements >MDC	5
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0345
Median	0.0357
Standard Deviation	0.0092
Maximum	0.0431
Minimum	0.0193

**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 EP 1.43-2.5" INST to be less than 1 mrem/yr. The dose contribution is estimated to be 0.035 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

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP 1.43-2.5" INST & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.43-2.5 INST	Survey Location	-12 el. Quad B
Survey Date	23-Apr-07	2350-1 #	203438
Survey Time	13:42	Detector-Sled #	44-159 238369 / no sled
Pipe Size	2.5"	Detector Efficiency	0.00066
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	608
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	0.3	Field BKG (cpm)	1.6
Routine Survey	X	Field MDCR (cpm)	7.3
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	2,648
Survey Measurement Results			
Total Number of Survey Measurements		5	
Number of Measurements >MDC		5	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0345	
Median		0.0357	
Standard Deviation		0.0092	
Maximum		0.0431	
Minimum		0.0193	
Survey Technician(s)		STOCK	
Survey Unit Classification		1	
TBD 06-004 Piping Group		1	
SR-13 Radionuclide Distribution Sample		EP 3-1	
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		Oel Randall 8-22-07	

**EP 1.43-2.5" INST**  
**2.5" 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	27	27	40,909	6,728	267	6,382	1,697	196	47	0.040
2	23	23	34,848	5,731	227	5,437	1,445	167	40	0.034
3	29	29	43,939	7,226	286	6,855	1,822	211	50	0.043
4	24	24	36,364	5,980	237	5,673	1,508	175	42	0.036
5	13	13	19,697	3,239	128	3,073	817	95	23	0.019
									MEAN	0.034
									MEDIAN	0.036
									STD DEV	0.009
									MAX	0.043
									MIN	0.019

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

### Pipe Interior Radiological Survey Form

Date: 4/23/07 Time: 1342  
Pipe ID#: 1,43 Pipe Diameter: 2.5" Access Point Area: QUAD B  
Building: LV Elevation: -12' System: R RINGS

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓

Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_

Detector ID# / Sled ID# 44-159 238369 / NO SLED

Detector Cal Date: 9/5/06 Detector Cal Due Date: 9/5/07

Instrument: 2350-1 Instrument ID #: 203438

Instrument Cal Date: 9/5/06 Instrument Cal Due Date: 9/5/07

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

Background Value 1.6 cpm

MDCR<sub>static</sub> 7.3 cpm

Efficiency Factor for Pipe Diameter 0.00066 (from detector efficiency determination)

MDC<sub>static</sub> 2648 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>)

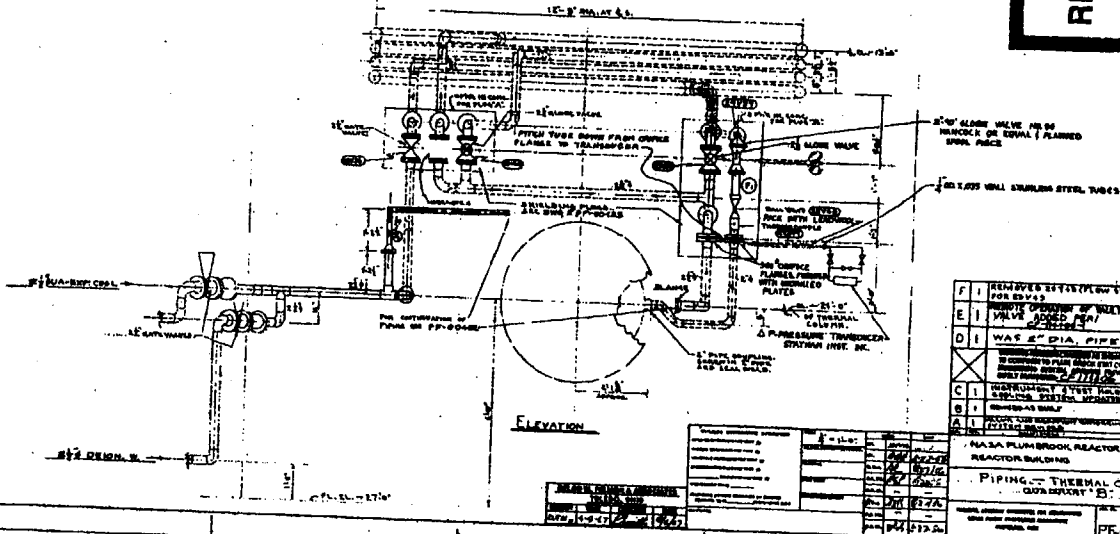
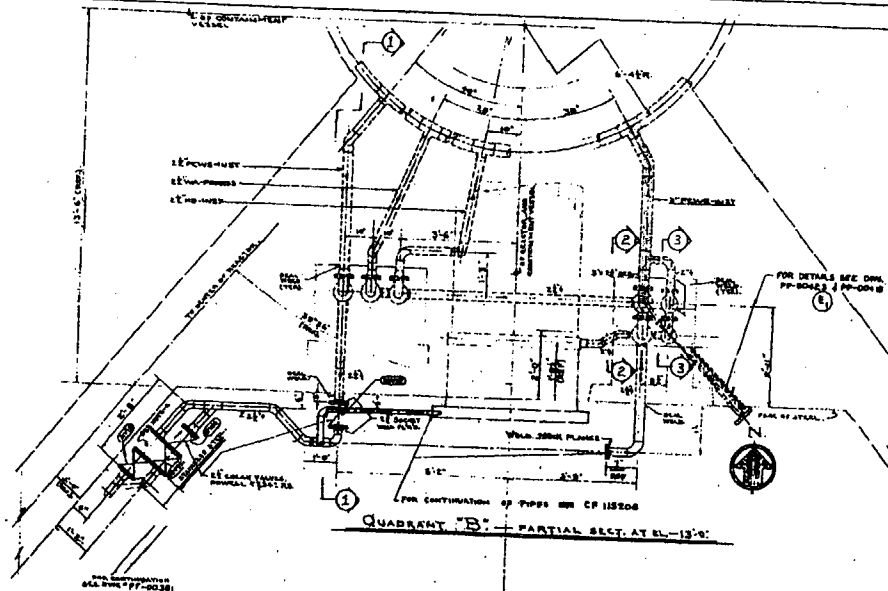
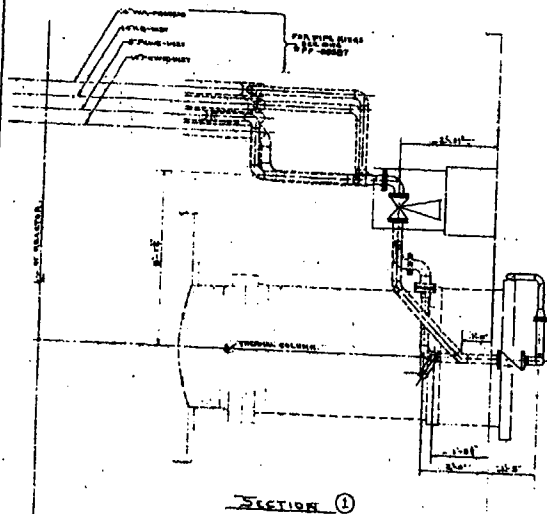
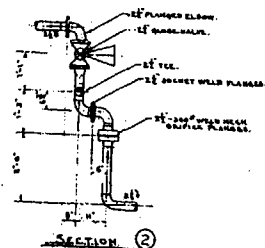
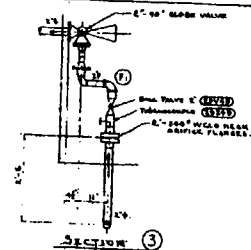
Comments: INITIAL EP3-1 COMPLETE

Technician Signature [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	27	27	N/A	N/A
2	2		23	23		
3	3		29	29		
4	4		24	24		
5	5		13	13		
6						
7						
8						
9						
10						

Package Page 1 of 2



# GENERAL NOTES

1. FOR SCHEDULE OF PIPES SEE "PF-00300"
2. ALL WELLS AND PIPES SHALL BE WELDED TO THE STEEL AREA.
3. ALL PIPING SHALL BE SCHEDULE 40 STAINLESS STEEL. ALL SPEC. AND WELD SCHEDULE.
4. LINES WELDED BY WELD FLANGES, WELDED TO THE STEEL AREA.

REFERENCE COPY

F1	REMOVED 2" DIA. PIPE TO FOR EX-103	10/1/58
E1	REMOVED 2" DIA. PIPE TO FOR EX-103	10/1/58
D1	WAS 2" DIA. PIPE	10/1/58
C1	REMOVED 2" DIA. PIPE TO FOR EX-103	10/1/58
B1	REMOVED 2" DIA. PIPE TO FOR EX-103	10/1/58
A1	REMOVED 2" DIA. PIPE TO FOR EX-103	10/1/58

NASA PLUMBROOK REACTOR FAC. 11111  
REACTOR BUILDING  
PIPING - THERMAL COLUMN  
QUADRANT "B"

PF-00392

1.43 (2.5")

PAGE 2 of 2

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




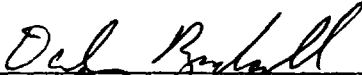
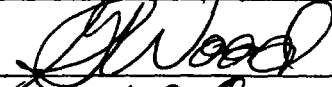

### DQA Check Sheet

Design #	EP 1.43-2.5" INST	Revision #	Original			
Survey Unit #	EP 1.43-2.5" INST					
<b>Preliminary Data Review</b>						
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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)		<i>Dale R. Case</i>			Date	8-26-07
FSS/ Characterization Manager (print/sign)		<i>[Signature]</i> R. Case			Date	9/10/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.45	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.45			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.45 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.45 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 1.45 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 style="text-align: center;"> <b>COPY</b></p>			
<b>Approval Signatures</b>				<b>Date:</b>
FSS/Characterization Engineer				8-29-07
Technical Reviewer (FSS/Characterization Engineer)				9-3-07
FSS/Characterization Manager	 R. Case			9/10/07

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.45	Revision # Original	Page 2 of 3
Survey Unit: 1.45		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 2" vent pipe from the Reactor tank to the drain trench on the Rx Building -25 foot elevation. The function of this pipe was to convey water from the top of the Rx Tank to the drain trench on the Rx line located in Quad "B" of the Reactor Building -25' elevation.
- 1.2 EP 1.45 consists of approximately 112 feet of piping.

## **2.0 Survey Design Information**

- 2.1 EP 1.45 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2" ID pipe was accessible for survey. The accessible 2" ID pipe was surveyed by static measurement at one foot increments, for a total of 112 survey measurements.
- 2.3 Surface area for the 2" ID piping is 486 cm<sup>2</sup> for each foot of piping, corresponding to a total 2" ID piping surface area of 54,481 cm<sup>2</sup> (5.4 m<sup>2</sup>) for the entire length of (112') of 2" 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 All measurement results 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.
- 5.3 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 1.45 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	2" Pipe
Total Number of Survey Measurements	112
Number of Measurements >MDC	69
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0878
Median	0.0478
Standard Deviation	0.0954
Maximum	0.4488
Minimum	0.0065

**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 EP 1.45 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.088 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.45 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.45	Survey Location	-27 el. Trench, 25 el. Quad A, 37 el. Sub Pile Room		
Survey Date	1-19-06, 3-6-06, 5-16-06, 2-22-06	2350-1 #	212223		
Survey Time	10:30, 12:40, 08:35, 08:22	Detector-Sled #	44-62 204402 / 121, 44-159 215957 / no sled, 44-159 238369 / no sled, 44-62 212701 / 121		
Pipe Size	2"	Detector Efficiency	0.00026, 0.00038, 0.0005, 0.0002		
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	486		
Pipe Area Incorporated by Survey Data (in cm <sup>2</sup> )	5.4	Field BKG (cpm)	5.2, 11, 12.3, 4.9		
Routine Survey	X	Field MDCR (cpm)	11.8, 14.4, 15.1, 10.6		
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	7836, 3493, 4410, 5305		
Survey Measurement Results					
Total Number of Survey Measurements			112		
Number of Measurements >MDC			69		
Number of Measurements Above 50% DCGL			0		
Number of Measurements Above DCGL			0		
Mean			0.0878		
Median			0.0478		
Standard Deviation			0.0954		
Maximum			0.4488		
Minimum			0.0065		
Survey Technician(s)		ROSENHAGEN, DEBRAUX, STOCK			
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:

1. THE DATA IS PRESENTED IN ORDER, TRAVERSING CONTINUOUSLY THROUGH THE PIPE SYSTEM, FROM THE -27 TRENCH TO THE BOTTOM OF THE Rx CAVITY, NOT IN DATE ORDER.

2. ACTIVITY VALUES NOT BACKGROUND CORRECTED

RP Engineer | Date

*Oral Roubal* 8-29-07

**EP 1.45**  
**2" 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	6.5	6.5	25,000	5,139	204	4,875	1,296	150	36	0.031
2	4	4	15,385	3,163	125	3,000	798	92	22	0.019
3	4.5	4.5	17,308	3,558	141	3,375	897	104	25	0.021
4	6	6	23,077	4,744	188	4,500	1,196	138	33	0.028
5	6.5	6.5	25,000	5,139	204	4,875	1,296	150	36	0.031
6	5	5	19,231	3,953	157	3,750	997	115	28	0.024
7	5.5	5.5	21,154	4,349	172	4,125	1,097	127	30	0.026
8	4.5	4.5	17,308	3,558	141	3,375	897	104	25	0.021
9	6	6	23,077	4,744	188	4,500	1,196	138	33	0.028
10	4	4	15,385	3,163	125	3,000	798	92	22	0.019
11	5.5	5.5	21,154	4,349	172	4,125	1,097	127	30	0.026
12	3	3	11,538	2,372	94	2,250	598	69	17	0.014
13	7	7	26,923	5,535	219	5,250	1,396	162	39	0.033
14	9.5	9.5	36,538	7,511	298	7,125	1,894	219	52	0.045
15	7.5	7.5	28,846	5,930	235	5,625	1,495	173	41	0.035
16	4	4	15,385	3,163	125	3,000	798	92	22	0.019
17	8	8	30,769	6,325	251	6,000	1,595	185	44	0.038
18	10	10	38,462	7,907	313	7,500	1,994	231	55	0.047
19	10	10	38,462	7,907	313	7,500	1,994	231	55	0.047
20	3.5	3.5	13,462	2,767	110	2,625	698	81	19	0.017
21	4.5	4.5	17,308	3,558	141	3,375	897	104	25	0.021
22	4	4	15,385	3,163	125	3,000	798	92	22	0.019
23	5	5	19,231	3,953	157	3,750	997	115	28	0.024
24	6.5	6.5	25,000	5,139	204	4,875	1,296	150	36	0.031
25	6	6	23,077	4,744	188	4,500	1,196	138	33	0.028
26	6	6	23,077	4,744	188	4,500	1,196	138	33	0.028
27	5.5	5.5	21,154	4,349	172	4,125	1,097	127	30	0.026
28	6.5	6.5	25,000	5,139	204	4,875	1,296	150	36	0.031
29	6	6	23,077	4,744	188	4,500	1,196	138	33	0.028
30	7.5	7.5	28,846	5,930	235	5,625	1,495	173	41	0.035
31	4.5	4.5	17,308	3,558	141	3,375	897	104	25	0.021
32	6	6	23,077	4,744	188	4,500	1,196	138	33	0.028



**EP 1.45**  
**2" 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
33	4.5	4.5	17,308	3,558	141	3,375	897	104	25	0.021
34	7	7	26,923	5,535	219	5,250	1,396	162	39	0.033
35	7	7	26,923	5,535	219	5,250	1,396	162	39	0.033
36	11.5	11.5	44,231	9,093	360	8,625	2,293	265	63	0.054
37	10.5	10.5	40,385	8,302	329	7,875	2,094	242	58	0.050
38	9.5	9.5	36,538	7,511	298	7,125	1,894	219	52	0.045
39	7.5	7.5	28,846	5,930	235	5,625	1,495	173	41	0.035
40	12.5	12.5	48,077	9,883	392	9,375	2,492	288	69	0.059
41	11	11	42,308	8,697	345	8,250	2,193	254	61	0.052
42	11.5	11.5	44,231	9,093	360	8,625	2,293	265	63	0.054
43	12	12	46,154	9,488	376	9,000	2,393	277	66	0.057
44	10.5	10.5	40,385	8,302	329	7,875	2,094	242	58	0.050
45	7	7	18,421	3,787	150	3,592	955	111	26	0.023
46	5	5	13,158	2,705	107	2,566	682	79	19	0.016
47	9	9	23,684	4,869	193	4,619	1,228	142	34	0.029
48	4	4	10,526	2,164	86	2,053	546	63	15	0.013
49	3	3	7,895	1,623	64	1,540	409	47	11	0.010
50	6	6	15,789	3,246	129	3,079	819	95	23	0.019
51	3	3	7,895	1,623	64	1,540	409	47	11	0.010
52	2	2	5,263	1,082	43	1,026	273	32	8	0.006
53	11	11	28,947	5,951	236	5,645	1,501	174	41	0.035
54	42	42	110,526	22,722	901	21,554	5,730	663	158	0.136
55	15	15	39,474	8,115	322	7,698	2,046	237	57	0.048
56	25	25	65,789	13,525	536	12,830	3,411	395	94	0.081
57	54	54	142,105	29,213	1,158	27,712	7,367	852	204	0.174
58	10	10	26,316	5,410	214	5,132	1,364	158	38	0.032
59	20	20	52,632	10,820	429	10,264	2,729	316	75	0.065
60	15	15	39,474	8,115	322	7,698	2,046	237	57	0.048
61	19	19	50,000	10,279	407	9,751	2,592	300	72	0.061
62	17	17	44,737	9,197	365	8,724	2,319	268	64	0.055
63	8	8	21,053	4,328	172	4,105	1,091	126	30	0.026

**EP 1.45**  
**2" 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)	Unlty
64	12	12	31,579	6,492	257	6,158	1,637	189	45	0.039
65	10	10	26,316	5,410	214	5,132	1,364	158	38	0.032
66	8	8	21,053	4,328	172	4,105	1,091	126	30	0.026
67	10	10	26,316	5,410	214	5,132	1,364	158	38	0.032
68	7	7	18,421	3,787	150	3,592	955	111	26	0.023
69	6	6	15,789	3,246	129	3,079	819	95	23	0.019
70	18	18	47,368	9,738	386	9,237	2,456	284	68	0.058
71	18	18	36,000	7,401	293	7,020	1,866	216	52	0.044
72	22	22	44,000	9,045	359	8,580	2,281	264	63	0.054
73	26	26	52,000	10,690	424	10,141	2,696	312	74	0.064
74	24	24	48,000	9,868	391	9,360	2,488	288	69	0.059
75	23	23	46,000	9,456	375	8,970	2,385	276	66	0.056
76	17	17	34,000	6,990	277	6,630	1,763	204	49	0.042
77	22	22	44,000	9,045	359	8,580	2,281	264	63	0.054
78	28	28	56,000	11,512	456	10,921	2,903	336	80	0.069
79	27	27	54,000	11,101	440	10,531	2,799	324	77	0.066
80	31	31	62,000	12,746	505	12,091	3,214	372	89	0.076
81	31	31	62,000	12,746	505	12,091	3,214	372	89	0.076
82	44	44	88,000	18,091	717	17,161	4,562	528	126	0.108
83	29	29	58,000	11,923	473	11,311	3,007	348	83	0.071
84	67	67	134,000	27,547	1,092	26,131	6,947	804	192	0.164
85	84	84	168,000	34,537	1,369	32,762	8,709	1,008	241	0.206
86	124	124	248,000	50,983	2,021	48,363	12,857	1,488	355	0.304
87	69	69	138,000	28,369	1,124	26,911	7,154	828	198	0.169
88	44	44	88,000	18,091	717	17,161	4,562	528	126	0.108
89	28	28	56,000	11,512	456	10,921	2,903	336	80	0.069
90	50	50	100,000	20,558	815	19,501	5,184	600	143	0.123
91	68	68	136,000	27,958	1,108	26,521	7,050	816	195	0.167
92	89	89	178,000	36,592	1,450	34,712	9,228	1,068	255	0.218
93	83	83	166,000	34,126	1,353	32,372	8,606	996	238	0.204
94	84	84	168,000	34,537	1,369	32,762	8,709	1,008	241	0.206

**EP 1.45**  
**2" 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)	Unlity
95	90	90	180,000	37,004	1,467	35,102	9,331	1,080	258	0.221
96	120	120	240,000	49,338	1,955	46,802	12,442	1,440	344	0.294
97	93	93	186,000	38,237	1,515	36,272	9,643	1,116	266	0.228
98	104	104	208,000	42,760	1,695	40,562	10,783	1,248	298	0.255
99	108	108	216,000	44,404	1,760	42,122	11,198	1,296	309	0.265
100	126	126	252,000	51,805	2,053	49,143	13,064	1,512	361	0.309
101	106	106	212,000	43,582	1,727	41,342	10,990	1,272	304	0.260
102	115	115	230,000	47,282	1,874	44,852	11,924	1,380	329	0.282
103	130	130	260,000	53,450	2,118	50,703	13,479	1,560	372	0.319
104	145	145	290,000	59,617	2,363	56,553	15,034	1,740	415	0.356
105	100	100	200,000	41,115	1,630	39,002	10,368	1,200	287	0.245
106	152	152	304,000	62,495	2,477	59,283	15,760	1,824	436	0.373
107	183	183	366,000	75,241	2,982	71,374	18,974	2,196	524	0.449
108	19	19	95,000	19,530	774	18,526	4,925	570	136	0.116
109	27.5	27.5	137,500	28,267	1,120	26,814	7,128	825	197	0.169
110	36.5	36.5	182,500	37,518	1,487	35,589	9,461	1,095	261	0.224
111	9	9	45,000	9,251	367	8,775	2,333	270	64	0.055
112	15	15	75,000	15,418	611	14,626	3,888	450	107	0.092
									MEAN	0.088
									MEDIAN	0.048
									STD DEV	0.095
									MAX	0.449
									MIN	0.006

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

# Pipe Interior Radiological Survey Form

Date: 1-19-06 Time: 1030  
 Building: RX Elevation -27-25 Access Point -27 TRENCH  
 System: SUBPILE RETURN Pipe Diameter: 2" Area: Pipe ID 1.45  
 Type of Survey Investigation Characterization Final Survey # Other ✓  
 Sled Size 2" VINYL PULLEY #121 inch  
 Detector: 44-6Z Detector ID #: 204402-<sup>5/16</sup>121  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.2 cpm  
 MDCR<sub>static</sub> 11.8 cpm  
 Efficiency Factor for Pipe 0.00026 (taken from detector efficiency determination calibration certificate)  
 Diameter MDC<sub>static</sub> dpm/100cm<sup>2</sup>  
 Is the MDC<sub>static</sub> 7836 Yes No (if no, adjust sample count time and recalculate MDCR<sub>static</sub>)  
 acceptable?  
 Comments: INITIAL SURVEY

SSP

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-19-06 Time: 1030

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	2	13	6.5	n/a	n/a
2	2	2	8	4		
3	3	2	9	4.5		
4	4	2	12	6		
5	5	2	13	6.5		
6	6	2	10	5		
7	7	2	11	5.5		
8	8	2	9	4.5		
9	9	2	12	6		
10	10	2	8	4		

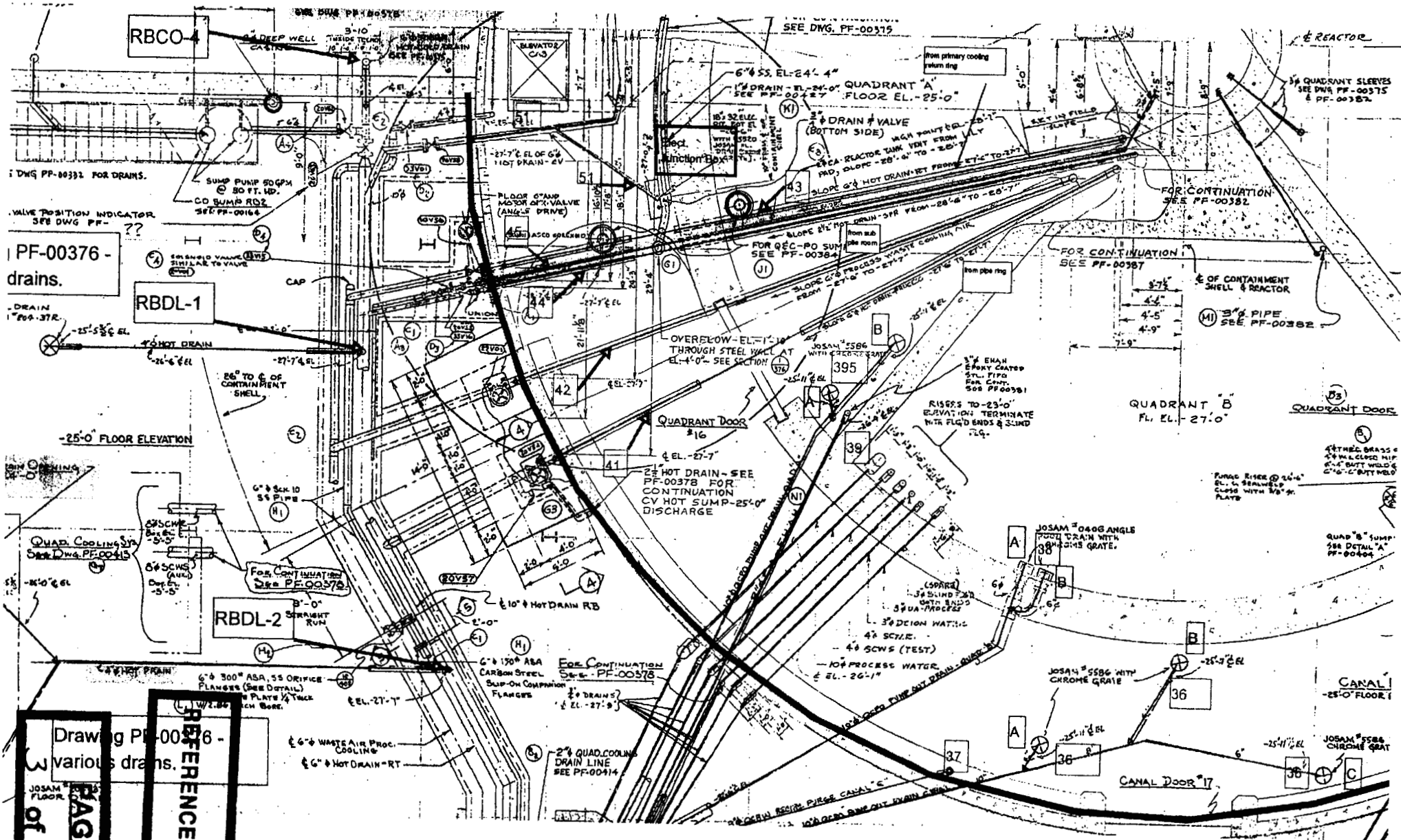
Package Page 1 of 3

# Pipe Interior Radiological Survey Form (Continuation Form)

1-19-06 1.45

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	2	11	5.5	n/a	n/a
12	12	2	6	3		
13	13	2	14	7.5		
14	14	2	19	9.5		
15	15	2	15	7.5		
16	16	2	8	4		
17	17	2	16	8		
18	18	2	20	10		
19	19	2	30	10		
20	20	2	7	3.5		
21	21	2	9	4.5		
22	22	2	8	4		
23	23	2	10	5		
24	24	2	13	6.5		
25	25	2	12	6		
26	26	2	12	6		
27	27	2	11	5.5		
28	28	2	13	6.5		
29	29	2	12	6		
30	30	2	15	7.5		
31	31	2	9	4.5		
32	32	2	12	6		
33	33	2	9	4.5		
34	34	2	14	7		
35	35	2	14	7		
36	36	2	23	11.5		
37	37	2	21	10.5		
38	38	2	19	9.5		
39	39	2	15	7.5		
40	40	2	25	12.5		
41	41	2	22	11		
42	42	2	23	11.5		
43	43	1	24	12		
44	44	2	21	10.5		
n/a	n/a	n/a	n/a	n/a		
↓	↓	↓	↓	↓	↓	↓

Package Page 2 of 3



= Pipe surveyed  
 I.D # 148 1.45  
 1-19-06

### Pipe Interior Radiological Survey Form

Date: 3-6-06 Time: 1240  
 Pipe ID#: 1.45 Pipe Diameter: 2" Access Point Area: LILY PAD FLOOR  
 Building: Rx Elevation: 0' System: ELER BOX  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-159 / 215957 / NO SLED  
 Detector Cal Date: 2-20-06 Detector Cal Due Date: 2-20-07  
 Instrument: 2350-1 Instrument ID #: 212223  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 11 cpm  
 MDCR<sub>static</sub> 14.4 cpm  
 Efficiency Factor for Pipe Diameter 0.00038 (from detector efficiency determination)  
 MDC<sub>static</sub> 3493 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: INITIAL SURVEY

NO MAP AVAILABLE

Technician Signature

C. O'BRYEN

### 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	<u>21</u>	<u>1</u>	<u>7</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
2	<u>2</u>	<u>1</u>	<u>5</u>			
3	<u>3</u>	<u>1</u>	<u>9</u>			
4	<u>4</u>	<u>1</u>	<u>4</u>			
5	<u>5</u>	<u>1</u>	<u>3</u>			
6	<u>6</u>	<u>1</u>	<u>6</u>			
7	<u>7</u>	<u>1</u>	<u>3</u>			
8	<u>8</u>	<u>1</u>	<u>2</u>			
9	<u>9</u>	<u>1</u>	<u>11</u>			
10	<u>10</u>	<u>1</u>	<u>42</u>			

Package Page 1 of 1

REFERENCE COPY



### Pipe Interior Radiological Survey Form

Date: 3-6-06 Time: 1300  
 Pipe ID#: 1.45 Pipe Diameter: 2" Access Point Area: QUAD #A TO QUAD C - 14' ABOVE FLOOR  
 Building: Rx Elevation: -25 QUAD A System: CAT VENT LINE  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other L  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-159 / 215957 / NO SLED  
 Detector Cal Date: 2-20-06 Detector Cal Due Date: 2-20-07  
 Instrument: 2350-1 Instrument ID #: 212223  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 11 cpm  
 MDCR<sub>static</sub> 14.4 cpm  
 Efficiency Factor for Pipe Diameter 0.00038 (from detector efficiency determination)  
 MDC<sub>static</sub> 3493 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: CONTINUATION SURVEY

Technician Signature C. O. Brown / [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	15	n/a	n/a	n/a
2	2	1	25			
3	3	1	54			
4	4	1	10			
5	5	1	20			
6	6	1	15			
7	7	1	19			
8	8	1	17			
9	9	1	8			
10	10	1	12			

Package Page 1 of 2

REFERENCE COPY

Access Point Area: QUAD A TO QUAD C - 141  
System: ADDC LEACH CANT FEAT LINE

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	1	10	10	n/a	n/a
12	12	1	8	8	↓	↓
13	13	1	10	10		
14	14	1	7	7		
15	15	1	6	6		
16	16	1	18	18		

### Pipe Interior Radiological Survey Form

Date: 5/16/06 Time: 0835  
 Pipe ID#: 1.45 Pipe Diameter: 2" Access Point Area: SUB PILE Room  
 Building: CV Elevation: -37' System: CART VENT LINE  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-159 #238369 / NO SLED  
 Detector Cal Date: 3/6/06 Detector Cal Due Date: 3/6/07  
 Instrument: 2350-1 Instrument ID #: 212223  
 Instrument Cal Date: 11/17/05 Instrument Cal Due Date: 11/17/06

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

Background Value 12.3 cpm

MDCR<sub>static</sub> 15.1 cpm

Efficiency Factor for Pipe Diameter 0.0005 (from detector efficiency determination)

MDC<sub>static</sub> 4410 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: CONTINUATION SURVEY COMPLETE  
EP3-9

Technician Signature [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	6	1	18	18	N/A	N/A
2	7		22	22		
3	8		26	26		
4	9		24	24		
5	10		23	23		
6	11		17	17		
7	12		22	22		
8	13		28	28		
9	14		27	27		
10	15		31	31		

Package Page 1 of 3

REFERENCE COPY

Pipe Interior Radiological Survey Form (Continuation Form)

Date: 5/16/06  
Pipe ID#: 1.45 Pipe Diameter: 2" Access Point Area: SUB PILE ROOM  
Building: CV Elevation: -37' System: CART VENT LINE

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	16	1	31	31	N/A	N/A
12	17		44	44		
13	18		29	29		
14	19		67	67		
15	20		84	84		
16	21		124	124		
17	22		69	69		
18	23		44	44		
19	24		28	28		
20	25		50	50		
21	26		68	68		
22	27		89	89		
23	28		83	83		
24	29		84	84		
25	30		90	90		
26	31		120	120		
27	32		93	93		
28	33		104	104		
29	34		108	108		
30	35		126	126		
31	36		106	106		
32	37		115	115		
33	38		130	130		
34	39		145	145		
35	40		100	100		
36	41		152	152		
37	42		183	183		
38	43		NOT	USED		
N						
A						

REFERENCE COPY

Package Page 2 of 3

Primary Coolant Loop drains, sheath drain, and primary instrument water loop

PART PLAN OF  
ELEVATOR & STAIR AREA

entrance to Sub Pile Room PF-00382

REFERENCE COPY

# Primary Coolant Loop

## PF-00382

→ PIPE SURVEYED  
1.45

F	1	REVISED AS BU
E	1	DRAWING REVISED FOR M ADDITIONS UNDER CO 103 B-92 PB DWG. C/VII
	4	20 P 01 WAS PUMP "B"
	3	20 P 02 WAS PUMP "C"
D	2	20 P 09 WAS PUMP "A"
	1	VALVE AND EQUIPMENT IN SYSTEM BE-1100

UNLESS OTHERWISE SPECIFIED	ALL $\frac{1}{4} = 1'-0"$
FINISH DIMENSIONS UNLESS NOTED	SEE THE PER CHAPTERS AND
STRUCTURE DIMENSIONS MAY VARY	
MECHANICAL DIMENSIONS MAY VARY	
MECHANICAL DIMENSIONS MAY VARY	
MECHANICAL DIMENSIONS MAY VARY	

Pipe Interior Radiological Survey Form

Date: 2-22-06 Time: 0822  
 Pipe ID#: 1.45 Pipe Diameter: 2" Access Point Area: SPR CAVE  
 Building: RX Elevation: -45 System: VENT LINE  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other 1  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-62 #212701 / 121  
 Detector Cal Date: 11-17-05 Detector Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 4.9 cpm  
 MDCR<sub>static</sub> 10.6 cpm  
 Efficiency Factor for Pipe Diameter 0.0002 (from detector efficiency determination)  
 MDC<sub>static</sub> 5305 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: INITIAL SURVEY

Technician Signature C. DERRAUX

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	2	38	19	n/a	n/a
2	2	2	55	27.5		
3	3	2	73	36.5		
4	4	2	18	9		
5	5	2	30	15		
6	n/a	n/a	n/a	n/a		
7	↓	↓	↓	↓		
8	↓	↓	↓	↓		
9	↓	↓	↓	↓		
10	↓	↓	↓	↓		

Package Page 1 of 2

REFERENCE COPY



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




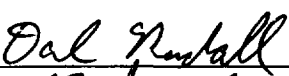

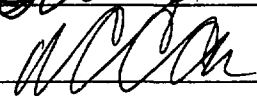
### DQA Check Sheet

Design #	EP 1.45	Revision #	Original					
Survey Unit #	EP 1.45							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)				<i>Dale Randall</i>		Date	8-29-07	
FSS/ Characterization Manager (print/sign)				<i>[Signature]</i>		Date	9/10/07	
				R. Case				

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.39	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.39			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.39 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.39 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.39 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: center;">  <b>COPY</b> </p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-12-07	
Technical Reviewer (FSS/Characterization Engineer)			6-29-07	
FSS/Characterization Manager	 R. Case		9/10/07	

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.39	Revision # Original	Page 2 of 3
Survey Unit: 1.39		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 3" purge line for Quad "A". The function of this pipe was to convey water from the one 3 inch riser in Quad "A" to the HD sump in Pump Room #22 on the Rx Building -25 ft, where the pipe is currently breached.
- 1.2 EP 1.39 consists of approximately 40 feet in length from the pump room to the riser in Quad "A". The pipe section has two mitered 90° elbows.

## **2.0 Survey Design Information**

- 2.1 EP 1.39 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 3" ID pipe was accessible for survey. The accessible 3" ID pipe was surveyed by static measurement at one foot increments, for a total of 38 survey measurements.
- 2.3 Surface area for the 3" ID piping is 729.7 cm<sup>2</sup> for each foot of piping, corresponding to a total 3" ID piping surface area of 27,728.6 cm<sup>2</sup> (2.8 m<sup>2</sup>) for the entire length of (38') of 3" 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 All measurement results 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.
- 5.3 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 1.39 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	3" Pipe
Total Number of Survey Measurements	38
Number of Measurements >MDC	25
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.015
Median	0.014
Standard Deviation	0.008
Maximum	0.044
Minimum	0.003

**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 EP 1.39 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.015 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.39 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.39	Survey Location	-27 TRENCH
Survey Date	12-15-05/12-20-05	2350-1 #	212223
Survey Time	0803/1350	Detector-Sled #	44-62/204402-101
Pipe Size	3"	Detector Efficiency	0.00014
DCGL (dpm/100cm <sup>2</sup> )	240800	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	730
Pipe Area Incorporated by Survey Data (in <sup>2</sup> )	2.2	Field BKG (cpm)	5.1/6.8
Routine Survey	X	Field MDCR (cpm)	10.7/11.9
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	2,842

### Survey Measurement Results

Total Number of Survey Measurements	38
Number of Measurements >MDC	25
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.015
Median	0.014
Standard Deviation	0.008
Maximum	0.044
Minimum	0.003

Survey Technician(s)	ROSENHAGEN
----------------------	------------


Survey Unit Classification	1
TBD 06-004 Piping Group	2
SR-13 Radionuclide Distribution Sample	EP 2-1
Measured Nuclide	Co60
Area Factor/EMC Used	No
Pass/Fail FSS	Pass
MREM/YR Contribution	<1

COMMENTS:  
ACTIVITY VALUES NOT BACKGROUND CORRECTED

RP Engineer   Date	<i>Oral Powell 6-12-07</i>
--------------------	----------------------------

**EP 1.39**  
**3" Pipe**  
**TBD 06-004 Group 2**

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	3.7	3.7	26,429	3,622	1,880	30	21	2	105	0.016
2	3.3	3.3	23,571	3,230	1,677	27	19	2	94	0.014
3	2.3	2.3	16,429	2,251	1,168	19	13	1	65	0.010
4	4.3	4.3	30,714	4,209	2,185	35	25	2	122	0.018
5	5	5	35,714	4,894	2,540	41	29	2	142	0.021
6	3.7	3.7	26,429	3,622	1,880	30	21	2	105	0.016
7	4	4	28,571	3,916	2,032	32	23	2	114	0.017
8	4.7	4.7	33,571	4,601	2,388	38	27	2	133	0.020
9	4.3	4.3	30,714	4,209	2,185	35	25	2	122	0.018
10	8	8	57,143	7,831	4,064	65	46	4	227	0.034
11	5	5	35,714	4,894	2,540	41	29	2	142	0.021
12	4.3	4.3	30,714	4,209	2,185	35	25	2	122	0.018
13	1.3	1.3	9,286	1,273	660	11	8	1	37	0.006
14	3	3	21,429	2,937	1,524	24	17	1	85	0.013
15	3	3	21,429	2,937	1,524	24	17	1	85	0.013
16	3.3	3.3	23,571	3,230	1,677	27	19	2	94	0.014
17	3.3	3.3	23,571	3,230	1,677	27	19	2	94	0.014
18	2.7	2.7	19,286	2,643	1,372	22	16	1	77	0.011
19	4.3	4.3	30,714	4,209	2,185	35	25	2	122	0.018
20	2	2	14,286	1,958	1,016	16	12	1	57	0.008
21	0.7	0.7	5,000	685	356	6	4	0	20	0.003
22	2	2	14,286	1,958	1,016	16	12	1	57	0.008
23	1.6	1.6	11,429	1,566	813	13	9	1	45	0.007
24	4	4	28,571	3,916	2,032	32	23	2	114	0.017
25	3.6	3.6	25,714	3,524	1,829	29	21	2	102	0.015
26	2	2	14,286	1,958	1,016	16	12	1	57	0.008
27	4	4	28,571	3,916	2,032	32	23	2	114	0.017
28	3.6	3.6	25,714	3,524	1,829	29	21	2	102	0.015
29	3.3	3.3	23,571	3,230	1,677	27	19	2	94	0.014
30	0.7	0.7	5,000	685	356	6	4	0	20	0.003
31	3.3	3.3	23,571	3,230	1,677	27	19	2	94	0.014
32	2.7	2.7	19,286	2,643	1,372	22	16	1	77	0.011



**EP 1.39**  
**3" Pipe**  
**TBD 06-004 Group 2**

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
33	2.7	2.7	19,286	2,643	1,372	22	16	1	77	0.011
34	1.3	1.3	9,286	1,273	660	11	8	1	37	0.006
35	2.7	2.7	19,286	2,643	1,372	22	16	1	77	0.011
36	10.3	10.3	73,571	10,082	5,233	84	59	5	292	0.044
37	4.3	4.3	30,714	4,209	2,185	35	25	2	122	0.018
38	5.3	5.3	37,857	5,188	2,693	43	31	3	150	0.022
									MEAN	0.015
									MEDIAN	0.014
									STD DEV	0.008
									MAX	0.044
									MIN	0.003

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

### Pipe Interior Radiological Survey Form

Date: 12-15-05 Time: 0803  
 Building: RX BLDG Elevation: -25 Access Point Area: TRENCH  
 System: QUAD A PURGE Pipe Diameter: 3" Pipe ID #: 1.39  
 Type of Survey: Investigation Characterization: Final Survey Other: ✓  
 Sled Size: 3 inch  
 Detector: 44-62 Detector ID #: 209402-101  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.1 cpm

MDCR<sub>static</sub> 10.7 cpm

Efficiency Factor for Pipe Diameter 0.00014 (taken from detector efficiency determination calibration certificate) for

MDC<sub>static</sub> 2842 dpm/100cm<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: INITIAL SURVEY

### Pipe Interior Radiological Survey

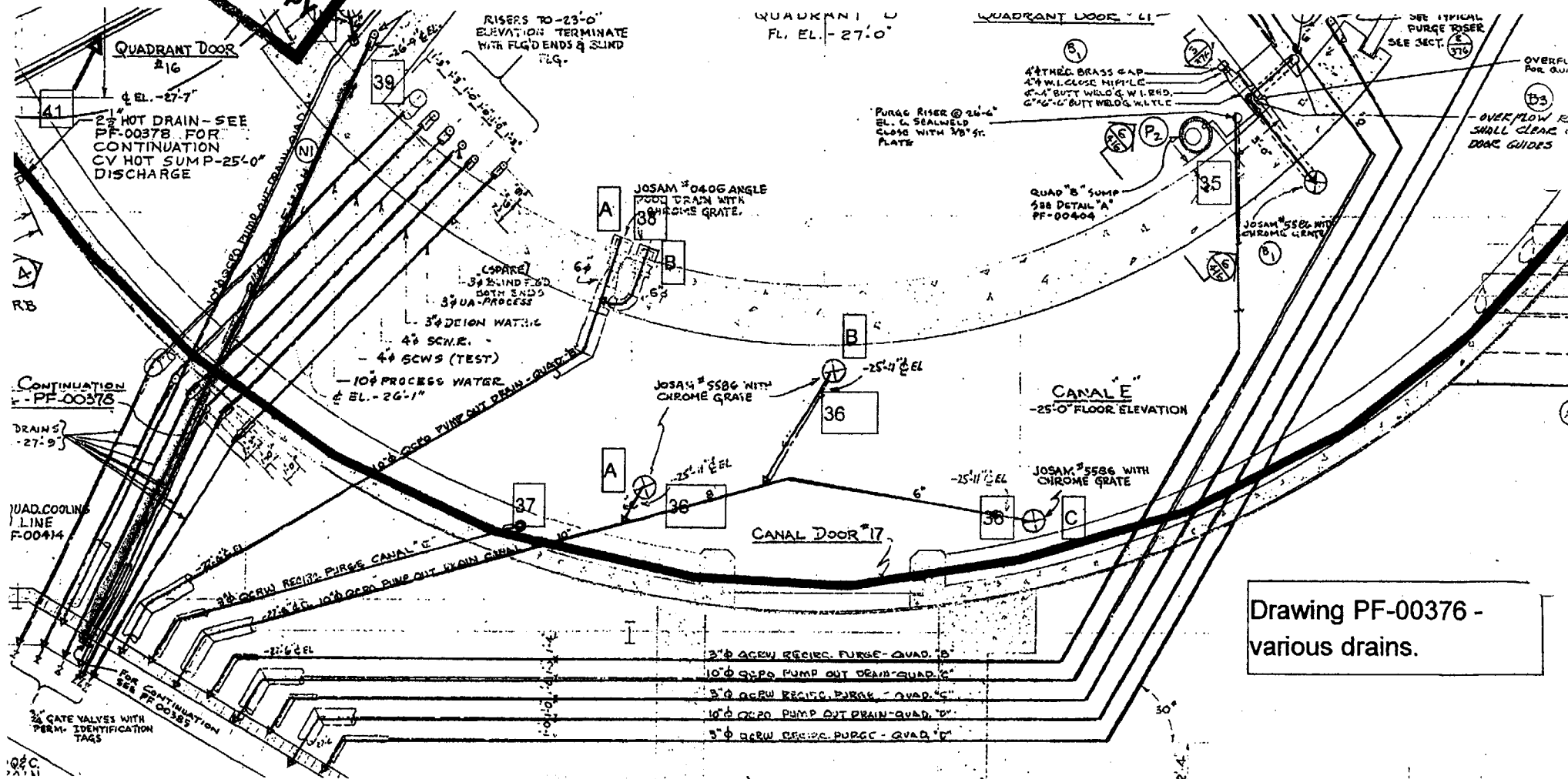
Radiological Survey Commenced: Date: 12-15-05 Time: 0803

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	3	11	3.7	n/a	n/a
2	2	3	10	3.3		
3	3	3	7	2.3		
4	4	3	13	4.3		
5	5	3	15	5		
6	6	3	11	3.7		
7	7	3	12	4		
8	8	3	14	4.7		
9	9	3	18	4.3		
10	10	3	24	8		

Package Page 1 of 2



REFERENCE COPY



Drawing PF-00376 - various drains.

= PIPE SURVEYED  
ID # 1.39  
12-15-05

### Pipe Interior Radiological Survey Form

Date: 12-20-05 Time: 1350  
 Building: RX Elevation: -25 Access Point Area: QUAD A  
 System: QUAD-A-PURGE Pipe Diameter: 3" Pipe ID #: 1,39  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3 inch  
 Detector: 44-62 Detector ID #: 204402  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 6.8 cpm  
 MDCR<sub>static</sub> 11.9 cpm  
 Efficiency Factor for Pipe Diameter 0.00014 (taken from detector calibration certificate) *efficiency determination*  
 MDC<sub>static</sub> 2842 dpm/100cm<sup>2</sup>  
 Is the MDC<sub>static</sub> acceptable? Yes No (if no, adjust sample count time and recalculate MDC<sub>static</sub>)

Comments: CONTINUATION SURVEY

JSP / SURVEY DONE

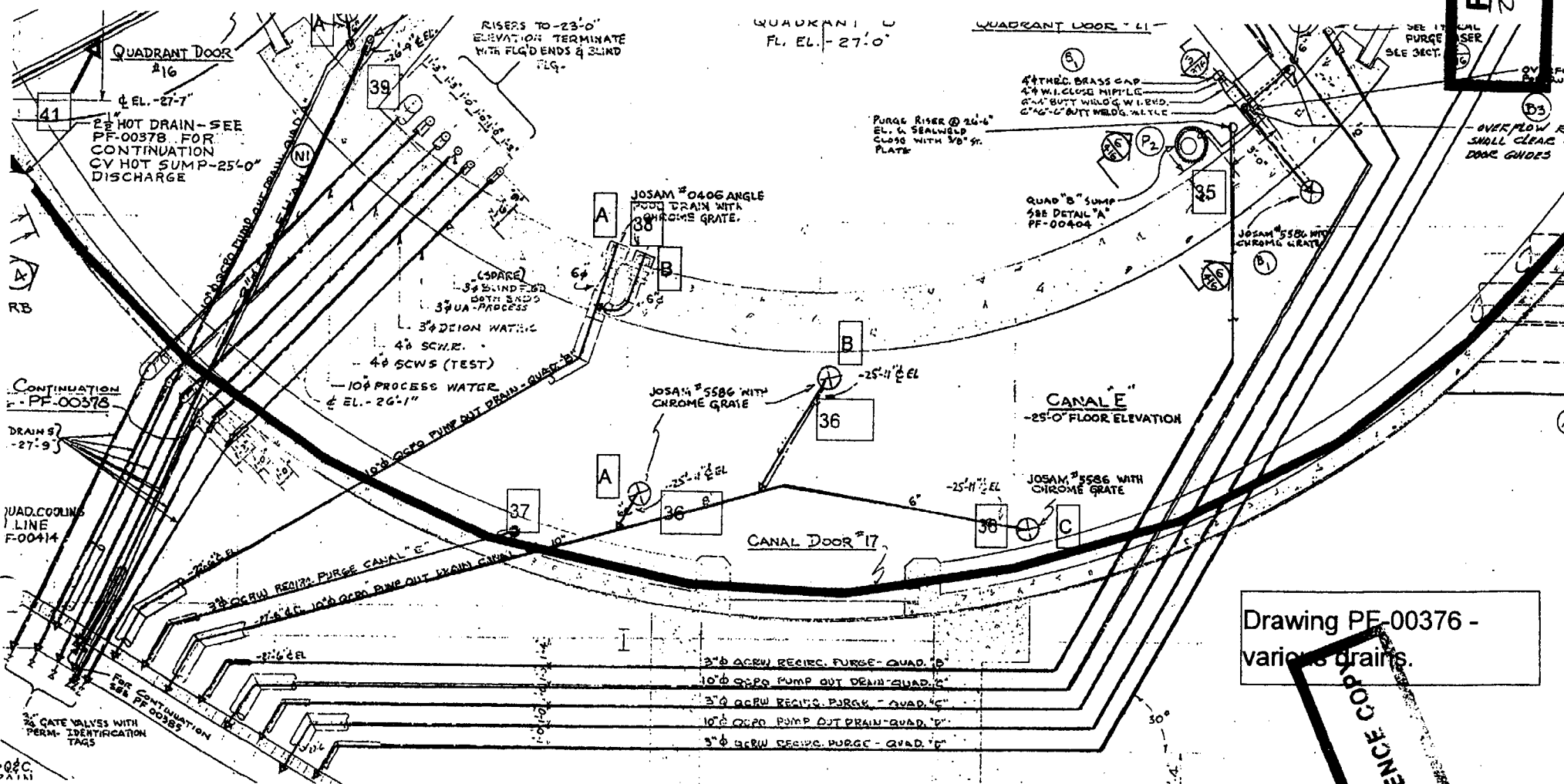
### Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 12-20-05 Time: 1350

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	<u>1</u>	<u>3</u>	<u>31</u>	<u>10.3</u>	<u>n/a</u>	<u>n/a</u>
2	<u>2</u>	<u>3</u>	<u>13</u>	<u>4.3</u>	<u>↓</u>	<u>↓</u>
3	<u>3</u>	<u>3</u>	<u>16</u>	<u>5.3</u>	<u>↓</u>	<u>↓</u>
4						
5						
6						
7						
8						
9						
10						

REFERENCE COPY

Package Page 1 of 2



Drawing PE-00376 -  
various drains.

REFERENCE COPY

= PIPE SURVEYED  
ID 1.39  
12-20-05

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





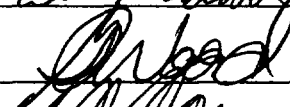
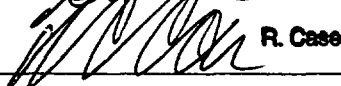
### DQA Check Sheet

Design #	EP 1.39	Revision #	Original					
Survey Unit #	EP 1.39							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 ( <i>S</i> + for Sign Test or <i>W</i> <sub>r</sub> for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)						<i>Dale Randall</i>		Date 6-12-07
FSS/ Characterization Manager (print/sign)						<i>[Signature]</i> R. Case		Date 9/10/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-1.43-2" INST	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.43-2" INST			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.43-2" INST meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.43-2" INST 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 1.43-2" INST were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 3-1 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> <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; font-weight: bold;">COPY</span> </div>			
<b>Approval Signatures</b>				<b>Date:</b>
FSS/Characterization Engineer			8-22-07	
Technical Reviewer (FSS/Characterization Engineer)			9-4-07	
FSS/Characterization Manager	 R. Case		9/11/07	

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.43-2" INST	Revision # Original	Page 2 of 3
Survey Unit: 1.43-2" INST		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 2" line located in Quad "B" of the Reactor building -12' elevation.
- 1.2 EP 1.43-2" INST consists of approximately 1 foot in length from the Reactor Building -25' elevation, Quad "B" to the Sub Pile Room.

## **2.0 Survey Design Information**

- 2.1 EP 1.43-2" INST was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2" ID pipe was accessible for survey. The accessible 2" ID pipe was surveyed by static measurement at one foot increments. Since this pipe segment is approximately one foot in length, one measurement was made.
- 2.3 Surface area for the 2" ID piping is 486 cm<sup>2</sup> for each foot of piping, corresponding to a total 2" ID piping surface area of 486 cm<sup>2</sup> (0.05 m<sup>2</sup>) for the one foot length of piping surveyed.

## **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 All measurement results 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.
- 5.3 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 1.43-2" INST passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	2" Pipe
Total Number of Survey Measurements	1
Number of Measurements >MDC	1
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0215
Median	0.0215
Standard Deviation	N/A
Maximum	0.0215
Minimum	0.0215

**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 EP 1.43-2" INST to be less than 1 mrem/yr. The dose contribution is estimated to be 0.022 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

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP 1.43-2" INST & Spreadsheet

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



# BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.43-2 INST	Survey Location	-12 el. Quad B
Survey Date	23-Apr-07	2350-1 #	203438
Survey Time	13:39	Detector-Sled #	44-159 238369 / no sled
Pipe Size	2"	Detector Efficiency	0.0008
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm2)	486
Pipe Area Incorporated by Survey Data (m2)	0.0	Field BKG (cpm)	1.6
Routine Survey	X	Field MDCR (cpm)	7.3
QA Survey		Nominal MDC (dpm/100cm2)	2,946
Survey Measurement Results			
Total Number of Survey Measurements		1	
Number of Measurements >MDC		1	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0215	
Median		0.0215	
Standard Deviation		N/A	
Maximum		0.0215	
Minimum		0.0215	
Survey Technician(s)		STOCK	
Survey Unit Classification		1	
TBD 06-004 Piping Group		1	
SR-13 Radionuclide Distribution Sample		EP 3-1	
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		Oil Randall 8-22-07	

**EP 1.43-2" INST**  
**2" 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	14	14	17,500	3,598	143	3,413	907	105	25	0.021
									MEAN	0.021
									MEDIAN	0.021
									STD DEV	N/A
									MAX	0.021
									MIN	0.021



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

## Pipe Interior Radiological Survey Form

Date: 4/23/07 Time: 1339  
 Pipe ID#: 1.43 Pipe Diameter: 2" Access Point Area: QUAD B  
 Building: CV Elevation: -12' System: B RINGS

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓

Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_

Detector ID# / Sled ID# 44-159 238369 / NO SLED

Detector Cal Date: 9/5/06 Detector Cal Due Date: 9/5/07

Instrument: 2350-1 Instrument ID #: 203438

Instrument Cal Date: 9/5/06 Instrument Cal Due Date: 9/5/07

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

Background Value 1.6 cpm

MDCR<sub>static</sub> 7.3 cpm

Efficiency Factor for Pipe Diameter 0.0008 (from detector efficiency determination)

MDC<sub>static</sub> 2946 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: INITIAL EP3-1 COMPLETE

Technician Signature [Signature]

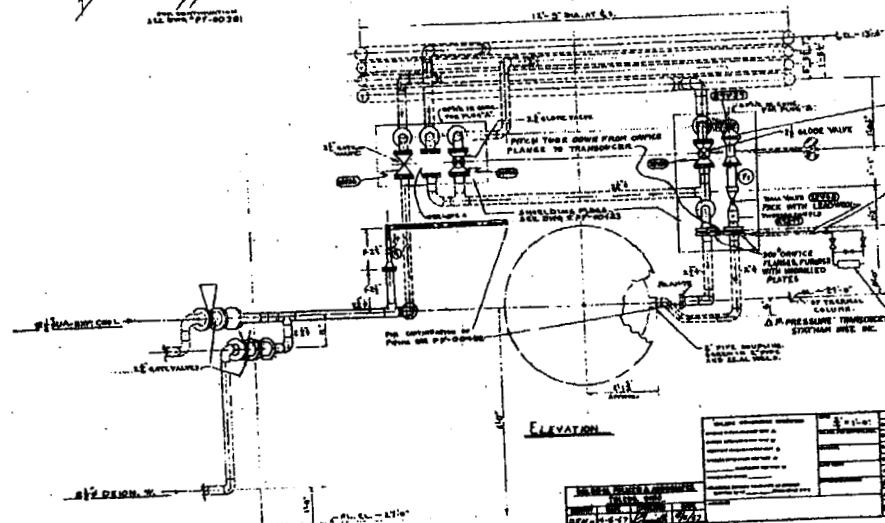
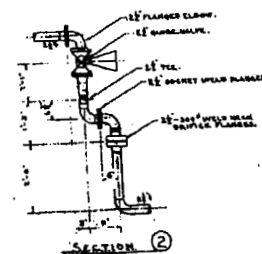
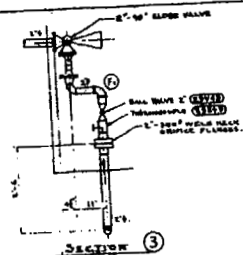
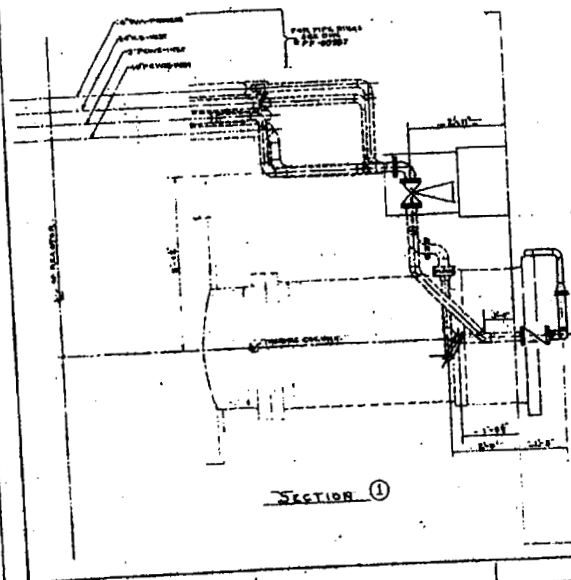
## Pipe Interior Radiological Survey

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	<u>1</u>	<u>1</u>	<u>14</u>	<u>14</u>	<u>n/a</u>	<u>n/a</u>
2						
3						
4						
5						
6						
7						
8						
9						
10						

REFERENCE COPY

Package Page 1 of 2

Attachment 3, Page 1



- GENERAL NOTES.**
1. FOR GENERAL OF SHEET SEE "PP-1000"
  2. ALL WELD ALL PIPES WELDED THAT POINTS STEEL WELLS.
  3. ALL PIPING SHALL BE SCHEDULE 40 STAINLESS STEEL. SEE SPECS AND TALKS SCHEDULE.
  4. LINES SCALED BY 1/4\"/>

F1	REMOVED 1/2\"/>
E1	REMOVED 1/2\"/>
D1	WAS 1/2\"/>
C1	REMOVED 1/2\"/>
B1	REMOVED 1/2\"/>
A1	REMOVED 1/2\"/>
<div> <div>MASS PLANTING REACTOR BUILDING</div> <div>PIPING - THERMAL COLUMN - QUADRANT "B"</div> <div> <div>DATE: 1/2/73</div> <div>BY: J. J. J.</div> <div>APP: J. J. J.</div> </div> </div>	
<div> <div>MASS PLANTING REACTOR BUILDING</div> <div>PIPING - THERMAL COLUMN - QUADRANT "B"</div> <div> <div>DATE: 1/2/73</div> <div>BY: J. J. J.</div> <div>APP: J. J. J.</div> </div> </div>	

1.43 (2")

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

### DQA Check Sheet

Design #	EP 1.43-2" INST	Revision #	Original			
Survey Unit #	EP 1.43-2" INST					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)				<i>Dale R. Case</i>		Date 8-22-07
FSS/ Characterization Manager (print/sign)				<i>[Signature]</i>		Date 9/11/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-1.42-2.5" INST	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.42-2.5" INST			
<div style="display: flex; align-items: center;"> <div> <p style="font-size: 2em; font-weight: bold; margin: 0;">COPY</p> </div> </div> <p style="margin-top: 20px;"><b>Description</b></p>	<p>1) Embedded Pipe (EP) Survey Unit 1.42-2.5" INST meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.42-2.5" INST 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 1.42-2.5" INST were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 3-1 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) The piping used in the construction of this system was a non-standard schedule that was nominally 2.5" in diameter. This caused difficulties with regard to the procurement of an identical pipe sample for detector geometry mock-up. As a result, the detector calibration efficiency was not acquired. To compensate for this, the instrument efficiency values applied to this Survey Unit were associated with 3" diameter piping. These values are conservative when applied to measurements made on the nominal 2.5" diameter piping.</p>			
<b>Approval Signatures</b>				<b>Date:</b>
FSS/Characterization Engineer				8-22-07
Technical Reviewer (FSS/Characterization Engineer)				8-27-07
FSS/Characterization Manager		R. Case		9/11/07

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.42-2.5" INST	Revision # Original	Page 2 of 3
Survey Unit: 1.42-2.5" INST		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 2.5" line located in Quad "B" of the Reactor building -12' elevation.
- 1.2 EP 1.42-2.5" INST consists of approximately 7 feet in length from the Reactor Building -25' elevation, Quad "B" to the Sub Pile Room.

## **2.0 Survey Design Information**

- 2.1 EP 1.42-2.5" INST was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2.5" ID pipe was accessible for survey. The accessible 2.5" ID pipe was surveyed by static measurement at one foot increments, for a total of 7 survey measurements.
- 2.3 Surface area for the 2.5" ID piping is 608 cm<sup>2</sup> for each foot of piping, corresponding to a total 2.5" ID piping surface area of 4,256 cm<sup>2</sup> (0.4 m<sup>2</sup>) for the entire length of (7') of 2.5" piping.

## **3.0 Survey Unit Measurement Locations/Data**

- 3.1 Pipe interior radiological survey forms are provided in Attachment 2 of this release record.
- 3.2 Although the measurements were performed on 2.5" diameter piping, instrument efficiencies for 3" diameter piping were applied, which is a conservative evaluation of the results.

## **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 All measurement results 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.
- 5.3 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 1.42-2.5" INST passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.



### 5.5 Statistical Summary Table

Statistical Parameter	2.5" Pipe
Total Number of Survey Measurements	7
Number of Measurements >MDC	0
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0036
Median	0.0030
Standard Deviation	0.0019
Maximum	0.0059
Minimum	0.0015

**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 EP 1.42-2.5" INST to be less than 1 mrem/yr. The dose contribution is estimated to be 0.004 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

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP 1.42-2.5" INST & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.42-2.5 INST	Survey Location	-12 el. Quad B
Survey Date	23-Apr-07	2350-1 #	203438
Survey Time	11:34	Detector-Sled #	44-159 238369 / no sled
Pipe Size	2.5"	Detector Efficiency	0.00066
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	608
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	0.4	Field BKG (cpm)	1.6
Routine Survey	X	Field MDCR (cpm)	7.3
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	2,648
Survey Measurement Results			
Total Number of Survey Measurements		7	
Number of Measurements >MDC		0	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0036	
Median		0.0030	
Standard Deviation		0.0019	
Maximum		0.0059	
Minimum		0.0015	
Survey Technician(s)		STOCK	
Survey Unit Classification		1	
TBD 06-004 Piping Group		1	
SR-13 Radionuclide Distribution Sample		EP 3-1	
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>Del Pembell</i> 8-22-07	

**EP 1.42-2.5" INST**  
**2.5" 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	4	4	6,061	997	40	946	251	29	7	0.006
2	1	1	1,515	249	10	236	63	7	2	0.001
3	3	3	4,545	748	30	709	189	22	5	0.004
4	1	1	1,515	249	10	236	63	7	2	0.001
5	2	2	3,030	498	20	473	126	15	3	0.003
6	4	4	6,061	997	40	946	251	29	7	0.006
7	2	2	3,030	498	20	473	126	15	3	0.003
									MEAN	0.004
									MEDIAN	0.003
									STD DEV	0.002
									MAX	0.006
									MIN	0.001

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

Pipe Interior Radiological Survey Form

Date: 4/23/07 Time: 1134  
Pipe ID#: 1.42 Pipe Diameter: 2.5" Access Point Area: Quad B  
Building: CV Elevation: -12' System: RINGS

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_

Detector ID# / Sled ID# 44-159 238369 1 NO SLED  
Detector Cal Date: 9/5/06 Detector Cal Due Date: 9/5/07  
Instrument: 2350-1 Instrument ID #: 203438  
Instrument Cal Date: 9/5/06 Instrument Cal Due Date: 9/5/07

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

Background Value 1.6 cpm  
MDCR<sub>static</sub> 7.3 cpm  
Efficiency Factor for Pipe Diameter 0.00066 (from detector efficiency determination)  
MDC<sub>static</sub> 2648 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: INITIAL EP3-1 COMPLETE

Technician Signature [Signature]

Pipe Interior Radiological Survey

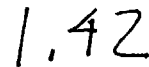
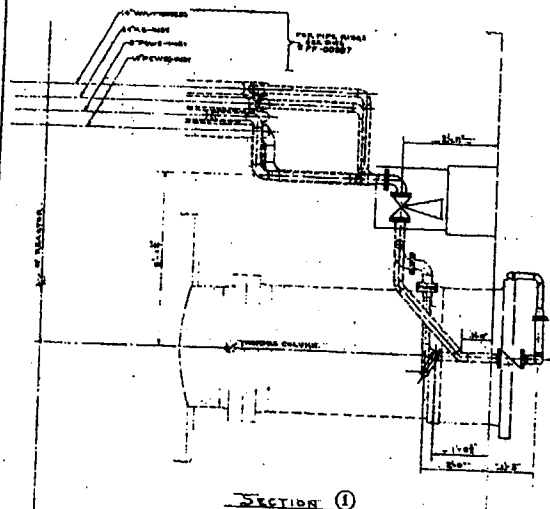
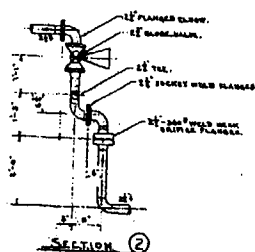
Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	1	4	4	N/A	N/A
2	2	↓	1	1	↓	↓
3	3	↓	3	3	↓	↓
4	4	↓	1	1	↓	↓
5	5	↓	2	2	↓	↓
6	6	↓	4	4	↓	↓
7	7	↓	2	2	↓	↓
8	N/A	N/A	N/A	N/A	↓	↓
9	A	A	A	A	↓	↓
10					↓	↓

REFERENCE COPY

Package Page 1 of 2

Attachment 3, Page 1



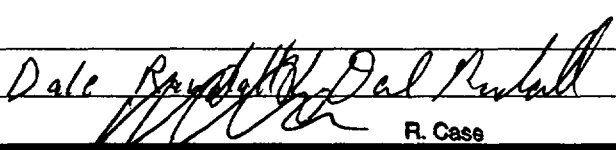


**PAGE** 2 of 2

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




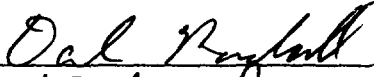

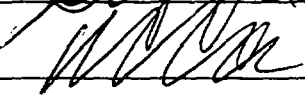
### DQA Check Sheet

Design #	EP 1.42-2.5" INST	Revision #	Original				
Survey Unit #	EP 1.42-2.5" INST						
<b>Preliminary Data Review</b>							
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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			
<b>Graphical Data Review</b>							
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	
<b>Data Analysis</b>							
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?						X	
Comments:							
FSS/Characterization Engineer (print/sign)				 Dale R. Case		Date	8-22-07
FSS/ Characterization Manager (print/sign)						Date	9/11/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-1.92	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.92			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.92 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.92 is a Class 1, Group 3.2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.92 were performed using a scintillation detector optimized to measure gamma energies representative of Cs-137. Sample #EP 3-11 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> <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; font-weight: bold;">COPY</span> </div>			
<b>Approval Signatures</b>				<b>Date:</b>
FSS/Characterization Engineer				2-8-07
Technical Reviewer (FSS/Characterization Engineer)				7-19-07
FSS/Characterization Manager	 R. Case			9/11/07

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.92	Revision # Original	Page 2 of 3
Survey Unit: 1.92		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 4" overflow header for the hot drain system servicing the Hot Dry Storage (HDS) pit in the hot lab. The header runs from the southwest corner of the HDS pit and ties into the 4 inch overflow header designated as ID# 1.64. The purpose of this system was to act as an overflow pipe for the HDS to the hot sump on the -25ft of the Reactor Building through the valve pit.
- 1.2 EP 1.92 consists of 4" diameter piping that is approximately 8 linear feet.

## **2.0 Survey Design Information**

- 2.1 EP 1.92 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 4" ID pipe was accessible for survey. The accessible 4" ID pipe was surveyed by static measurement at one foot increments, for a total of 8 survey measurements.
- 2.3 Surface area for the 4" ID piping is  $973 \text{ cm}^2$  for each foot of piping, corresponding to a total 4" ID piping surface area of  $7,783 \text{ cm}^2$  ( $0.7 \text{ m}^2$ ) for the entire length of (approximately 8') of 4" 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 All measurement results 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.
- 5.3 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 1.92 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	4" 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	0.0041
Median	0.0023
Standard Deviation	0.0045
Maximum	0.0152
Minimum	0.002

**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 EP 1.92 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.004 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.92 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.92	Survey Location	Hot Lab /HDS riser
Survey Date	16-Oct-06	2350-1 #	203488
Survey Time	0837	Detector-Sled #	44-159/238369-101
Pipe Size	4"	Detector Efficiency	0.00071
DCGL (dpm/100cm <sup>2</sup> )	3.79E+06	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	973
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	0.78	Field BKG (cpm)	6.4
Routine Survey	X	Field MDCR (cpm)	11.7
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	2,165
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		0.0041	
Median		0.0023	
Standard Deviation		0.0045	
Maximum		0.0152	
Minimum		0.0019	
Survey Technician(s)	STOCK		
Survey Unit Classification		1	
TBD 06-004 Piping Group		3.2	
SR-13 Radionuclide Distribution Sample		EP 3-11	
Measured Nuclide		Cs-137	
Area Factor/EMC Used		No	
Pass/Fail FSS		Pass	
MREM/YR Contribution		<1	
COMMENTS: ACTIVITY VALUES NOT BACKGROUND CORRECTED			
RP Engineer   Date		Oat Numbull 7-7-07	

**EP 1.92**  
**4" Pipe**  
**TBD 06-004 Group 3.2**

Measurement #	gcpm	ncpm	Cs-137 activity (dpm/100cm2)	Cs-137 activity (dpm/100cm2)	Co-60 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	18	18	25,352	2,606	285	-	18	-	-	0.002
2	20	20	28,169	2,895	317	-	20	-	-	0.002
3	23	23	32,394	3,330	365	-	23	-	-	0.002
4	21	21	29,577	3,040	333	-	21	-	-	0.002
5	21	21	29,577	3,040	333	-	21	-	-	0.002
6	37	37	52,113	5,357	587	-	38	-	-	0.004
7	29	29	40,845	4,198	460	-	29	-	-	0.003
8	143	143	201,408	20,702	2,268	-	145	-	-	0.015
									MEAN	0.004
									MEDIAN	0.002
									STD DEV	0.005
									MAX	0.015
									MIN	0.002



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

Pipe Interior Radiological Survey Form

Date: 10/16/06 Time: 0837  
Pipe ID#: 1.92 Pipe Diameter: 4" Access Point Area: HOT DRY STORE  
Building: HOT LAB Elevation: -25' System: RISED

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
Gross \_\_\_\_\_ Co60 \_\_\_\_\_ Cs ✓

Detector ID# / Sled ID# 44-159 #238369 / 101  
Detector Cal Date: 9/5/06 Detector Cal Due Date: 9/5/07  
Instrument: 2350-1 Instrument ID #: 203488  
Instrument Cal Date: 7/5/06 Instrument Cal Due Date: 7/5/07

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

Background Value 6.4 cpm

MDCR<sub>static</sub> 11.7 cpm

Efficiency Factor for Pipe Diameter \_\_\_\_\_ (from detector efficiency determination)

MDC<sub>static</sub> \_\_\_\_\_ dpm/ \_\_\_\_\_ 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: RESURVEY EPS-11 COMPLETE

Technician Signature [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	18	18	n/a	n/a
2	2		20	20		
3	3		23	23		
4	4		21	21		
5	5		21	21		
6	6		37	37		
7	7		29	29		
8	8		143	143		
9	N/A	N/A	N/A	N/A		
10	N/A	N/A	N/A	N/A		

Package Page 1 of 2



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


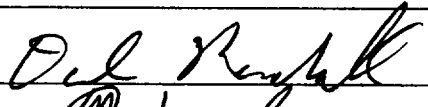


### DQA Check Sheet

Design #	EP 1.92	Revision #	Original			
Survey Unit #	EP 1.92					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)		<i>Dele R. Case</i>			Date	7-8-07
FSS/ Characterization Manager (print/sign)		<i>[Signature]</i> R. Case			Date	9/11/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.72	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.72			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.72 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.72 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.72 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #CS050330-0003 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> <div style="text-align: center;">  <b>COPY</b> </div>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-30-07	
Technical Reviewer (FSS/Characterization Engineer)			7-3-07	
FSS/Characterization Manager	 R. Case		9/11/07	

Form  
CS-09/1  
Rev 0

## Survey Unit: 1.72

**1.0 History/Description**

- 1.1 The subject pipe system is the 2" waste air for canal "H". The function of this pipe was to convey water from the 3" risers in Canal H to the HD sump in Pump Room #22 on the Rx building -25ft..
- 1.2 EP 1.72 consists of 2" diameter piping that is approximately 100 feet in length from the pump room to the riser in Canal H. The pipe section has mitered elbows of ranging between 45 and 90 degrees.

**2.0 Survey Design Information**

- 2.1 EP 1.72 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2" ID pipe was accessible for survey. The accessible 2" ID pipe was surveyed by static measurement at one foot increments, for a total of 100 survey measurements.
- 2.3 Surface area for the 2" ID piping is  $486 \text{ cm}^2$  for each foot of piping, corresponding to a total 2" ID piping surface area of  $48,600 \text{ cm}^2$  ( $4.9 \text{ m}^2$ ) for the entire length of (approximately 100') of 2" 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 All measurement results 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.
- 5.3 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 1.72 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.



### 5.5 Statistical Summary Table

Statistical Parameter	2" Pipe
Total Number of Survey Measurements	100
Number of Measurements >MDC	2
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0104
Median	0.0103
Standard Deviation	0.0037
Maximum	0.0206
Minimum	0.0034

**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 EP 1.72 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.01 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.72 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.72	Survey Location	Canal H Waste Air -27
Survey Date	1/27/06, 1/30/06, 2/1/06, 3/09/06	2350-1 #	212223
Survey Time	1030 / 0815 / 1020 / 1055	Detector-Sled #	204402-121, 215957- NO SLED
Pipe Size	2"	Detector Efficiency	0.00026/0.00026/ 0.00026/0.00038
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	486
Pipe Area Incorporated by Survey Date (m <sup>2</sup> )	4.9	Field BKG (cpm)	5.2/5.9/5.4/14.1
Routine Survey	X	Field MDCR (cpm)	10.8/ 11.3 /11 / 15.9
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	7836/7836/7836/ 3493

### Survey Measurement Results

Total Number of Survey Measurements	100
Number of Measurements >MDC	2
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0104
Median	0.0103
Standard Deviation	0.0037
Maximum	0.0206
Minimum	0.0034

Survey Technician(s)	Rosenhagen, Debraux
----------------------	---------------------

Survey Unit Classification	1
TBD 06-004 Piping Group	2
SR-13 Radionuclide Distribution Sample	CS050330-003
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>Oral Marshall 6-30-07</i>
--------------------	------------------------------

**EP 1.72**  
**2" Pipe**  
**TBD 06-004 Group 2**

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	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
2	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
3	4	4	15,385	3,166	1,641	26	19	2	91	0.014
4	4	4	15,385	3,166	1,641	26	19	2	91	0.014
5	4.5	4.5	17,308	3,561	1,847	30	21	2	102	0.015
6	2	2	7,692	1,583	821	13	9	1	46	0.007
7	3	3	11,538	2,374	1,231	20	14	1	68	0.010
8	5.5	5.5	21,154	4,353	2,257	36	25	2	125	0.019
9	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
10	4	4	15,385	3,166	1,641	26	19	2	91	0.014
11	2	2	7,692	1,583	821	13	9	1	46	0.007
12	1.5	1.5	5,769	1,187	616	10	7	1	34	0.005
13	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
14	3	3	11,538	2,374	1,231	20	14	1	68	0.010
15	1.5	1.5	5,769	1,187	616	10	7	1	34	0.005
16	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
17	1.5	1.5	5,769	1,187	616	10	7	1	34	0.005
18	2	2	7,692	1,583	821	13	9	1	46	0.007
19	3	3	11,538	2,374	1,231	20	14	1	68	0.010
20	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
21	3	3	11,538	2,374	1,231	20	14	1	68	0.010
22	3	3	11,538	2,374	1,231	20	14	1	68	0.010
23	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
24	4.5	4.5	17,308	3,561	1,847	30	21	2	102	0.015
25	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
26	4.5	4.5	17,308	3,561	1,847	30	21	2	102	0.015
27	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
28	2	2	7,692	1,583	821	13	9	1	46	0.007
29	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
30	2	2	7,692	1,583	821	13	9	1	46	0.007
31	1.5	1.5	5,769	1,187	616	10	7	1	34	0.005
32	3	3	11,538	2,374	1,231	20	14	1	68	0.010

**EP 1.72**  
**2" Pipe**  
**TBD 06-004 Group 2**

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
33	5	5	19,231	3,957	2,052	33	23	2	114	0.017
34	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
35	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
36	3	3	11,538	2,374	1,231	20	14	1	68	0.010
37	6	6	23,077	4,748	2,462	39	28	2	137	0.021
38	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
39	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
40	2	2	7,692	1,583	821	13	9	1	46	0.007
41	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
42	4	4	15,385	3,166	1,641	26	19	2	91	0.014
43	2	2	7,692	1,583	821	13	9	1	46	0.007
44	3	3	11,538	2,374	1,231	20	14	1	68	0.010
45	3	3	11,538	2,374	1,231	20	14	1	68	0.010
46	2	2	7,692	1,583	821	13	9	1	46	0.007
47	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
48	1	1	3,846	791	410	7	5	0	23	0.003
49	1.5	1.5	5,769	1,187	616	10	7	1	34	0.005
50	4.5	4.5	17,308	3,561	1,847	30	21	2	102	0.015
51	2	2	7,692	1,583	821	13	9	1	46	0.007
52	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
53	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
54	5	5	19,231	3,957	2,052	33	23	2	114	0.017
55	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
56	1.5	1.5	5,769	1,187	616	10	7	1	34	0.005
57	4.5	4.5	17,308	3,561	1,847	30	21	2	102	0.015
58	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
59	3	3	11,538	2,374	1,231	20	14	1	68	0.010
60	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
61	2	2	7,692	1,583	821	13	9	1	46	0.007
62	2	2	7,692	1,583	821	13	9	1	46	0.007
63	3	3	11,538	2,374	1,231	20	14	1	68	0.010

**EP 1.72**  
**2" Pipe**  
**TBD 06-004 Group 2**

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)	Unlty
64	4	4	15,385	3,166	1,641	26	19	2	91	0.014
65	4	4	15,385	3,166	1,641	26	19	2	91	0.014
66	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
67	5	5	19,231	3,957	2,052	33	23	2	114	0.017
68	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
69	2	2	7,692	1,583	821	13	9	1	46	0.007
70	1	1	3,846	791	410	7	5	0	23	0.003
71	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
72	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
73	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
74	1	1	3,846	791	410	7	5	0	23	0.003
75	3	3	11,538	2,374	1,231	20	14	1	68	0.010
76	4	4	15,385	3,166	1,641	26	19	2	91	0.014
77	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
78	3	3	11,538	2,374	1,231	20	14	1	68	0.010
79	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
80	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
81	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
82	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
83	5	5	19,231	3,957	2,052	33	23	2	114	0.017
84	4.5	4.5	17,308	3,561	1,847	30	21	2	102	0.015
85	3	3	11,538	2,374	1,231	20	14	1	68	0.010
86	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
87	4	4	15,385	3,166	1,641	26	19	2	91	0.014
88	3.5	3.5	13,462	2,770	1,436	23	16	1	80	0.012
89	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
90	2.5	2.5	9,615	1,978	1,026	16	12	1	57	0.009
91	1	1	3,846	791	410	7	5	0	23	0.003
92	2	2	7,692	1,583	821	13	9	1	46	0.007
93	4	4	10,526	2,166	1,123	18	13	1	62	0.009
94	7	7	18,421	3,790	1,965	31	22	2	109	0.016

**EP 1.72**  
**2" Pipe**  
**TBD 06-004 Group 2**

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
95	6	6	15,789	3,249	1,685	27	19	2	94	0.014
96	5	5	13,158	2,707	1,404	22	16	1	78	0.012
97	6	6	15,789	3,249	1,685	27	19	2	94	0.014
98	8	8	21,053	4,332	2,246	36	25	2	125	0.019
99	4	4	10,526	2,166	1,123	18	13	1	62	0.009
100	6	6	15,789	3,249	1,685	27	19	2	94	0.014
									MEAN	0.010
									MEDIAN	0.010
									STD DEV	0.004
									MAX	0.021
									MIN	0.003

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

---



# Pipe Interior Radiological Survey Form

Date: 1-27-06 Time: 1030  
 Building: REACTION Elevation: -25 Access Point: -27 TRENCH  
 System: CANAL H WASTE AIR Pipe Diameter: 2" Area: 1.72  
 Type of Survey: Investigation Characterization: Final Survey # Other ✓  
 Sled Size: 2" Vinyl Puffer inch  
 Detector: 44-62 Detector ID #: 204402-SW  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value: 5.2 cpm  
 MDCR<sub>static</sub>: 10.8 cpm  
 Efficiency Factor for Pipe: 0.00026 (taken from detector calibration certificate)  
 Diameter: 7836 dpm/100cm<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: INITIAL SURVEY

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-27-06 Time: 1030

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	2	5	2.5	n/a	n/a
2	2		5	2.5		
3	3		8	4		
4	4		8	4		
5	5		9	4.5		
6	6		4	2		
7	7		6	3		
8	8		11	5.5		
9	9		5	2.5		
10	10		8	4		

REFERENCE COPY

Package Page 1 of 4

Attachment 3, Page 1

Pipe Interior Radiological Survey Form (Continuation Form)

1.27.04 1.72 <sup>70</sup> <sub>CAVITY</sub>

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11	2	4	2	NA	NA
12	12		3	1.5		
13	13		5	2.5		
14	14		6	3		
15	15		3	1.5		
16	16		5	2.5		
17	17		3	1.5		
18	18		4	2		
19	19		6	3		
20	20		5	2.5		
21	21		6	3		
22	22		6	3		
23	23		7	3.5		
24	24		9	4.5		
25	25		5	2.5		
26	26		9	4.5		
27	27		7	3.5		
28	28		4	2		
29	29		5	2.5		
30	30		4	2		
31	31		3	1.5		
32	32		6	3		
33	33		10	5		
34	34		5	2.5		
35	35		5	2.5		
36	36		6	3		
37	37		12	6		
38	38		7	3.5		
39	39		5	2.5		
40	40		4	2		
41	41		7	3.5		
42	42		8	4		
43	43		4	2		
44	44		6	3		
45	45		6	3		
46	46		4	2		
47	47		5	2.5		

Package Page 2 of 4

REFERENCE COPY

Pipe Interior Radiological Survey Form (Continuation Form)

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
48	48	2	2	1	n/a	n/a
49	49	2	3	1.5	↓	↓
50	50	2	9	4.5	↓	↓
51	51	2	4	2	↓	↓
52	52	2	5	2.5	↓	↓
n/a						

REFERENCE COPY

Package Page 3 of 4

Page 4 of 4



Drawing PF-00376 -  
various drains.

Surveyed pipe  
1.72 52 FT

**.114401**

Blue lines in baseline.  
Red lines are piping that  
may be done later.

[illegible]

# Pipe Interior Radiological Survey Form

Date: 1-30-06 Time: 1045  
 Building: REACTOR Elevation: -25 Access Point Area: -32 Trench  
 System: CANAL WASTE AIR Pipe Diameter: 2" Pipe ID # 1-72 <sup>-32 Trench</sup>  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 2" vinyl Pulley inch  
 Detector: 44-62 Detector ID #: 204402-5/121  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2950-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.9 cpm  
 MDCR<sub>static</sub> 11.3 cpm  
 Efficiency Factor for Pipe Diameter 0.00026 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 1836 dpm/100cm<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: CONTINUATION SURVEY

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-30-06 Time: 1045

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	<u>1</u>	<u>2</u>	<u>5</u>	<u>2.5</u>	<u>n/a</u>	<u>n/a</u>
2	<u>2</u>	<u>2</u>	<u>10</u>	<u>5</u>	<u>↓</u>	<u>↓</u>
3						
4						
5						
6			<u>n</u>			
7				<u>a</u>		
8						
9						
10						

Package Page 1 of 5

# **Pipe Interior Radiological Survey Form**

Date: 1-30-06 Time: 1040  
 Building: REACTOR Elevation -25 Access Point -27 Trench  
 System: CANAL H WASTE AREA Pipe Diameter: 2" Area: 1.72 Pipe ID 1.72 conc bore  
 Type of Survey Investigation Characterization Final Survey # ✓ Other ✓  
 Sled Size 2" vinyl Pulley inch  
 Detector: 44-62 Detector ID #: 204407-3A#12.1  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 0350-1 Instrument ID #: 012223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.9 cpm

MDCR<sub>static</sub> 11.3 cpm

Efficiency Factor for Pipe \_\_\_\_\_ (taken from detector calibration certificate)

Diameter \_\_\_\_\_ dpm/100cm<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: CONTINUATION Survey

## **Pipe Interior Radiological Survey**

Radiological Survey Commenced: Date: 1-30-06 Time: 1040

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	2	5	2.5	N/A	N/A
2	2	2	3	1.5	↓	↓
3	3	2	9	4.5	↓	↓
4	4	2	5	2.5	↓	↓
5	5	2	6	3	↓	↓
6	6	2	7	3.5	↓	↓
7						
8						
9						
10						

# Pipe Interior Radiological Survey Form

Date: 1-30-06 Time: 0815  
 Building: REACTOR Elevation -25 Access Point -27 TRENCH  
 System: CANAL H WASTE AIR Pipe Diameter: 2" Area: 1.72 TO CANAL #  
 Type of Survey Investigation Characterization Final Survey # Other ✓  
 Sled Size 2" vinyl Puller inch  
 Detector: 44-62 Detector ID #: 204402-5/12  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.9 cpm  
 MDCR<sub>static</sub> 11.3 cpm  
 Efficiency Factor for Pipe 0.00026 (taken from detector calibration certificate)  
 Diameter 2" MDC<sub>static</sub> 7836 dpm/100cm<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: CONTINUATION SURVEY

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-30-06 Time: 0815

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	53	2	4	2	n/a	n/a
2	54	↓	4	2	↓	↓
3	55	↓	6	3	↓	↓
4	56	↓	8	4	↓	↓
5	57	↓	8	4	↓	↓
6	58	↓	2	3.5	↓	↓
7	59	↓	10	5	↓	↓
8	60	↓	2	3.5	↓	↓
9	61	↓	4	2	↓	↓
10	62	↓	2	1	↓	↓

Package Page 3 of 5

Pipe Interior Radiological Survey Form (Continuation Form)

1-30-16

1.72 TO CANAL  
H

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	63	2	5	2.5	N/A	N/A
12	64		7	3.5		
13	65		7	3.5		
14	66		2	1		
15	67		6	3		
16	68		8	4		
17	69		5	2.5		
18	70		6	3		
19	71		7	3.5		
20	72		7	3.5		
21	73		5	2.5		
22	74		7	3.5		
23	75		10	5		
24	76		9	4.5		
25	77		6	3		
26	78		7	3.5		
27	79		8	4		
28	80		7	3.5		
29	81		5	2.5		
30	82		5	2.5		
31	83	2	2	1		
N/A						

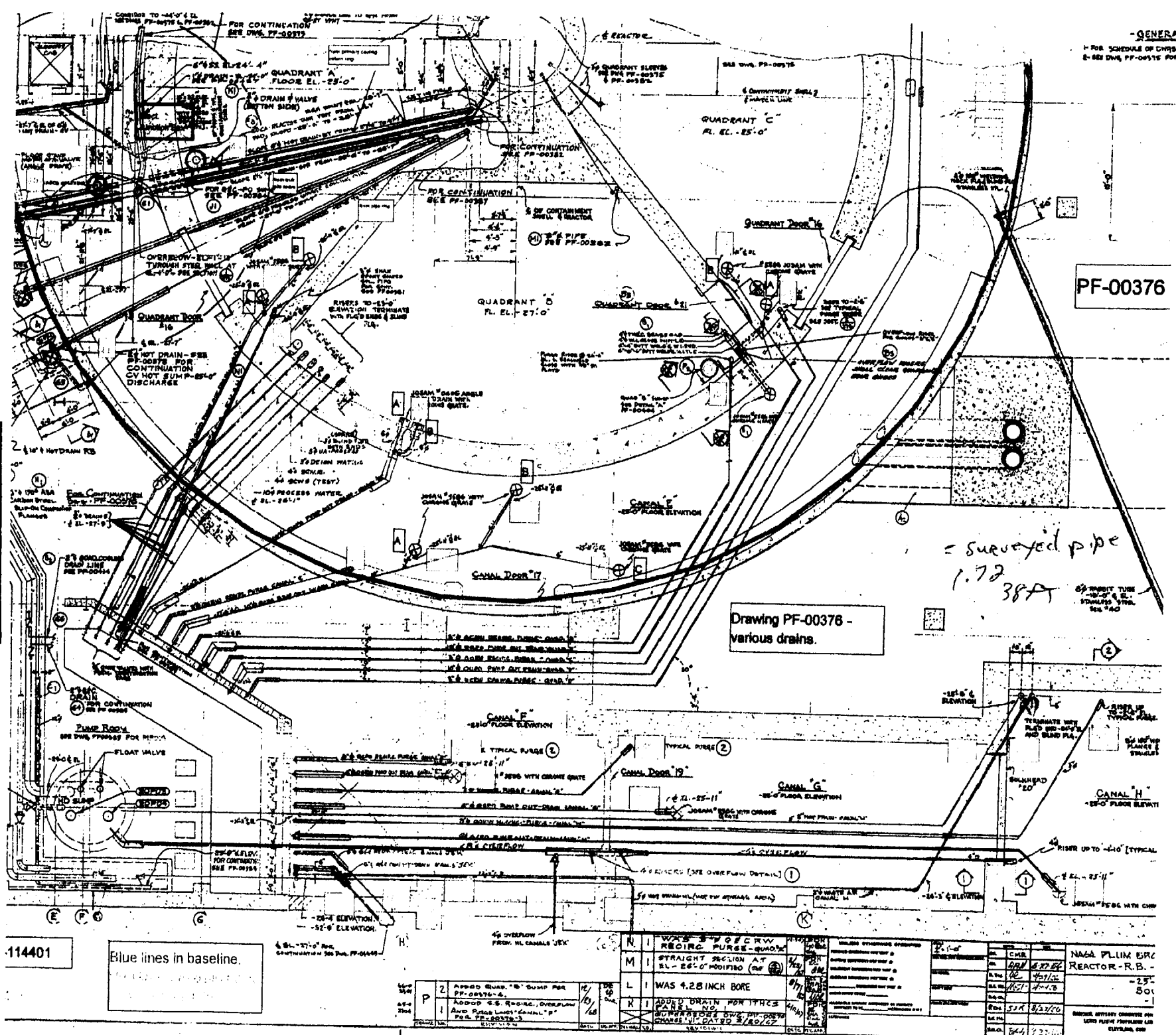
Package Page 4 of 5

REFERENCE COPY

Attachment 3, Page 2



REFERENCE COPY



page 5 of 5

# Pipe Interior Radiological Survey Form

Date: 2-1-06 Time: 1020  
 Building: RX Elevation: -25 Access Point Area: CANAL H  
 System: CANAL H Pipe Diameter: 2" Pipe ID # (1-72) RLC 72  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 2" VINLY PULVER #12 inch  
 Detector: 44-62 Detector ID #: 204402-SIN 121  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.4 cpm

MDCR<sub>static</sub> 11 cpm

Efficiency Factor for Pipe Diameter 0.00026 (taken from detector calibration certificate)

MDC<sub>static</sub> 7836 dpm/100cm<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: CONTINUATION SURVEY

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 2-1-06 Time: 1020

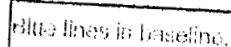
Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	2	4	2	N/A	N/A
2						
3						
4						
5						
6						
7						
8						
9						
10						

Package Page 1 of 2

Attachment 3, Page 1



REFERENCE COPY



$\therefore$  Pipe Surveyed  
1 ft

**REFERENCE COPY**

## Pipe Interior Radiological Survey Form

Date: 3-9-06 Time: 1055  
 Pipe ID#: 1.72 Pipe Diameter: 2" Access Point Area: -25 CANAL H  
 Building: Rx Elevation: -25 System: CANAL H WASTE  
 Type of Survey Investigation        Characterization        Final Survey X Other ✓  
 Gross        Co60 ✓ Cs         
 Detector ID# / Sled ID# 44-151 #215957 1 NO SLED 9/20/07  
 Detector Cal Date: 9/20/06 44-1599 Detector Cal Due Date: 20-Feb-07  
 Instrument: 2350-1 Instrument ID #: 212223  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 14.1 cpm

MDCR<sub>static</sub> 15.9 cpm

Efficiency Factor for Pipe Diameter 0.00038 (from detector efficiency determination)

MDC<sub>static</sub> 3493 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: CONTINUATION SURVEY

Technician Signature C. OBRADO

## 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	2	1	4	4	n/a	n/a
2	3	1	7	7	↓	↓
3	4	1	6	6	↓	↓
4	5	1	5	5	↓	↓
5	6	1	6	6	↓	↓
6	7	1	6	6	↓	↓
7	8	1	4	4	↓	↓
8	9	1	6	6	↓	↓
9	n/a	n/a	n/a	n/a	n/a	n/a
10	↓	↓	↓	↓	↓	↓

Package Page 1 of 2

REFERENCE COPY



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

### DQA Check Sheet


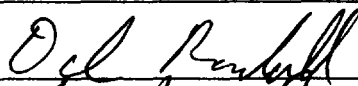
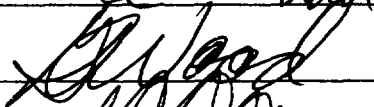

Design #	EP 1.72	Revision #	Original						
Survey Unit #	EP 1.72								
<b>Preliminary Data Review</b>									
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						Yes	No	N/A	
1. Have surveys been performed in accordance with survey instructions 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			
<b>Graphical Data Review</b>									
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	
<b>Data Analysis</b>									
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?								X	
Comments:									
FSS/Characterization Engineer (print/sign)						<i>Dale R. Case</i>		Date	6-30-07
FSS/ Characterization Manager (print/sign)						<i>R. Case</i>		Date	9/11/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**



## Survey Unit Release Record

<b>Design #</b>	EP-1.41-2" INST	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.41-2" INST			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.41-2" INST meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.41-2" INST is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.41-2" INST were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-2 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> <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; font-weight: bold;">COPY</span> </div>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			8-26-07	
Technical Reviewer (FSS/Characterization Engineer)			9-4-07	
FSS/Characterization Manager			9/10/07	

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.41-2" INST	Revision # Original	Page 2 of 3
Survey Unit: 1.41-2" INST		

## **1.0 History/Description**

1.1 The subject pipe system is the 2" line located in Quad "B" -25' elevation.

## **2.0 Survey Design Information**

2.1 EP 1.41-2" INST was surveyed IAW Procedure #BSI/LVS-002.

2.2 100% of the 2" ID pipe was accessible for survey. The accessible 2" ID pipe was surveyed by static measurement at one foot increments, for a total of 2 survey measurements.

2.3 Surface area for the 2" ID piping is 486 cm<sup>2</sup> for each foot of piping, corresponding to a total 2" ID piping surface area of 973 cm<sup>2</sup> (0.1 m<sup>2</sup>) for the entire length of (2') of 2" 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 All measurement results 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.

5.3 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 1.41-2" INST passes FSS.

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

### 5.5 Statistical Summary Table

Statistical Parameter	2" Pipe
Total Number of Survey Measurements	2
Number of Measurements >MDC	1
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0267
Median	0.0267
Standard Deviation	0.0227
Maximum	0.0428
Minimum	0.0107

**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 EP 1.41-2" INST to be less than 1 mrem/yr. The dose contribution is estimated to be 0.027 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.41-2" INST & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.41-2 INST	Survey Location	-25 el. Quad B
Survey Date	12-May-06	2350-1 #	203488
Survey Time	10:30	Detector-Sled #	44-159 238369 / no sled
Pipe Size	2"	Detector Efficiency	0.0005
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm2)	486
Pipe Area Incorporated by Survey Data (in <sup>2</sup> )	0.1	Field BKG (cpm)	13.4
Routine Survey	X	Field MDCR (cpm)	15.6
QA Survey		Nominal MDC (dpm/100cm2)	4,410
Survey Measurement Results			
Total Number of Survey Measurements			2
Number of Measurements >MDC			1
Number of Measurements Above 50% DCGL			0
Number of Measurements Above DCGL			0
Mean			0.0267
Median			0.0267
Standard Deviation			0.0227
Maximum			0.0428
Minimum			0.0107
Survey Technician(s)		STOCK	
Survey Unit Classification			1
TBD 06-004 Piping Group			2
SR-13 Radionuclide Distribution Sample			EP 2-2
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		Ode Randall 8-26-07	

**EP 1.41-2" INST**  
**2" Pipe**  
**TBD 06-004 Group 2**

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)	Unlty
1	24	24	48,000	9,868	5,117	82	58	5	284	0.043
2	6	6	12,000	2,467	1,279	20	14	1	71	0.011
									MEAN	0.027
									MEDIAN	0.027
									STD DEV	0.023
									MAX	0.043
									MIN	0.011

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

## Pipe Interior Radiological Survey Form

Date: 5/12/06 Time: 1030  
 Pipe ID#: W-42 1.41 Pipe Diameter: 2.0" Access Point Area: QUAD B <sup>WEST VLI</sup> Box  
 Building: CV Elevation: -25' System: RING HEADER

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_

Detector ID# / Sled ID# 44-159 238369 / NO SLED  
 Detector Cal Date: 3/6/06 Detector Cal Due Date: 3/6/07  
 Instrument: 2350-1 Instrument ID #: 203408  
 Instrument Cal Date: 11/17/05 Instrument Cal Due Date: 11/17/06

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

Background Value 13.4 cpm

MDCR<sub>static</sub> 15.6 cpm

Efficiency Factor for Pipe Diameter 0.0005 (from detector efficiency determination)

MDC<sub>static</sub> 4410 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: UNABLE TO PASS THE ELBOW INTO THE PIPE RISER  
EP2-2

Technician Signature [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	2	1	24	24	n/a	n/a
2	3	1	6	6	n/a	n/a
3						
4						
5						
6						
7						
8						
9						
10						

REFERENCE COPY

Package Page 1 of 2

Attachment 3, Page 1





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


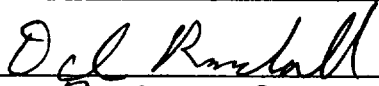
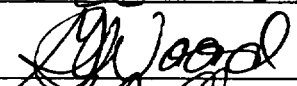
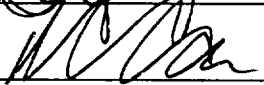
### DQA Check Sheet

Design #	EP 1.41-2" INST	Revision #	Original					
Survey Unit #	EP 1.41-2" INST							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)						Date <i>R. Case</i> / <i>Oct 10/07</i>		Date <i>8-26-07</i>
FSS/ Characterization Manager (print/sign)						Date <i>R. Case</i>		Date <i>9/10/07</i>

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

## Survey Unit Release Record

<b>Design #</b>	EP-1.42A-6	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.42A-6			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.42A-6 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.42A-6 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 1.42A-6 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> <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; font-weight: bold;">COPY</span> </div>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			8-8-07	
Technical Reviewer (FSS/Characterization Engineer)			8.13.07	
FSS/Characterization Manager	 R. Case		9/10/07	

Form  
CS-09/1  
Rev 0

Survey Unit: 1.42A-6

**1.0 History/Description**

- 1.1 The subject pipe system is a 6" Quad "C" system line.
- 1.2 EP 1.42A-6 consists of approximately 15 feet in length from the Reactor Building -25' elevation to Quad "C".

**2.0 Survey Design Information**

- 2.1 EP 1.42A-6 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 6" ID pipe was accessible for survey. The accessible 6" ID pipe was surveyed by static measurement at one foot increments, for a total of 15 survey measurements.
- 2.3 Surface area for the 6" ID piping is 1,459 cm<sup>2</sup> for each foot of piping, corresponding to a total 6" ID piping surface area of 21,890 cm<sup>2</sup> (2.2 m<sup>2</sup>) for the entire length of (15') of 6" 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 All measurement results 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.
- 5.3 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 1.42A-6 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	6" Pipe
Total Number of Survey Measurements	15
Number of Measurements >MDC	9
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0221
Median	0.0225
Standard Deviation	0.0070
Maximum	0.0368
Minimum	0.0102

**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 EP 1.42A-6 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.022 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.42A-6 & Spreadsheet

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





## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.42A-6	Survey Location	Quad C / -27 Trench
Survey Date	03-Jul-07	2350-1 #	189094
Survey Time	10:24	Detector-Sled #	1MG1 LVS-1/101
Pipe Size	6"	Detector Efficiency	0.0002
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm2)	1459
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	2.2	Field BKG (cpm)	3.2
Routine Survey	X	Field MDCR (cpm)	9.2
QA Survey		Nominal MDC (dpm/100cm2)	3,143
Survey Measurement Results			
Total Number of Survey Measurements		15	
Number of Measurements >MDC		9	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0221	
Median		0.0225	
Standard Deviation		0.0070	
Maximum		0.0368	
Minimum		0.0102	
Survey Technician(s)		STOCK	
		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		Owl Russell 8-8-07	

**EP 1.42A-6**  
**6" 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	11	11	55,000	3,769	149	3,575	950	110	26	0.022
2	8	8	40,000	2,741	109	2,600	691	80	19	0.016
3	13	13	65,000	4,454	177	4,225	1,123	130	31	0.027
4	8	8	40,000	2,741	109	2,600	691	80	19	0.016
5	18	18	90,000	6,167	244	5,850	1,555	180	43	0.037
6	11	11	55,000	3,769	149	3,575	950	110	26	0.022
7	5	5	25,000	1,713	68	1,625	432	50	12	0.010
8	7	7	35,000	2,398	95	2,275	605	70	17	0.014
9	8	8	40,000	2,741	109	2,600	691	80	19	0.016
10	13	13	65,000	4,454	177	4,225	1,123	130	31	0.027
11	11	11	55,000	3,769	149	3,575	950	110	26	0.022
12	8	8	40,000	2,741	109	2,600	691	80	19	0.016
13	13	13	65,000	4,454	177	4,225	1,123	130	31	0.027
14	14	14	70,000	4,797	190	4,550	1,210	140	33	0.029
15	14	14	70,000	4,797	190	4,550	1,210	140	33	0.029
									MEAN	0.022
									MEDIAN	0.022
									STD DEV	0.007
									MAX	0.037
									MIN	0.010

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

# Pipe Interior Radiological Survey Form

Date: 7/3/07 Time: 1024  
 Pipe ID#: 1.42A Pipe Diameter: 6" Access Point Area: 21' TRENCH  
 Building: R BLDG Elevation: -27' System: \_\_\_\_\_  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 1MG1 LVS-1 / 101  
 Detector Cal Date: 1/11/07 Detector Cal Due Date: 1/11/08  
 Instrument: 2350-1 Instrument ID #: 189094  
 Instrument Cal Date: 1/11/07 Instrument Cal Due Date: 1/11/08

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

Background Value 3.2 cpm

MDCR<sub>static</sub> 9.2 cpm

Efficiency Factor for Pipe Diameter 0.0002 (from detector efficiency determination)

MDC<sub>static</sub> 3143 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: INITIAL FP3-9 COMPLETE

GREEN TAG #7-14

Technician Signature [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	42	1	11	11	n/a	n/a
2	43	1	8	8	↓	↓
3	44	1	13	13	↓	↓
4	45	1	8	8	↓	↓
5	46	1	18	18	↓	↓
6	47	1	11	11	↓	↓
7	48	1	5	5	↓	↓
8	49	1	7	7	↓	↓
9	50	1	8	8	↓	↓
10	51	1	13	13	↓	↓

Package Page 1 of 2

REFERENCE COPY

Date: 7/3/07  
Pipe ID#: 1.42A Pipe Diameter: 6" Access Point Area: -27' TRENCH  
Building: R BLD Elevation: -27' System: \_\_\_\_\_

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	52	7	11	11	n/a	n/a
12	53		8	8		
13	54		13	13		
14	55		14	14		
15	56		14	14		

The graph shows a curve representing a relationship between position and count rate. The curve starts at the bottom left and rises towards the top right. The data points from the table above are plotted as dots along this curve. The curve is labeled 'N' and 'A' in the middle.

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

### DQA Check Sheet


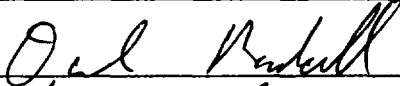

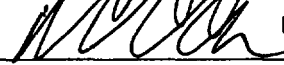
Design #	EP 1.42A-6	Revision #	Original					
Survey Unit #	EP 1.42A-6							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						Yes	No	N/A
1. Have surveys been performed in accordance with survey instructions 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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)						<i>Dale R. Case</i>		Date 8-8-07
FSS/ Characterization Manager (print/sign)						<i>R. Case</i>		Date 8/10/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**



## Survey Unit Release Record

<b>Design #</b>	EP-1.12-2.5	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.12-2.5			
<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="text-align: center;">  <p style="font-size: 2em; font-weight: bold;">COPY</p> </div> <div> <p><b>Description</b></p> <p>1) Embedded Pipe (EP) Survey Unit 1.12-2.5 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.12-2.5 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 1.12-2.5 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 3-8 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) The piping used in the construction of this system was a non-standard schedule that was nominally 2.5" in diameter. This caused difficulties with regard to the procurement of an identical pipe sample for detector geometry mock-up. As a result, the detector calibration efficiency was not acquired. To compensate for this, the instrument efficiency values applied to this Survey Unit were associated with 3" diameter piping. These values are conservative when applied to measurements made on the nominal 2.5" diameter piping.</p> </div> </div>				
<b>Approval Signatures</b>				<b>Date:</b>
FSS/Characterization Engineer				8-17-07
Technical Reviewer (FSS/Characterization Engineer)				9-4-07
FSS/Characterization Manager		 R. Case		9/10/07

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.12-2.5	Revision # Original	Page 2 of 3
Survey Unit: 1.12-2.5		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 2.5" Quad "B" spare system line.
- 1.2 EP 1.12-2.5 consists of approximately 6 feet in length from the Reactor Building -25' elevation, Quad "B" to the Sub Pile Room.

## **2.0 Survey Design Information**

- 2.1 EP 1.12-2.5 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2.5" ID pipe was accessible for survey. The accessible 2.5" ID pipe was surveyed by static measurement at one foot increments, for a total of 6 survey measurements.
- 2.3 Surface area for the 2.5" ID piping is 608 cm<sup>2</sup> for each foot of piping, corresponding to a total 2.5" ID piping surface area of 3,648 cm<sup>2</sup> (0.4 m<sup>2</sup>) for the entire length of (6') of 2.5" piping.

## **3.0 Survey Unit Measurement Locations/Data**

- 3.1 Pipe interior radiological survey forms are provided in Attachment 2 of this release record.
- 3.2 Although the measurements were performed on 2.5" diameter piping, instrument efficiencies for 3" diameter piping were applied, which is a conservative evaluation of the results.

## **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 All measurement results 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.
- 5.3 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 1.12-2.5 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	2.5" Pipe
Total Number of Survey Measurements	6
Number of Measurements >MDC	1
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0129
Median	0.0104
Standard Deviation	0.0074
Maximum	0.0268
Minimum	0.0059

**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 EP 1.12-2.5 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.013 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.12-2.5 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.12-2.5	Survey Location	-25 el. Quad B		
Survey Date	21-Feb-07	2350-1 #	203488		
Survey Time	13:40	Detector-Sled #	44-154 238369/101		
Pipe Size	2.5"	Detector Efficiency	0.00066		
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (ln cm2)	608		
Pipe Area Incorporated by Survey Data (ln cm2)	0.4	Field BKG (cpm)	1.3		
Routine Survey	X	Field MDCR (cpm)	6.9		
QA Survey		Nominal MDC (dpm/100cm2)	2,648		
Survey Measurement Results					
Total Number of Survey Measurements			6		
Number of Measurements >MDC			1		
Number of Measurements Above 50% DCGL			0		
Number of Measurements Above DCGL			0		
Mean			0.0129		
Median			0.0104		
Standard Deviation			0.0074		
Maximum			0.0268		
Minimum			0.0059		
Survey Technician(s)		STOCK			
Survey Unit Classification			1		
TBD 06-004 Piping Group			1		
SR-13 Radionuclide Distribution Sample			EP 3-8		
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		Oal P. Marshall 8-17-07			

**EP 1.12-2.5**  
**2.5" 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	6	6	9,091	1,495	59	1,418	377	44	10	0.009
2	10	10	15,152	2,492	99	2,364	628	73	17	0.015
3	7	7	10,606	1,744	69	1,655	440	51	12	0.010
4	4	4	6,061	997	40	946	251	29	7	0.006
5	7	7	10,606	1,744	69	1,655	440	51	12	0.010
6	18	18	27,273	4,485	178	4,255	1,131	131	31	0.027
									MEAN	0.013
									MEDIAN	0.010
									STD DEV	0.007
									MAX	0.027
									MIN	0.006

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

Pipe Interior Radiological Survey Form

Date: 2/21/07 Time: 1340  
Pipe ID#: 1.12 Pipe Diameter: 2.5" Access Point Area: Quad B  
Building: CV Elevation: -15' System: R Ring

Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other C

Gross \_\_\_\_\_ Co60 V Cs \_\_\_\_\_

Detector ID# / Sled ID# 44-154 2383691 101

Detector Cal Date: 9/5/06 Detector Cal Due Date: 9/5/07

Instrument: 2350-1 Instrument ID #: 203488

Instrument Cal Date: 7/5/06 Instrument Cal Due Date: 7/5/07

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

Background Value 1.3 cpm

MDCR<sub>static</sub> 6.9 cpm

Efficiency Factor for Pipe Diameter 0.00060 (from detector efficiency determination)

MDC<sub>static</sub> 2648 dpm/ 100 cm<sup>2</sup>

Is the MDC<sub>static</sub> acceptable? Yes No (if no, adjust sample count time and recalculate MDC<sub>static</sub>)

Comments: POST GRIT BLAST SURVEY EP3-8 OR EP2-2

POSITIONS # 5, 6 → NO SLED

Technician Signature [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	6.8	6.8	n/a	n/a
2	2	1	10	10		
3	3	1	7	7		
4	4	1	4	4		
5	5	1	7	7		
6	6	1	18	18		
7	N/A					
8						
9						
10						

Package Page 1 of 2

Attachment 3, Page 1



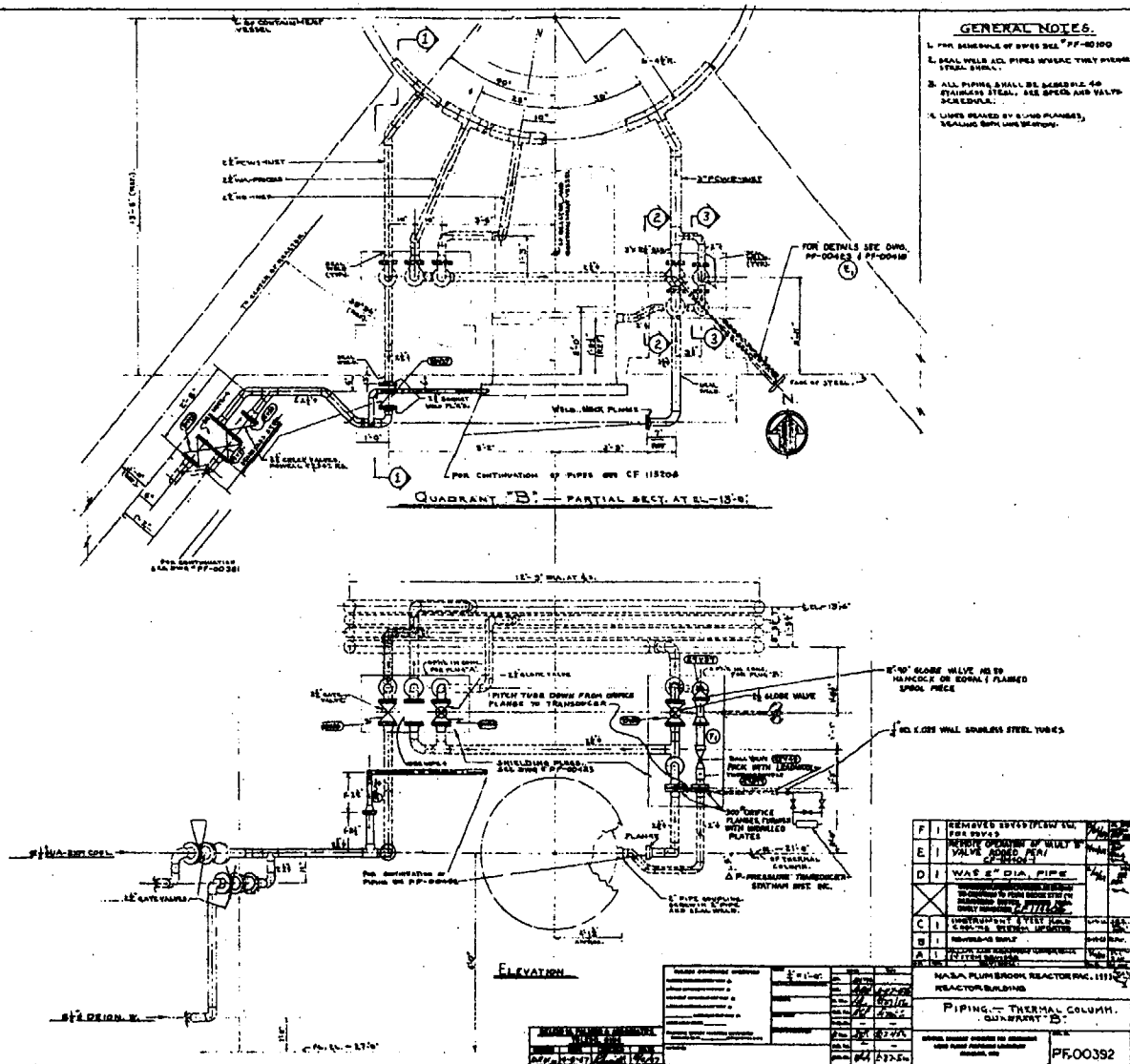
REFERENCE COPY



SECTION ③

SECTION ②

### SECTION ①



### GENERAL NOTES

1. FOR SCHEDULE OF DWGS SEE "P-80100"
2. SEAL WELLS ALL PIPES WHERE THEY PIERCE STEEL SHELL.
3. ALL PIPING SHALL BE SCHEDULE 40 STAINLESS STEEL, SEE SPECS AND VALVE SCHEDULE.
4. LINES DRAINED BY SLOPE, FLANGES, DRAINING BOTH WAYS BEYOND.

F	REMOVED 80445 (FLOW SW. FOR 80445)	W	W
E	REPAIR OPERATION OF "WULT" VALVE <u>COMPLETED</u>	W	W
D	WAS 8" DIA. PIPE	W	W
X	CONNECTION TO PUMP ROOM BY 1/2" GALVANIZED STEEL PIPE ONLY REMOVED <u>8" DIA. PIPE</u>	W	W
C	EXHAUSTION & VENT HOLE IN CEILING REPAIRS COMPLETED	W	W
B	REPAIRS TO WULT	W	W
A	REPAIRS TO WULT	W	W

[illegible]

REACTOR BUILDING

**References**

PIPING - THERMAL COLUMN  
QUANTITY B:

SECRET

REF 00381

150033

1. *Journal of the American Medical Association*, 277, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674,

---

1

**REFERENCE COPY**

**PAGE**  
2 of 2

1.12

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


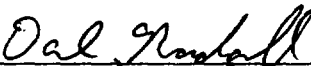


### DQA Check Sheet

Design #	EP 1.12-2.5	Revision #	Original			
Survey Unit #	EP 1.12-2.5					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)			<i>Dele R. Case</i>		Date	8-17-07
FSS/ Characterization Manager (print/sign)			<i>[Signature]</i>		Date	9/10/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP Rx113	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	Rx113			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit Rx113 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP Rx113 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP Rx113 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-1 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 style="text-align: center;"> <b>COPY</b></p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			6-11-07	
Technical Reviewer (FSS/Characterization Engineer)			7-3-07	
FSS/Characterization Manager	 R. Case		9/10/07	

Form  
CS-09/1  
Rev 0

## Survey Unit: Rx155

**1.0 History/Description**

- 1.1 The subject pipe is a water line from Quad B to the -25 ft of the Rx Building in Pump Room #22. The function of this pipe was to convey water from a Pump Room #22 on the Rx Building -25 ft, where the pipe is currently breached.
- 1.2 EP Rx113 consists of 20 linear feet (') of 10 inch (") Inside Diameter (ID) piping from the breach point in Pump Room #22 to Quad B.

**2.0 Survey Design Information**

- 2.1 EP Rx113 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 10" ID pipe was accessible for survey. The accessible 10" ID pipe was surveyed by static measurement at one foot increments, for a total of 20 survey measurements.
- 2.3 Surface area for the 10" ID piping is 2,432 cm<sup>2</sup> for each foot of piping, corresponding to a total 10" ID piping surface area of 48,640 cm<sup>2</sup> (4.9 m<sup>2</sup>) for the entire length of (20') of 10" 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 All measurement results 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.
- 5.3 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 Rx113 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

FSS Design # EP Rx113	Revision # Original	Page 3 of 3
Survey Unit: Rx113		

## 5.5 Statistical Summary Table

Statistical Parameter	10" Pipe
Total Number of Survey Measurements	20
Number of Measurements >MDC	0
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.012
Median	0.012
Standard Deviation	0.001
Maximum	0.016
Minimum	0.010

**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 EP Rx 113 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.012 mrem/yr based on the average of the actual gross counts measured.

## 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 –Disc containing RR for EP Rx113 & Spreadsheet

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





## BSI EP/BP SURVEY REPORT

Pipe ID	Rx 113	Survey Location	-25/Quad B
Survey Date	12-8-05/1-17-06	2350-1 #	203488
Survey Time	0825/1020	Detector-Sled #	BICRON G3
Pipe Size	10"	Detector Efficiency	0.003
DCGL (dpm/100cm <sup>2</sup> )	240800	Pipe Area Incorporated by Detector Efficiency (In cm <sup>2</sup> )	2432
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	4.9	Field BKG (cpm)	389/396.1
Routine Survey	X	Field MDCR (cpm)	70.7/71.6
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	11223
Survey Measurement Results			
Total Number of Survey Measurements		20	
Number of Measurements >MDC		0	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.012	
Median		0.012	
Standard Deviation		0.001	
Maximum		0.016	
Minimum		0.010	
Survey Technician(s)	ROSENHAGEN		
Survey Unit Classification		1	
TBD 06-004 Piping Group		2	
SR-13 Radionuclide Distribution Sample		EP 2-1	
Measured Nuclide		Co60	
Area Factor/EMC Used		No	
Pass/Fail FSS		Pass	
MREM/YR Contribution		<1	
COMMENTS: ACTIVITY VALUES NOT BACKGROUND CORRECTED			
RP Engineer   Date		Orel Marshall 6-11-07	

**TBD 06-004 Group 2**

[illegible]

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

# **Pipe Interior Radiological Survey Form**

Date: 12.6.05 Time: 0825  
 Building: REACTOR Elevation: -25 Access Point Area: -25  
 System: REACTOR PROCESSING SYSTEM Pipe Diameter: 10" Pipe ID #: RX 113  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 10" inch  
 Detector: G3 / BICRON Detector ID #: B566A-111  
 Cal Date: 11/17/05 Cal Due Date: 11/17/06  
 Instrument: 6404M 2350-1 Instrument ID #: 203488  
 Cal Date: 11/17/05 Cal Due Date: 11/17/06

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

Background Value 389 cpm  
 MDCR<sub>static</sub> 70.7 cpm  
 Efficiency Factor for Pipe Diameter 0.003 (taken from detector ~~calibration~~ <sup>efficiency determination</sup> certificate)  
 MDC<sub>static</sub> 11223 dpm/100cm<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: \_\_\_\_\_

## **Pipe Interior Radiological Survey**

Radiological Survey Commenced: Date: 12.6.05 Time: 0825

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1 1ft	1ft	1	189	189	-200	n/a
2 2	2ft	1	195	195	-194	
3 3	3ft	1	183	183	-206	
4 4	4ft	1	182	182	-207	
5 5	5ft	1	175	175	-214	
6 6	6ft	1	190	190	-199	
7 7	7ft	1	213	213	-176	
8 8	8ft	1	171	171	-218	
9 9	9ft	1	193	193	-196	
10 10	10 ft	1	200	200	-189	

Package Page 1 of 2

**REFERENCE COPY**

## Pipe Interior Radiological Survey Form (Continuation Form)

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	11 ft	1	178	178	-211	n/a
12	12 ft	1	208	208	-181	↓
13	13 ft	1	197	197	-192	
14	14 ft	1	216	216	-173	
15	15 ft	1	198	198	-191	
16	16 ft	1	200	200	-189	
17	17 ft	1	219	219	-170	↓
n/a						

Package Page 2 of 2

Attachment 3, Page 2



**REFERENCE COPY**

42-00-1

QUADRANT DOOR

#16

CL EL. -27'-7"

41

2 1/2" HOT DRAIN - SEE  
PF-00378 FOR  
CONTINUATION  
CV HOT SUMP -25'-0"  
DISCHARGE

39

RISE TO -23'-0"  
ELEVATION TERMINATE  
WITH FLG'D ENDS & BLIND  
FLG.

QUAD  
FL, E

PIPE SURVEY

17'

DD R X 113

12-6-05

JOSAM #0406 ANGLE  
PODE DRAIN WITH  
CHROME GRATE.

A

38

B

(SPARE)

3" BLIND FLG'D

BOTH ENDS

3" UA-PROCESS

3" DEION WATER

4" SCH.R.

4" SCWS (TEST)

10" PROCESS WATER

CL EL. -26'-1"

10" GCPD PUMP OUT DRAIN - QUAD

JOSAM #5586 WITH  
CHROME GRATE

A

CL EL

NTINUATION  
PF-00378

NS  
-9"

REFERENCE COPY

# Pipe Interior Radiological Survey Form

Date: 1-17-06 Time: 1020  
 Building: RX Elevation: -25 Access Point Area: QUAD B  
 System: WATER TO PUMP RM Pipe Diameter: 10" Pipe ID # RX 113  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 8" inch  
 Detector: G3 - BICRON Detector ID #: B566A - 312 108  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 396.1 cpm  
 MDCR<sub>static</sub> 71.6 cpm  
 Efficiency Factor for Pipe Diameter 0.003 (taken from detector efficiency determination calibration certificate)  
 MDC<sub>static</sub> 11223 dpm/100cm<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: CONTINUATION SURVEY

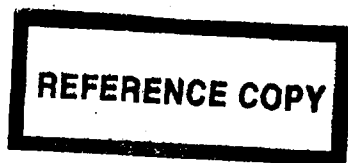
COMPLETE

## Pipe Interior Radiological Survey

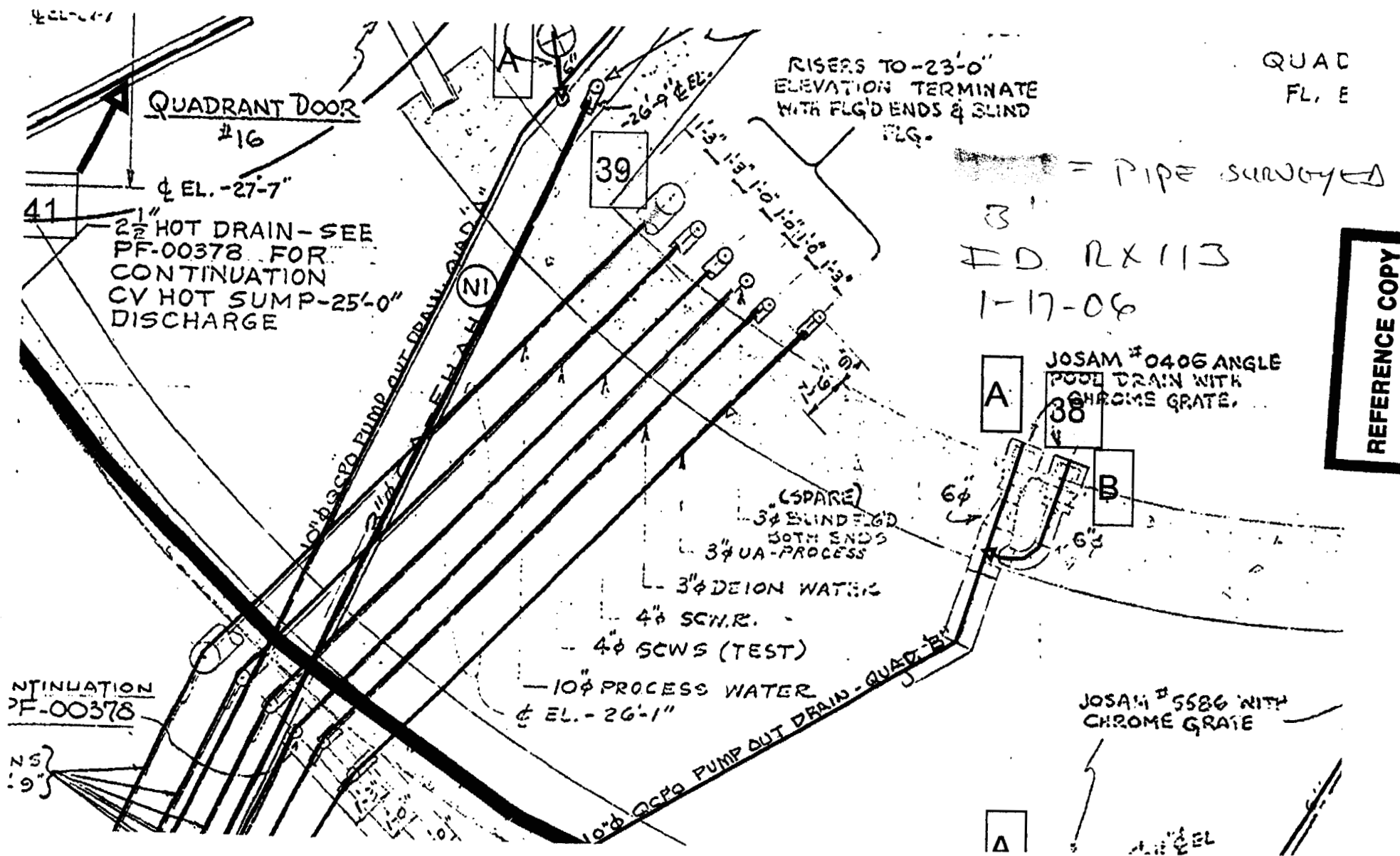
Radiological Survey Commenced: Date: 1-17-06 Time: 1020

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	1	261	261	n/a	n/a
2	2	1	232	232	↓	↓
3	3	1	182	182	↓	↓
4						
5						
6						
7						
8						
9						
10						

Package Page 1 of 1



Attachment 3, Page 1



QUAD  
FL. E

= PIPE SURVEYED  
3'  
ID. RX113  
1-17-06

REFERENCE COPY

A

JOSAM #0406 ANGLE  
POOL DRAIN WITH  
CHROME GRATE

B

A

JOSAM #5586 WITH  
CHROME GRATE



**SECTION 7**  
**ATTACHMENT 3**  
**—|— PAGE(S)**




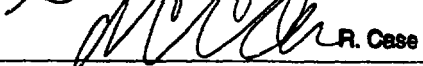
### DQA Check Sheet

Design #	EP Rx113	Revision #	Original			
Survey Unit #	EP Rx113					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 (S+ for Sign Test or W <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)		Date <i>R. Case</i>		Date	6-11-07	
FSS/ Characterization Manager (print/sign)		<i>[Signature]</i> R. Case		Date	9/10/07	

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.35	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.35			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.35 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.35 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.35 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #CS050104-003 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 style="text-align: center;">  <b>COPY</b> </p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			7-2-07	
Technical Reviewer (FSS/Characterization Engineer)			7-11-07	
FSS/Characterization Manager	 R. Case		9/10/07	

Form  
CS-09/1  
Rev 0

FSS Design # EP 1.35	Revision # Original	Page 2 of 3
Survey Unit: 1.35		

## **1.0 History/Description**

- 1.1 The subject pipe system is the 3" purge line for Quad "B". The function of this pipe was to convey water from the 3"risers in Quad "B" to the HD sump in Pump Room#22 on the Rx building -25ft., where the pipe is currently breached.
- 1.2 EP 1.35 consists of 3" diameter piping that is approximately 78 feet in length from the pump room to the riser in Canal H. The pipe section has approximately five mitered elbows of ranging between 45 and 90 degrees.

## **2.0 Survey Design Information**

- 2.1 EP 1.35 was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 3" ID pipe was accessible for survey. The accessible 3" ID pipe was surveyed by static measurement at one foot increments, for a total of 78 survey measurements.
- 2.3 Surface area for the 3" ID piping is  $730 \text{ cm}^2$  for each foot of piping, corresponding to a total 3" ID piping surface area of  $56,940 \text{ cm}^2$  ( $5.7 \text{ m}^2$ ) for the entire length of (approximately 78') of 3" 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 All measurement results 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.
- 5.3 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 1.35 passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

### 5.5 Statistical Summary Table

Statistical Parameter	3" Pipe
Total Number of Survey Measurements	78
Number of Measurements >MDC	19
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0111
Median	0.0098
Standard Deviation	0.0052
Maximum	0.0365
Minimum	0.0021

**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 EP 1.35 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.011 mrem/yr based on the average of the actual gross counts measured.

### 7.0 Attachments

Attachment 1 – BSI EP/BP Survey Report

Attachment 2 – Pipe Interior Radiological Survey Form

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.35 & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	1.35	Survey Location	Quad B purge -27
Survey Date	12/13/05, 12/15/05, 12/19/05, 1/04/06, 1/05/06	2350-1 #	212223
Survey Time	1415 / 1400 / 0850 / 1355 /0820	Detector-Sled #	204402-121, 212701- 121
Pipe Size	3"	Detector Efficiency	0.0002 / 0.0002 / 0.0002 / 0.00013 / 0.00013
DCGL (dpm/100cm <sup>2</sup> )	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm <sup>2</sup> )	730
Pipe Area Incorporated by Survey Data (in m <sup>2</sup> )	5.7	Field BKG (cpm)	5.2/5.1/5.1/4.7/5.5
Routine Survey	X	Field MDCR (cpm)	10.8/ 10.7 /10.7 / 10.5/ 11
QA Survey		Nominal MDC (dpm/100cm <sup>2</sup> )	6726 / 2779
Survey Measurement Results			
Total Number of Survey Measurements		78	
Number of Measurements >MDC		19	
Number of Measurements Above 50% DCGL		0	
Number of Measurements Above DCGL		0	
Mean		0.0111	
Median		0.0098	
Standard Deviation		0.0052	
Maximum		0.0365	
Minimum		0.0021	
Survey Technician(s)		Rosenhagen	
Survey Unit Classification		1	
TBD 06-004 Piping Group		2	
SR-13 Radionuclide Distribution Sample		CS050104-003	
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		Orel Marshall 6-30-07	



**EP 1.35**  
**3" Pipe**  
**TBD 06-004 Group 2**

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	6.3	6.3	31,500	4,315	2,238	36	25	2	124	0.019
2	2.7	2.7	13,500	1,849	959	15	11	1	53	0.008
3	2.7	2.7	13,500	1,849	959	15	11	1	53	0.008
4	5	5	25,000	3,425	1,776	28	20	2	99	0.015
5	4.7	4.7	23,500	3,219	1,669	27	19	2	93	0.014
6	4	4	20,000	2,740	1,421	23	16	1	79	0.012
7	2.7	2.7	13,500	1,849	959	15	11	1	53	0.008
8	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
9	2	2	10,000	1,370	710	11	8	1	39	0.006
10	1.7	1.7	8,500	1,164	604	10	7	1	34	0.005
11	4.7	4.7	23,500	3,219	1,669	27	19	2	93	0.014
12	2.7	2.7	13,500	1,849	959	15	11	1	53	0.008
13	0.7	0.7	3,500	479	249	4	3	0	14	0.002
14	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
15	3	3	15,000	2,055	1,065	17	12	1	59	0.009
16	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
17	3	3	15,000	2,055	1,065	17	12	1	59	0.009
18	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
19	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
20	3	3	15,000	2,055	1,065	17	12	1	59	0.009
21	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
22	3	3	15,000	2,055	1,065	17	12	1	59	0.009
23	5.7	5.7	28,500	3,904	2,024	32	23	2	112	0.017
24	5	5	25,000	3,425	1,776	28	20	2	99	0.015
25	4	4	20,000	2,740	1,421	23	16	1	79	0.012
26	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
27	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
28	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
29	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
30	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
31	3	3	15,000	2,055	1,065	17	12	1	59	0.009
32	2.7	2.7	13,500	1,849	959	15	11	1	53	0.008

**EP 1.35**  
**3" Pipe**  
**TBD 06-004 Group 2**

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
33	2	2	10,000	1,370	710	11	8	1	39	0.006
34	2.7	2.7	13,500	1,849	959	15	11	1	53	0.008
35	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
36	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
37	2	2	10,000	1,370	710	11	8	1	39	0.006
38	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
39	3	3	15,000	2,055	1,065	17	12	1	59	0.009
40	2	2	10,000	1,370	710	11	8	1	39	0.006
41	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
42	4.3	4.3	33,077	4,531	2,350	38	27	2	130	0.020
43	3.6	3.6	27,692	3,793	1,967	31	22	2	109	0.016
44	4	4	30,769	4,215	2,186	35	25	2	121	0.018
45	3	3	23,077	3,161	1,639	26	19	2	91	0.014
46	3.6	3.6	27,692	3,793	1,967	31	22	2	109	0.016
47	4	4	30,769	4,215	2,186	35	25	2	121	0.018
48	3.6	3.6	27,692	3,793	1,967	31	22	2	109	0.016
49	4.3	4.3	33,077	4,531	2,350	38	27	2	130	0.020
50	8	8	61,538	8,430	4,371	70	49	4	243	0.037
51	4.6	4.6	35,385	4,847	2,513	40	28	2	140	0.021
52	3.6	3.6	27,692	3,793	1,967	31	22	2	109	0.016
53	3.3	3.3	16,500	2,260	1,172	19	13	1	65	0.010
54	6.3	6.3	31,500	4,315	2,238	36	25	2	124	0.019
55	4.6	4.6	23,000	3,151	1,634	26	18	2	91	0.014
56	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
57	4.6	4.6	23,000	3,151	1,634	26	18	2	91	0.014
58	4.6	4.6	23,000	3,151	1,634	26	18	2	91	0.014
59	5.3	5.3	26,500	3,630	1,882	30	21	2	104	0.016
60	4	4	20,000	2,740	1,421	23	16	1	79	0.012
61	2	2	10,000	1,370	710	11	8	1	39	0.006
62	4	4	20,000	2,740	1,421	23	16	1	79	0.012
63	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008

**EP 1.35**  
**3" Pipe**  
**TBD 06-004 Group 2**

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
64	1.6	1.6	8,000	1,096	568	9	6	1	32	0.005
65	2.3	2.3	11,500	1,575	817	13	9	1	45	0.007
66	4	4	20,000	2,740	1,421	23	16	1	79	0.012
67	1.6	1.6	8,000	1,096	568	9	6	1	32	0.005
68	2	2	10,000	1,370	710	11	8	1	39	0.006
69	5.6	5.6	28,000	3,836	1,989	32	22	2	110	0.017
70	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
71	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
72	4.3	4.3	21,500	2,945	1,527	24	17	1	85	0.013
73	2	2	10,000	1,370	710	11	8	1	39	0.006
74	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
75	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
76	3	3	15,000	2,055	1,065	17	12	1	59	0.009
77	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
78	2.6	2.6	13,000	1,781	923	15	10	1	51	0.008
									MEAN	0.011
									MEDIAN	0.010
									STD DEV	0.005
									MAX	0.037
									MIN	0.002

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

# Pipe Interior Radiological Survey Form

Date: 12-13-05 Time: 1415  
 Building: W. REACTOR BLDG Elevation: -25 Access Point Area: QUAD B  
 System: PURGE Pipe Diameter: 3" Pipe ID # 1.35 Purge  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3 inch  
 Detector: 44-62 Detector ID #: 204402-121  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.2 cpm

MDCR<sub>static</sub> 10.8 cpm

Efficiency Factor for Pipe Diameter 0.0002 (taken from detector calibration certificate)

MDC<sub>static</sub> 6726 dpm/100cm<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: INITIAL SURVEY

DROP COMPLETE

## Pipe Interior Radiological Survey

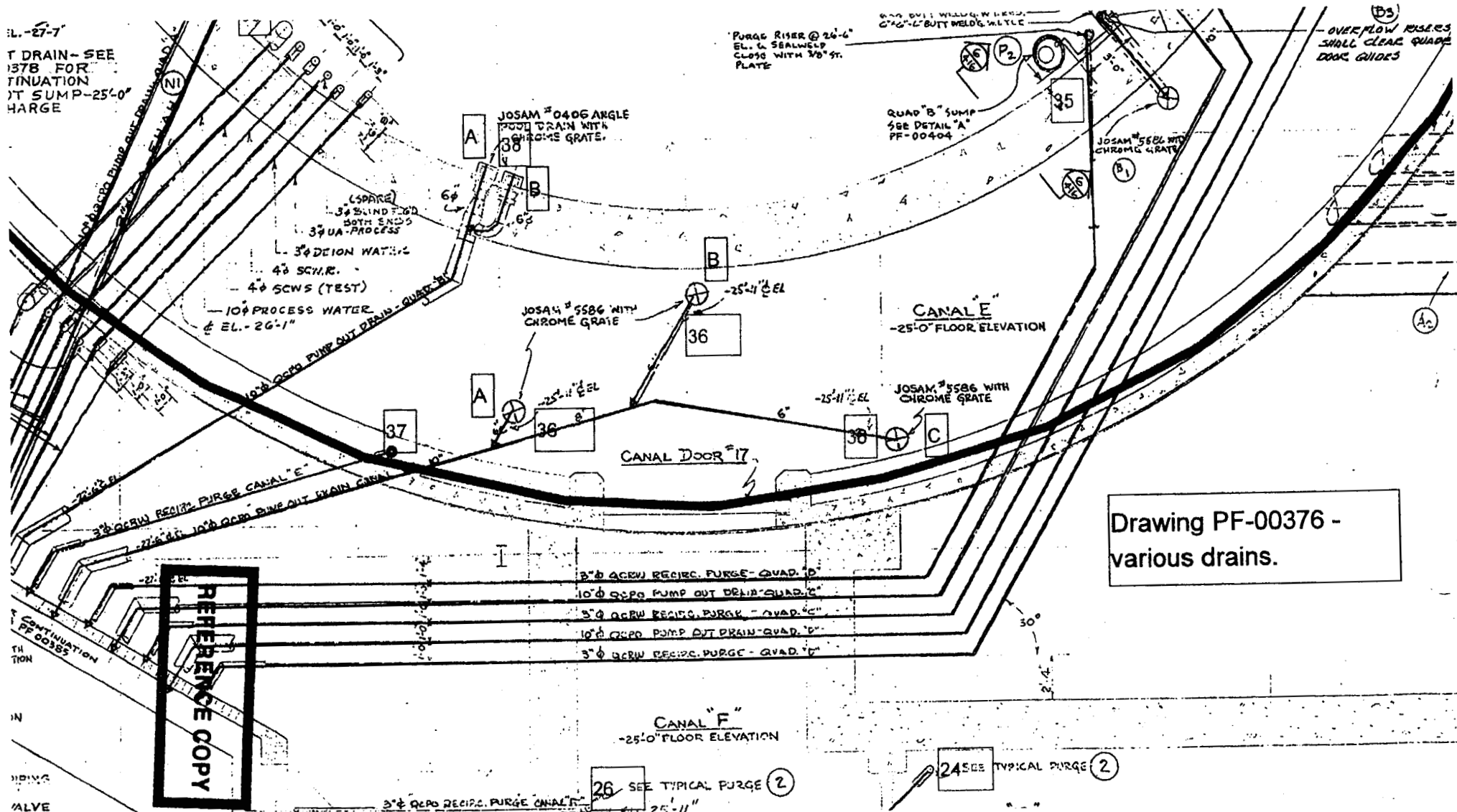
Radiological Survey Commenced: Date: 12-13-05 Time: 1415

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	<u>1</u>	<u>3</u>	<u>19</u>	<u>6.3</u>	<u>N/A</u>	<u>N/A</u>
2	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
3	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
4	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
5	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
6	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
7	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
8	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
9	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
10	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>

REFERENCE COPY

Package Page 1 of 2

EL. -27'-7"  
T DRAIN- SEE  
1378 FOR  
FINUATION  
IT SUMP-25'-0"  
HARGE



Drawing PF-00376 -  
various drains.

REFERENCE  
COPY

26 SEE TYPICAL PURGE ②

24 SEE TYPICAL PURGE ②

= PIPE SURVEYED

I-D 1.35

12-13-05

2082

# **Pipe Interior Radiological Survey Form**

Date: 12-15-05 Time: 1400  
 Building: 2X Elevation: -25' Access Point Area: TRUCK  
 System: QUAD B - PURGE Pipe Diameter: 3" Pipe ID #: 1.35  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3 inch  
 Detector: 44-62 Detector ID #: 204402-121  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350T Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.1 cpm  
 MDCR<sub>static</sub> 10.7 cpm  
 Efficiency Factor for Pipe Diameter 0.0002 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 6726 dpm/100cm<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: CONTINUATION SURVEY

## **Pipe Interior Radiological Survey**

Radiological Survey Commenced: Date: 12-15-05 Time: 1400

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	3	8	2.7	n/a	n/a
2	2	3	8	2.7		
3	3	3	15	5		
4	4	3	14	4.7		
5	5	3	12	4		
6	6	3	n/a	n/a		
7	n/a	n/a				
8						
9						
10						

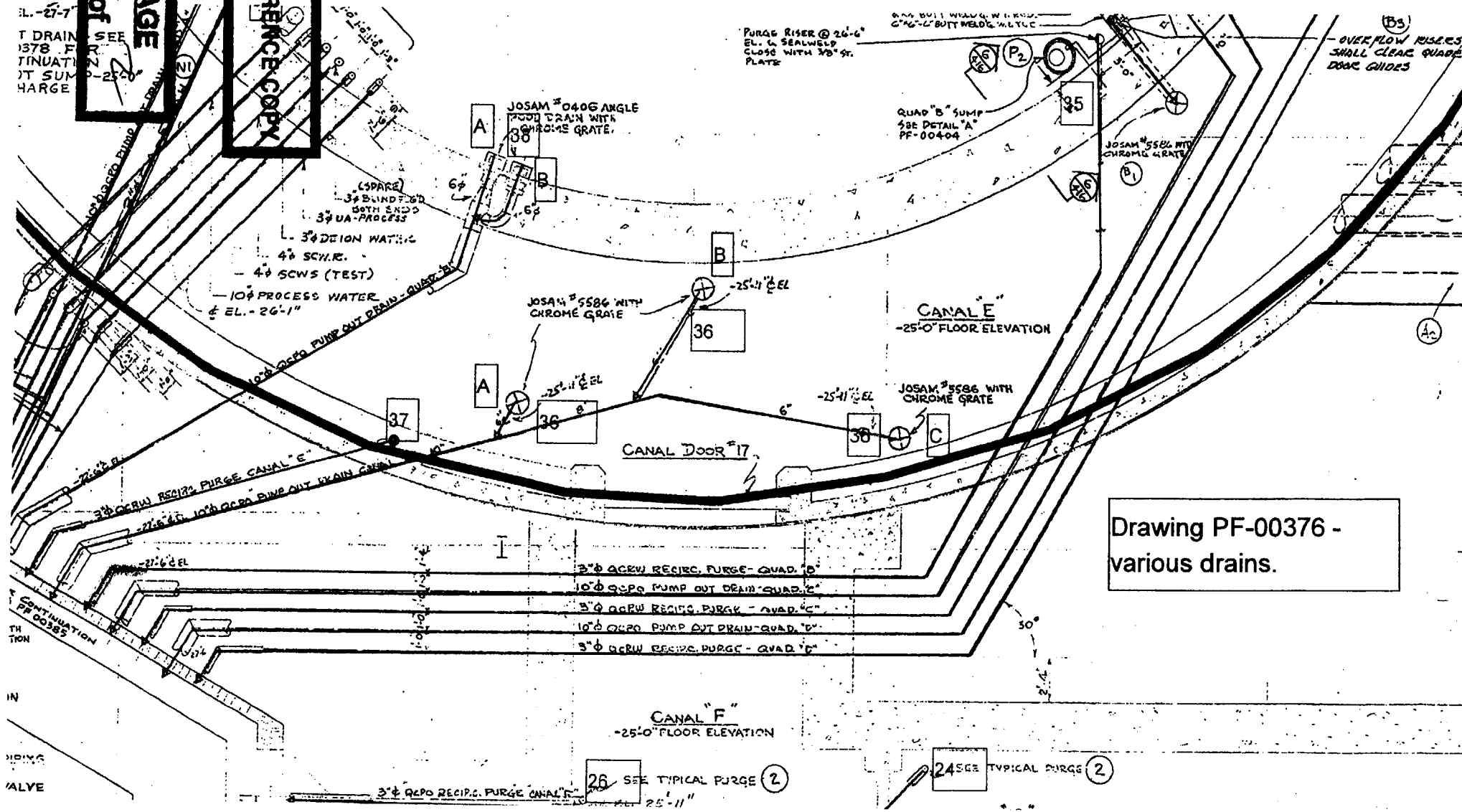
Package Page 1 of 2

**REFERENCE COPY**

11-27-7  
T DRAIN SEE  
1378 FOR  
FINUATION  
IT SUMP-25'-0"  
HARGE

PAGE  
2 of 2

REFERENCE COPY



Drawing PF-00376 - various drains.

= PIPE SURVEYED  
ID # 1.35  
12-15-05



# Pipe Interior Radiological Survey Form

Date: 12-19-05 Time: 0850  
 Building: REACTOR Elevation: -25 Access Point Area: -27 TRENCH  
 System: QUAD B PUMP Pipe Diameter: 3" Pipe ID #: 1-35  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3" inch  
 Detector: 44-62 Detector ID #: 204402-121  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 212223  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 5.1 cpm  
 MDCR<sub>static</sub> 10.7 cpm  
 Efficiency Factor for Pipe Diameter 0.0002 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 6726 dpm/100cm<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: CONTINUATION Survey from 12-15-05

## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 12-19-05 Time: 0850

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	6	3	8	2.7	n/a	n/a
2	7	3	10	3.3	↓	↓
3	8	3	6	2		
4	9	3	5	1.7		
5	10	3	14	4.7		
6	11	3	8	2.7		
7	12	3	2	0.7		
8	13	3	7	2.3		
9	14	3	9	3		
10	15	3	13	4.3		

Package Page 1 of 3

12-19-05

## Pipe Interior Radiological Survey Form (Continuation Form)

PIPE ID # 1.35 QUAD-B PURGE - TACONIC

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
11	16	3	9	3	n/a	n/a
12	17	3	10	3.3		
13	18	3	10	3.3		
14	19	3	9	3		
15	20	3	13	4.3		
16	21	3	9	3		
17	22	3	17	5.7		
18	23	3	15	5		
19	24	3	12	4		
20	25	3	13	4.3		
21	26	3	7	2.3		
22	27	3	10	3.3		
23	28	3	13	4.3		
24	29	3	10	3.3		
25	30	3	9	3		
26	31	3	8	2.7		
27	32	3	6	2		
28	33	3	8	2.7		
29	34	3	7	2.3		
30	35	3	7	2.3		
31	36	3	6	2		
32	37	3	7	2.3		
33	38	3	9	3		
34	39	3	6	2		
35	40	3	10	3.3		
n/a	n/a	n/a	n/a	n/a		

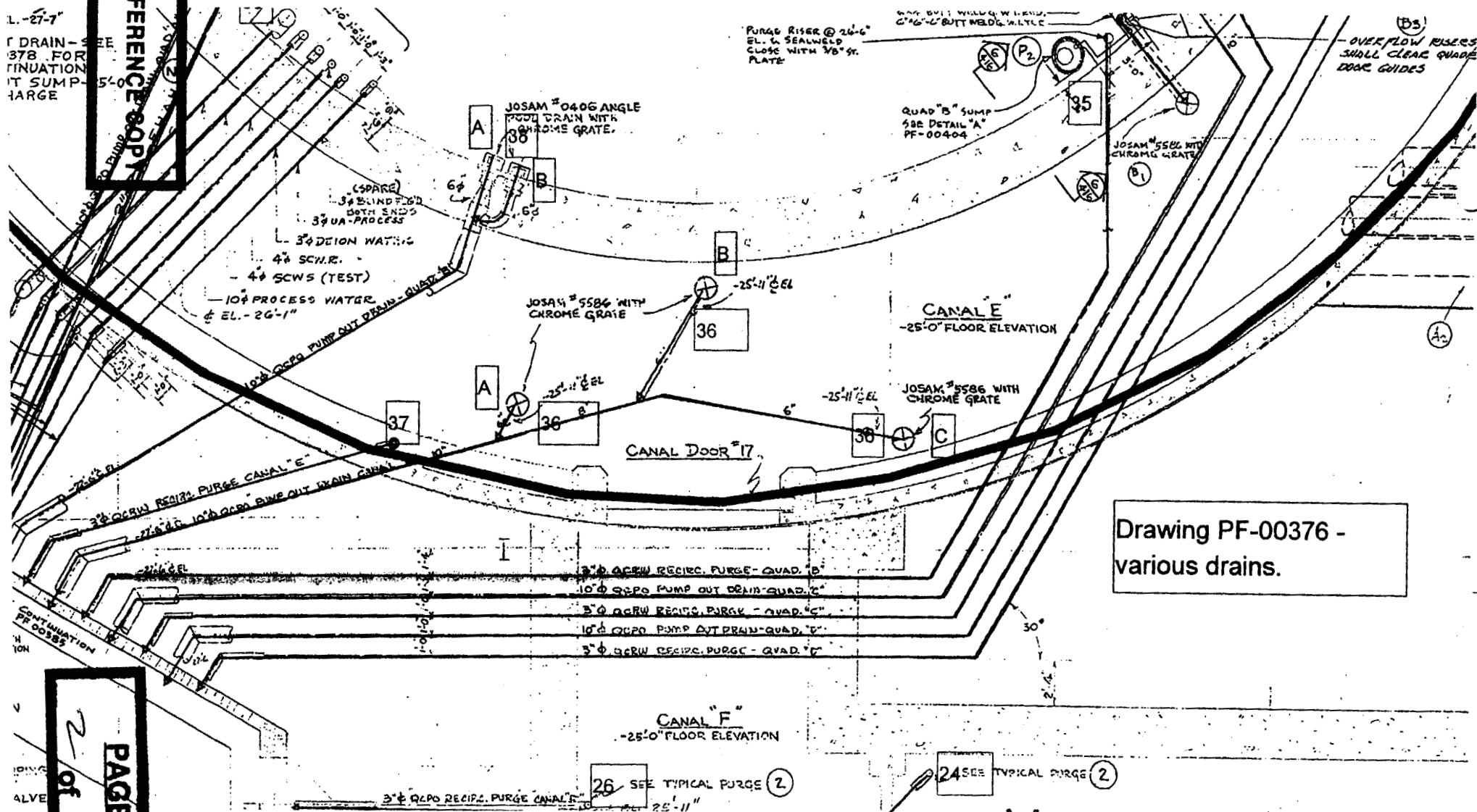
Package Page 2 of 3

REFERENCE COPY

L.-27-7"

1 DRAIN-SEE  
378 FOR  
FINUATION  
IT SUMP-  
HARGE

REFERENCE COPY



Drawing PF-00376 -  
various drains.

PAGE

2 of 3

= PIPE SURVEYED  
ID# 1.35  
12-12-05

# Pipe Interior Radiological Survey Form

Date: 1-4-06 Time: 1355  
 Building: PERATOR Elevation: -25 Access Point Area: 22 TRE-CH  
 System: QUB B Aug 2 Pipe Diameter: 3" Pipe ID #: 1.35  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3" vinyl Sled inch  
 Detector: 44-62 Detector ID #: 212701  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06  
 Instrument: 2351-1 Instrument ID #: 212723  
 Cal Date: 11-17-05 Cal Due Date: 11-17-06

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

Background Value 10.5 cpm  
 MDCR<sub>static</sub> 4.7 cpm  
 Efficiency Factor for Pipe Diameter 0.00013 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 2779 dpm/100cm<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: CONTINUATION SURVEY

SSP / NOT Complete

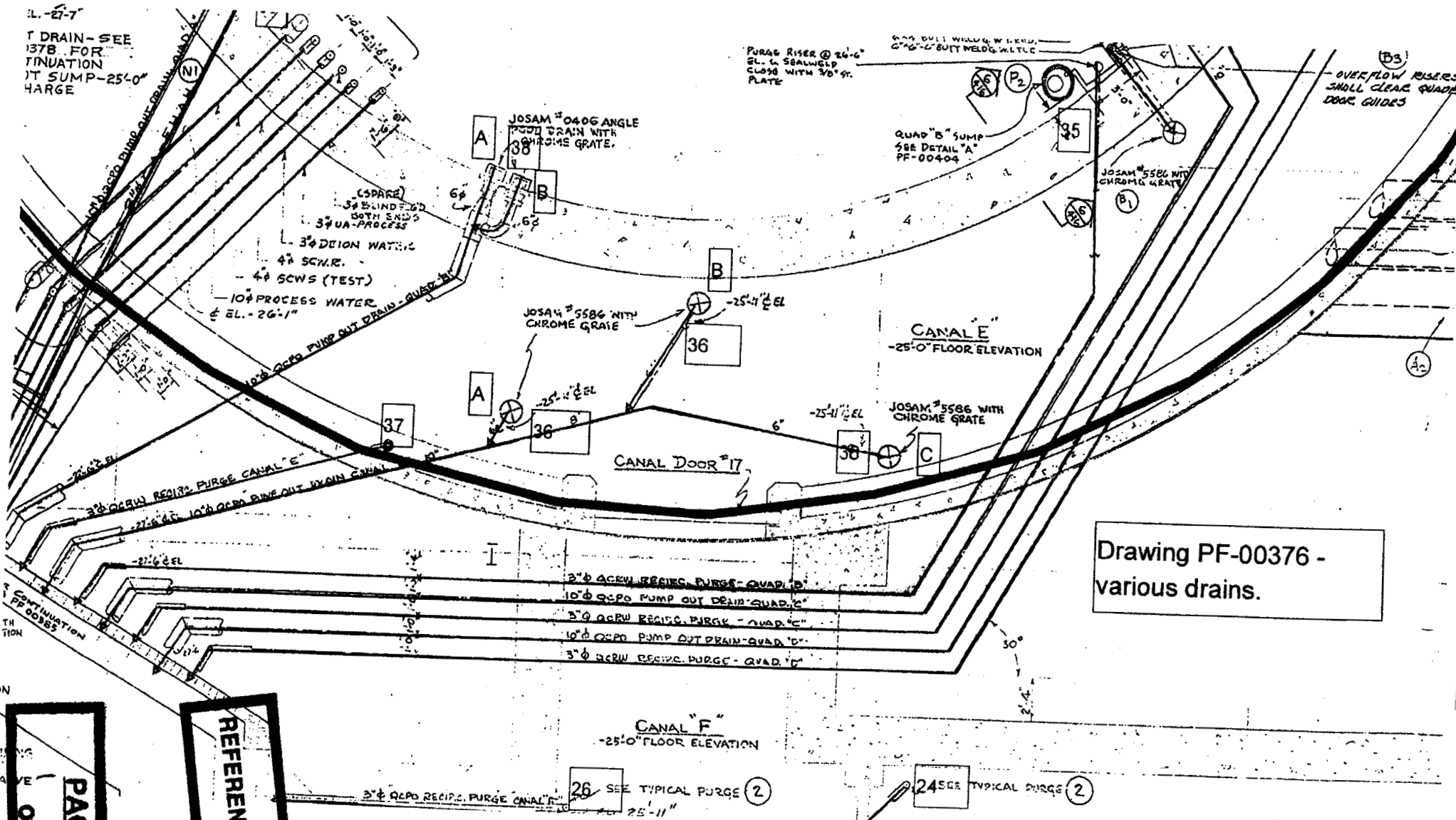
## Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-4-06 Time: 1355

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	41	3	13	4.3	n/a	n/a
2	42	3	11	3.6		
3	43	3	12	4		
4	44	3	9	3		
5	45	3	11	3.6		
6	46	3	12	4		
7	47	3	11	3.6		
8	48	3	13	4.3		
9	49	3	24	8		
10	50	3	14	4.6		

Package Page 1 of 1

IL-27-7  
T DRAIN-SEE  
1378 FOR  
TINUATION  
IT SUMP-25'-0"  
HARGE



Drawing PF-00376 -  
various drains.

PAGE  
of 1

REFERENCE COPY

= PIPE SANITIZED  
IND # 1.35  
1-4-86

# **Pipe Interior Radiological Survey Form**

Date: 1.5.06 Time: 0820  
 Building: Reactor Elevation: -25 Access Point Area: -27 Trench  
 System: Quads B Purge Pipe Diameter: 3" Pipe ID #: 1.35  
 Type of Survey Investigation Characterization Final Survey Other ✓  
 Sled Size 3" vinyl Puffer inch  
 Detector: 44-67 Detector ID #: 212701  
 Cal Date: 17-NOV-05 Cal Due Date: 17-NOV-06  
 Instrument: 2350-1 Instrument ID #: 212823  
 Cal Date: 17-NOV-05 Cal Due Date: 17-NOV-06

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

Background Value 5.5 cpm  
 MDCR<sub>static</sub> 11 cpm  
 Efficiency Factor for Pipe Diameter 0.00013 (taken from detector calibration certificate)  
 MDC<sub>static</sub> 2779 dpm/100cm<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: CONTINUATION SURVEY

SSP / DONE

## **Pipe Interior Radiological Survey**

Radiological Survey Commenced: Date: 1.5.06 Time: 082

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	51	3	11	3.6	N/A	N/A
2	52	3	10	3.3		
3	53	3	19	6.3		
4	54	3	14	4.6		
5	55	3	13	4.3		
6	56	3	14	4.6		
7	57	3	14	4.6		
8	58	3	16	5.3		
9	59	3	12	4		
10	60	3	6	2		

Package Page 1 of 2



**REFERENCE COPY**

Attachment 3, Page 1

1.35

Package Page 2 of 2

IL-21-7  
T DRAIN-SEE  
1378 FOR  
TINUATION  
IT SUMP-25'-0"  
HARGE

PURGE RISER @ 26'-6"  
EL. 6 SEALWELD  
CLOSE WITH 30" ST.  
PLATE

6'4" BUTT WELD'G. W.I. END  
C'46"-6" BUTT WELD'G. W.I. T.C.

(B3)  
- OVERFLOW RISER  
SHALL CLEAR QUAD  
DOOR GUIDES

QUAD "B" SUMP  
SEE DETAIL "A"  
PF-00404

JOSAM 5566 N  
CHROM 4 RAT

(SPARE)  
34 BLIND FOLD  
BOTH ENDS  
34 UA-PROCESS

- 3<sup>rd</sup> DEION WATER  
 - 4<sup>th</sup> SCH. R.  
 - 4<sup>th</sup> SCWS (TEST)  
 - 10<sup>th</sup> PROCESS WATER  
 - & EL. - 26'-1"

JOSAM #5586 NIT  
CHROME GRATE

CANAL E  
-25'-0" FLOOR ELEVATION

JOSAM. #5586 WITH  
CHROME GRATE

CANAL DOOR #17.

Drawing PF-00376 -  
various drains.

3"Ø ACRW RECIRC. PURGE- QUAD. "B"  
10"Ø GCRQ PUMP OUT DRAIN-QUAD. "C"  
3"Ø ACRW RECIRC. PURGE - QUAD. "C"  
10"Ø GCRQ PUMP OUT DRAIN-QUAD. "D"  
3"Ø ACRW RECIRC. PURGE- QUAD. "D"

CANAL "F"  
+25'-0" FLOOR ELEVATION

26 SEE TYPICAL PURGE (2)

24 SEC TYPICAL PURGE (2)

= PIPE SCRUBBED  
± D# 1.35  
5.06

REFERENCE.COM

**~~PAGE~~**



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

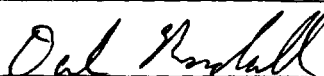
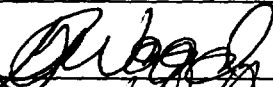
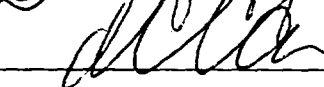
### DQA Check Sheet

Design #	EP 1.35	Revision #	Original			
Survey Unit #	EP 1.35					
<b>Preliminary Data Review</b>						
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>				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		
<b>Graphical Data Review</b>						
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
<b>Data Analysis</b>						
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 ( <i>S</i> + for Sign Test or <i>W</i> <sub>r</sub> for WRS Test) ≥ the critical value?						X
Comments:						
FSS/Characterization Engineer (print/sign)				<i>Dale R. Case</i>		Date 7-2-07
FSS/ Characterization Manager (print/sign)				<i>[Signature]</i>		Date 7/10/07

Form  
CS-09/2  
Rev 0

**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

# Survey Unit Release Record

<b>Design #</b>	EP-1.41 2.5" INST	<b>Revision #</b>	Original	<b>Page 1 of 3</b>
<b>Survey Unit #(s)</b>	1.41 2.5" INST			
<b>Description</b>	<p>1) Embedded Pipe (EP) Survey Unit 1.41 2.5" INST meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF).</p> <p>2) EP 1.41 2.5" INST is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004.</p> <p>3) Surveys in EP 1.41 2.5" INST were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP 2-2 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) The piping used in the construction of this system was a non-standard schedule that was nominally 2.5" in diameter. This caused difficulties with regard to the procurement of an identical pipe sample for detector geometry mock-up. As a result, the detector calibration efficiency was not acquired. To compensate for this, the instrument efficiency values applied to this Survey Unit were associated with 3" diameter piping. These values are conservative when applied to measurements made on the nominal 2.5" diameter piping.</p>			
<b>Approval Signatures</b>			<b>Date:</b>	
FSS/Characterization Engineer			8-26-07	
Technical Reviewer (FSS/Characterization Engineer)			9-4-07	
FSS/Characterization Manager	 R. Case		9/16/07	

COPY

Survey Unit: 1.41 2.5" INST

**1.0 History/Description**

- 1.1 The subject pipe system is the 2.5" line located in Quad "B" of the Reactor building -25' elevation.
- 1.2 EP 1.41 2.5" INST is approximately 3 feet in length.

**2.0 Survey Design Information**

- 2.1 EP 1.41 2.5" INST was surveyed IAW Procedure #BSI/LVS-002.
- 2.2 100% of the 2.5" ID pipe was accessible for survey. The accessible 2.5" ID pipe was surveyed by static measurement at one foot increments, for a total of 3 survey measurements.
- 2.3 Surface area for the 2.5" ID piping is 608 cm<sup>2</sup> for each foot of piping, corresponding to a total 2.5" ID piping surface area of 1,824 cm<sup>2</sup> (0.2 m<sup>2</sup>) for the entire length of (3') of 2.5" piping..

**3.0 Survey Unit Measurement Locations/Data**

- 3.1 Pipe interior radiological survey forms are provided in Attachment 2 of this release record.
- 3.2 Although the measurements were performed on 2.5" diameter piping, instrument efficiencies for 3" diameter piping were applied, which is a conservative evaluation of the results.

**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 All measurement results 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.
- 5.3 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 1.41 2.5" INST passes FSS.
- 5.4 Background was not subtracted from the survey measurements and the Elevated Measurement Comparison (EMC) was not employed for this survey unit.

## 5.5 Statistical Summary Table

Statistical Parameter	2.5" Pipe
Total Number of Survey Measurements	3
Number of Measurements >MDC	1
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0196
Median	0.0071
Standard Deviation	0.0216
Maximum	0.0446
Minimum	0.0071

## 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 EP 1.41 2.5" INST to be less than 1 mrem/yr. The dose contribution is estimated to be 0.02 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

Attachment 3 – DQA Worksheet

Attachment 4 – Disc containing RR for EP 1.41 2.5" INST & Spreadsheet

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



## BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.41-2.5 INST	Survey Location	-25 Quad B
Survey Date	02-Mar-06	2350-1 #	203488
Survey Time	8:05	Detector-Sled #	44-62 212701/121
Pipe Size	2.5"	Detector Efficiency	0.0002
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm2)	608
Pipe Area Incorporated by Survey Data (m <sup>2</sup> )	0.2	Field BKG (cpm)	4.7
Routine Survey	X	Field MDCR (cpm)	10.4
QA Survey		Nominal MDC (dpm/100cm2)	5,305
Survey Measurement Results			
Total Number of Survey Measurements			3
Number of Measurements >MDC			1
Number of Measurements Above 50% DCGL			0
Number of Measurements Above DCGL			0
Mean			0.0196
Median			0.0071
Standard Deviation			0.0216
Maximum			0.0446
Minimum			0.0071
Survey Technician(s)		DEBRAUX	
Survey Unit Classification			1
TBD 06-004 Piping Group			2
SR-13 Radionuclide Distribution Sample			EP 2-2
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>Doc Pembell</i> 8-26-07	



**EP 1.41 2.5" INST**  
**2.5" Pipe**  
**TBD 06-004 Group 2**

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)	Unlty
1	12.5	12.5	62,500	10,279	5,330	85	60	5	296	0.045
2	2	2	10,000	1,645	853	14	10	1	47	0.007
3	2	2	10,000	1,645	853	14	10	1	47	0.007
									MEAN	0.020
									MEDIAN	0.007
									STD DEV	0.022
									MAX	0.045
									MIN	0.007

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

Pipe Interior Radiological Survey Form

Date: 3-2-06 Time: 0905  
 Pipe ID#: 1.42 1.418 Pipe Diameter: 2.5" Access Point Area: QUAD B  
 Building: RX Elevation: -25 System: STAINLESS BOX-LCP  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-63 # 212701 / 121  
 Detector Cal Date: 11-17-05 Detector Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 203488  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 4.7 cpm  
 MDCR<sub>static</sub> 10.4 cpm  
 Efficiency Factor for Pipe Diameter 0.0002 (from detector efficiency determination)  
 MDC<sub>static</sub> 5305 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: INITIAL SURVEY

Technician Signature

C. DeBrock

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	2	25	12.5	n/a	n/a
2						
3						
4						
5						
6						
7						
8						
9						
10						

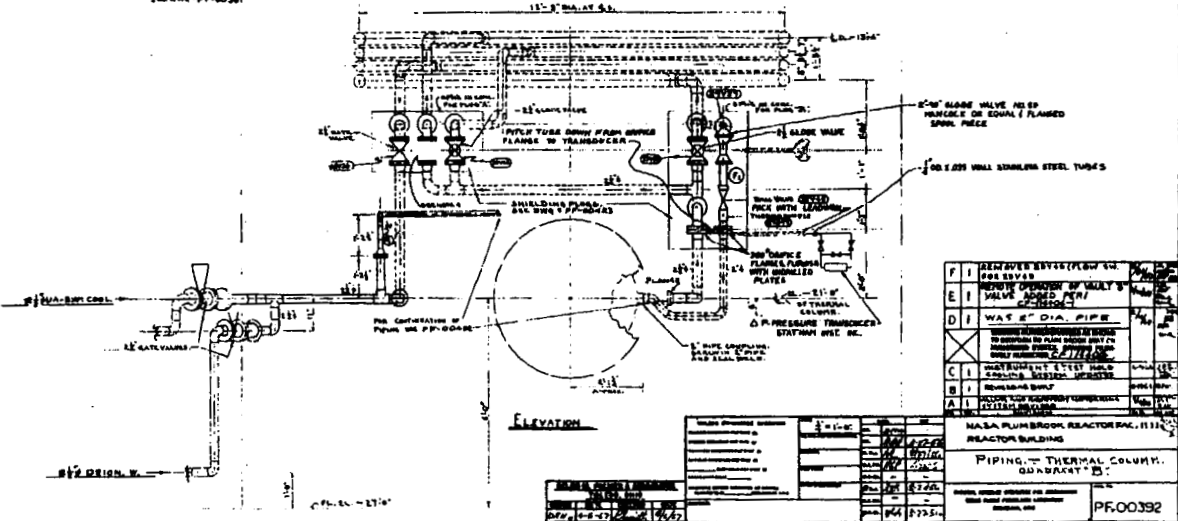
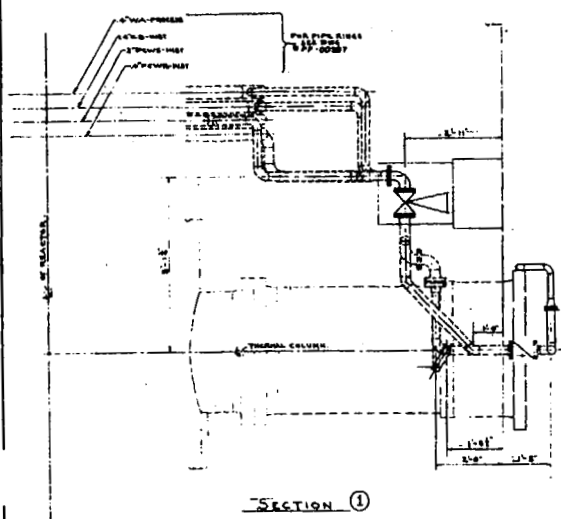
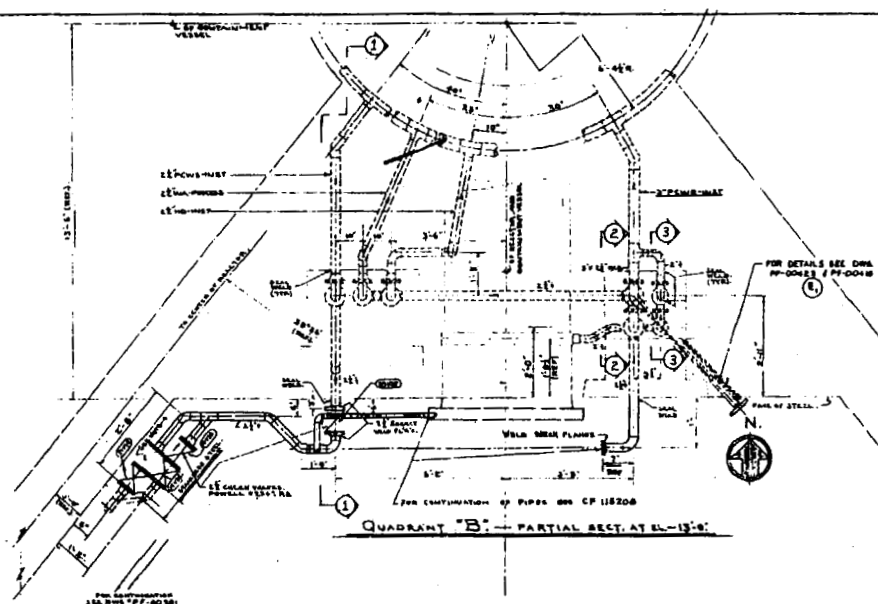
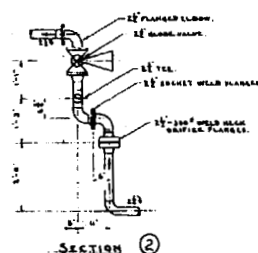
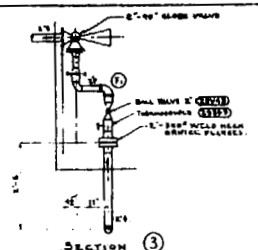
Package Page 1 of 2

REFERENCE COPY

# GENERAL NOTES

1. FOR MATERIALS OF WELD SEE "PP-00100"
2. SHALL WELD ALL PIPES WHERE THEY PENETRATE STEEL DECK.
3. ALL PIPING SHALL BE SCHEDULE 40 STAINLESS STEEL, ALL SPICES AND VALVE ASSEMBLY.
4. LINES DERIVED BY QUANT PLANNING, MECHANICAL SUPPLY SYSTEMS.

PAGE 2 of 2



F	REMOVES EXISTING PIPE	PP-00100
E	REMOVES EXISTING PIPE	PP-00100
D	REMOVES EXISTING PIPE	PP-00100
C	REMOVES EXISTING PIPE	PP-00100
B	REMOVES EXISTING PIPE	PP-00100
A	REMOVES EXISTING PIPE	PP-00100

NASA PLUMBROOK REACTOR FAC. 1111  
REACTOR BUILDING  
PIPING - THERMAL COLUMN,  
QUADRANT "B"

PP-00392

PIPE SCHEDULES  
1-42 1-41  
3-2-86

REFERENCE COPY

Pipe Interior Radiological Survey Form

Date: 3-2-06 pm 1:41 Time: 0807  
 Pipe ID#: 1-41-1-42 Pipe Diameter: 2.5" Access Point Area: QUAD B  
 Building: RX Elevation: -25 System: STAINLESS STEEL  
 Type of Survey Investigation \_\_\_\_\_ Characterization \_\_\_\_\_ Final Survey X Other ✓  
 Gross \_\_\_\_\_ Co60 ✓ Cs \_\_\_\_\_  
 Detector ID# / Sled ID# 44-62 # 212701 / 121  
 Detector Cal Date: 11-17-05 Detector Cal Due Date: 11-17-06  
 Instrument: 2350-1 Instrument ID #: 203438  
 Instrument Cal Date: 11-17-05 Instrument Cal Due Date: 11-17-06

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

Background Value 4.7 cpm  
 MDC<sub>static</sub> 10.4 cpm  
 Efficiency Factor for Pipe Diameter 0.0002 (from detector efficiency determination)  
 MDC<sub>static</sub> 5325 dpm/ 100 cm<sup>2</sup>  
 Is the MDC<sub>static</sub> acceptable? Yes No (if no, adjust sample count time and recalculate MDC<sub>static</sub>)  
 Comments: INITIAL SURVEY

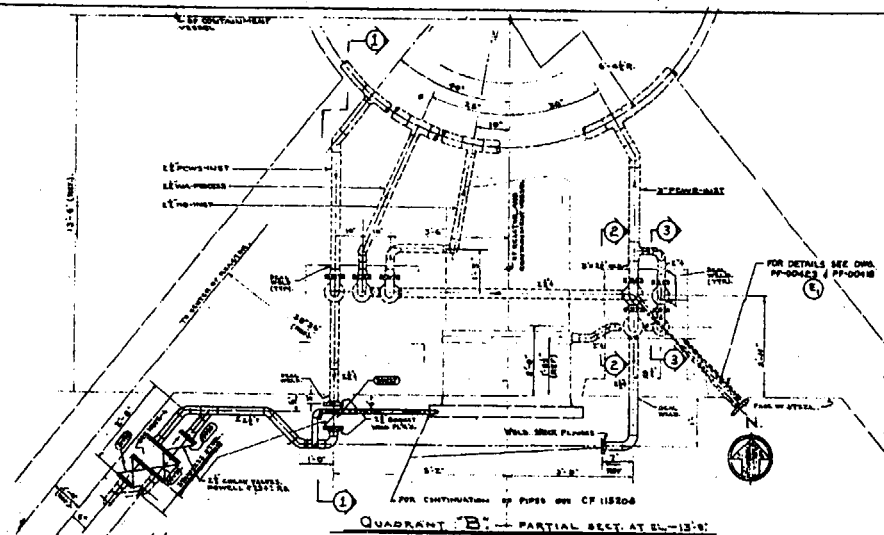
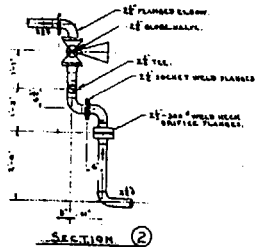
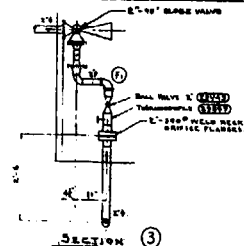
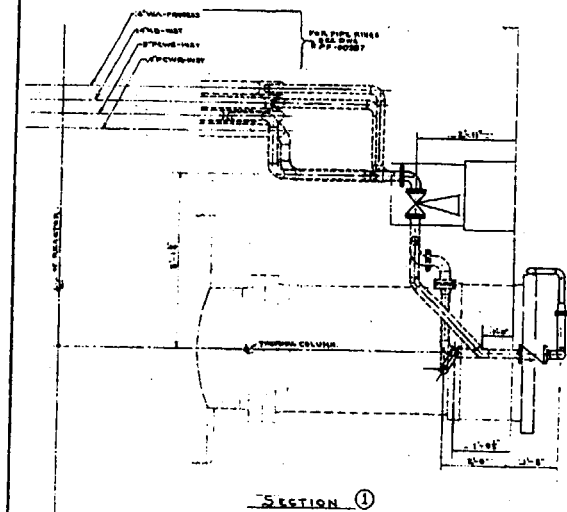
Technician Signature C. DORRANCE

Pipe Interior Radiological Survey

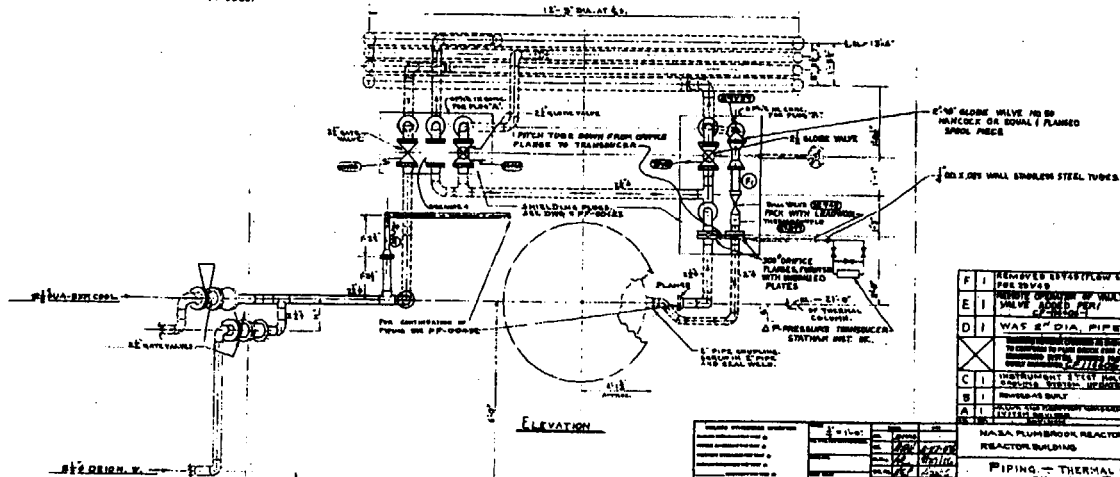
Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm <sup>2</sup>
1	1	2	4	2	n/a	n/a
2	2	2	4	2	n/a	n/a
3						
4						
5						
6						
7						
8						
9						
10						

REFERENCE COPY

Package Page 1 of 102



- GENERAL NOTES.**
1. FOR SCHEDULE OF PIPES SEE "PF-00100"
  2. ALL WELDS SHALL BE STAINLESS STEEL. SEE SPEC AND VALVE SCHEDULE.
  3. ALL PIPING SHALL BE STAINLESS STEEL. SEE SPEC AND VALVE SCHEDULE.
  4. LINES SHALL BE 1/2 INCH DIA. UNLESS OTHERWISE SPECIFIED.



F	REMOVED EXISTING PIPE	
E	REMOVED EXISTING PIPE	
D	WAS 1/2 INCH DIA. PIPE	
C	REMOVED EXISTING PIPE	
B	REMOVED EXISTING PIPE	
A	REMOVED EXISTING PIPE	

DATE	10/1/54
BY	J. H. HARRIS
CHECKED	J. H. HARRIS
APPROVED	J. H. HARRIS
REVISION	

= PIPE SURVEYED

IND # 1.41

3-2-66

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

### DQA Check Sheet

Design #	EP 1.41 2.5" INST	Revision #	Original					
Survey Unit #	EP 1.41 2.5" INST							
<b>Preliminary Data Review</b>								
<b>Answers to the following questions should be fully documented in the Survey Unit Release Record</b>						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		
<b>Graphical Data Review</b>								
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
<b>Data Analysis</b>								
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 (S+ for Sign Test or W, for WRS Test) ≥ the critical value?								X
Comments:								
FSS/Characterization Engineer (print/sign)						<i>Dale R. Case</i> <i>R. Case</i>		Date 8-26-07 Date 9/11/07
FSS/ Characterization Manager (print/sign)								

Form  
CS-09/2  
Rev 0



**SECTION 7**  
**ATTACHMENT 4**  
**1 DISC**

Align top of FedEx Express Ship

FedEx | Ship Manager | Label

Page 1 of 1

From: Origin ID: 8446 (410621-3271)  
Julia Frenkenberg  
Plan Brook OPS Support Group  
8100 Columbus Ave  
NAGA TRAILER #1  
Sandusky, OH 44870



Ship Date: 11SEP07  
Actual: 3 LB  
System: 422000009677001  
Account: 5

Delivery Address Bar Code



Ref #  
Invoice #  
PO #  
Dest #

SHIP TO: (000025-0000) BILL SENDER  
Mr. William Snell  
U.S. NRC Region III  
2443 Warrenville Road, Suite 210  
N/A  
Lisle, IL 60532



TRACKING 7908 2539 3671

WED - 12SEP A2  
PRIORITY OVERNIGHT

NY-BDFA

ORD  
IL-US  
60532



Press Here. Press Here. Press Here. Press Here. Press Here.

Medium B

For FedEx Express®

Align bottom of Peel and Stick Area