Survey Unit Release Record				
Design #	EP-1.51C-4	**Revision #**	Original	**Page 1 of 3**
Survey Unit #(s)	1.51C-4			
Description	1) Embedded Pipe (EP) Survey Unit 1.51C-4 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF). 2) EP 1.51C-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. 3) Surveys in EP 1.51C-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. 4) Survey Instructions for this survey unit are incorporated into and performed in accordance with (IAW) the Babcock Services Incorporated (BSI)/LVS-002, Work Execution Package (WEP) 05-006. Survey instructions described in this document constitute "Special Methods" and the survey design used in the acquisition of survey measurements. 5) Instrument efficiency determinations are developed in accordance with the BSI/LVS-002, WEP 05-006, these determinations are appropriate for the types of radiation involved and the media being surveyed.			

Approval Signatures		**Date:**
FSS/Characterization Engineer	Dal Rudall	11-29-07
Technical Reviewer (FSS/Characterization Engineer)	Wood	12-5-07
FSS/Characterization Manager	R. Case	12/10/07

1.0 History/Description

1.1 The subject pipe system is a 4" drain line located on the drain system for the annulus on the -25' elevation of the Reactor Building.

1.2 EP 1.51C-4 is approximately 37 feet in length.

2.0 Survey Design Information

2.1 EP 1.51C-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 37 survey measurements.

2.3 Surface area for the 4" ID piping is 973 cm^2 for each foot of piping, corresponding to a total 4" ID piping surface area of 35,996 cm^2 (3.5 m^2) for the entire accessible length of (37') 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 1.51C-4 passes FSS.

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

Statistical Summary Table

Statistical Parameter	4" Pipe
Total Number of Survey Measurements	37
Number of Measurements >MDC	31
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0196
Median	0.0141
Standard Deviation	0.0150
Maximum	0.0637
Minimum	0.0047

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

6.1 A review of the survey results has shown that the dose contribution for the accessible portion of EP 1.51C-4 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.020 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 1.51C-4 & Spreadsheet

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BSI EP/BP SURVEY REPORT

Pipe ID	**EP 1.51C-4**	**Survey Location**	Annulus Floor Drain - 25' el.
Survey Date	15-Feb-06	**2350-1 #**	203488
Survey Time	13:20	**Detector-Sled #**	Bicron 1MG1 LVS-1/101
Pipe Size (in.)	4	**Detector Efficiency**	0.00052
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm2)	973
Pipe Area Incorporated by Survey Data (m^2)	3.6	**Field BKG** (cpm)	24.4
Routine Survey	X	**Field MDCR** (cpm)	20.0
QA Survey		**Nominal MDC** (dpm/100cm2)	1,577

Survey Measurement Results	
Total Number of Survey Measurements	37
Number of Measurements >MDC	31
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0196
Median	0.0141
Standard Deviation	0.0150
Maximum	0.0637
Minimum	0.0047

Survey Technician(s)	DEBRAUX

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 Rundall 11-29-07

EP 1.51C-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	23	23	44,231	4,546	180	4,313	1,146	133	32	0.027
2	14	14	26,923	2,767	110	2,625	698	81	19	0.017
3	28	28	53,846	5,535	219	5,250	1,396	162	39	0.033
4	12	12	23,077	2,372	94	2,250	598	69	17	0.014
5	14	14	26,923	2,767	110	2,625	698	81	19	0.017
6	11	11	21,154	2,174	86	2,063	548	63	15	0.013
7	4	4	7,692	791	31	750	199	23	6	0.005
8	12	12	23,077	2,372	94	2,250	598	69	17	0.014
9	16	16	30,769	3,163	125	3,000	798	92	22	0.019
10	9	9	17,308	1,779	71	1,688	449	52	12	0.011
11	9	9	17,308	1,779	71	1,688	449	52	12	0.011
12	15	15	28,846	2,965	118	2,813	748	87	21	0.018
13	11	11	21,154	2,174	86	2,063	548	63	15	0.013
14	17	17	32,692	3,360	133	3,188	847	98	23	0.020
15	10	10	19,231	1,977	78	1,875	498	58	14	0.012
16	10	10	19,231	1,977	78	1,875	498	58	14	0.012
17	7	7	13,462	1,384	55	1,313	349	40	10	0.008
18	10	10	19,231	1,977	78	1,875	498	58	14	0.012
19	11	11	21,154	2,174	86	2,063	548	63	15	0.013
20	12	12	23,077	2,372	94	2,250	598	69	17	0.014
21	7	7	13,462	1,384	55	1,313	349	40	10	0.008
22	13	13	25,000	2,570	102	2,438	648	75	18	0.015
23	15	15	28,846	2,965	118	2,813	748	87	21	0.018
24	17	17	32,692	3,360	133	3,188	847	98	23	0.020
25	11	11	21,154	2,174	86	2,063	548	63	15	0.013
26	7	7	13,462	1,384	55	1,313	349	40	10	0.008
27	7	7	13,462	1,384	55	1,313	349	40	10	0.008
28	13	13	25,000	2,570	102	2,438	648	75	18	0.015
29	12	12	23,077	2,372	94	2,250	598	69	17	0.014
30	16	16	30,769	3,163	125	3,000	798	92	22	0.019
31	7	7	13,462	1,384	55	1,313	349	40	10	0.008

EP 1.51C-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
32	16	16	30,769	3,163	125	3,000	798	92	22	0.019
33	18	18	34,615	3,558	141	3,375	897	104	25	0.021
34	46	46	88,462	9,093	360	8,625	2,293	265	63	0.054
35	50	50	96,154	9,883	392	9,375	2,492	288	69	0.059
36	54	54	103,846	10,674	423	10,126	2,692	311	74	0.064
37	50	50	96,154	9,883	392	9,375	2,492	288	69	0.059
									MEAN	0.020
									MEDIAN	0.014
									STD DEV	0.015
									MAX	0.064
									MIN	0.005

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Pipe Interior Radiological Survey Form

Date: 2-15-06 Time: 1320 1.51C
Pipe ID#: 1.51 Pipe Diameter: 4" Access Point Area: ANNULUS
Building: RX Elevation: -2.5 System: FLOOR DRAIN

Type of Survey Investigation ____ Characterization ____ Final Survey X Other ____
Gross ____ Co60 ✓ Cs ____
Detector ID# / Sled ID# BICRON IMG-1 / LVS-1 101
Detector Cal Date: 12-20-05 Detector Cal Due Date: 12-20-06
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 24.4 cpm JW
$MDCR_{static}$ 20 cpm JW
Efficiency Factor for Pipe Diameter 0.00052 (from detector efficiency determination)
MDC_{static} 1577 dpm/ 100 cm^2
Is the MDC_{static} acceptable? (Yes) No (if no, adjust sample count time and recalculate $MDCR_{static}$)
Comments: INITIAL SURVEY

Technician Signature C. DEBRAUX/[redacted]

Pipe Interior Radiological Survey

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm²
1	1	1	23	N/a	N/a	N/a
2	2	1	14	↓	↓	↓
3	3	1	28			
4	4	1	12			
5	5	1	14			
6	6	1	11			
7	7	1	4			
8	8	1	12			
9	9	1	16			
10	10	1	9			

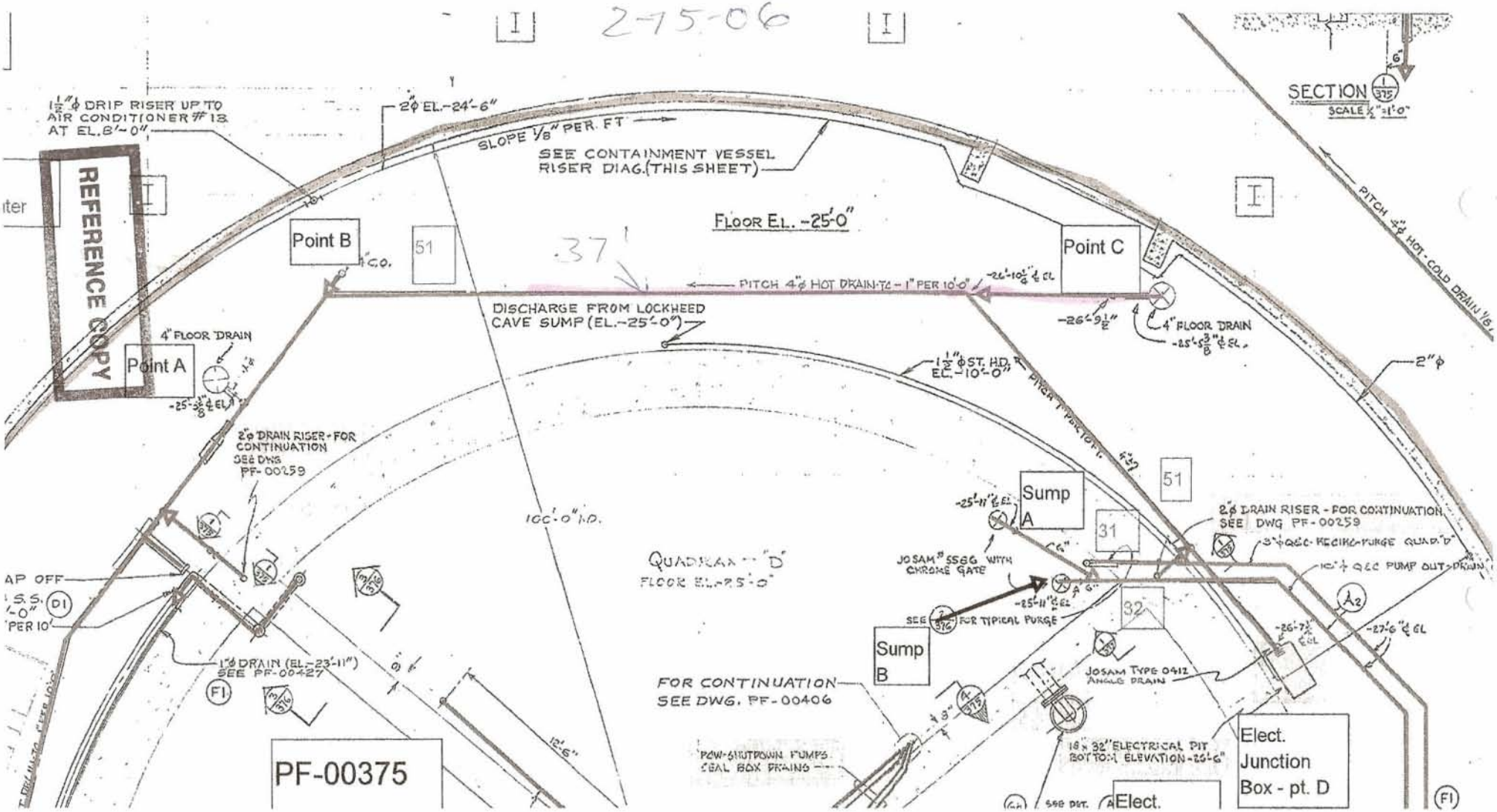
Pipe Interior Radiological Survey Form (Continuation Form)

Date: 2-15-06
Pipe ID#: 1.51 Pipe Diameter: 4" Access Point Area: 1.51C ANNULUS
Building: RX Elevation: -25 System:

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm^2
11	11	1	9	n/a	n/a	n/a
12	12	1	15			
13	13	1	11			
14	14	1	17			
15	15	1	10			
16	16	1	10			
17	17	1	7			
18	18	1	10			
19	19	1	11			
20	20	1	12			
21	21	1	7			
22	22	1	13			
23	23	1	15			
24	24	1	17			
25	25	1	11			
26	26	1	7			
27	27	1	7			
28	28	1	13			
29	29	1	12			
30	30	1	12			
31	31	1	7			
32	32	1	16			
33	33	1	18			
34	34	1	46			
35	35	1	58			
36	36	1	54			
37	37	1	50			

1.51 4"

2-15-06


REFERENCE COPY
1½"ϕ DRIP RISER UP TO AIR CONDITIONER #13 AT EL. 8'-0"
2"ϕ EL.-24'-6"
SLOPE ⅛" PER FT
SEE CONTAINMENT VESSEL RISER DIAG. (THIS SHEET)
FLOOR EL. -25'-0"
Point B
Point C
Point A
PITCH 4"ϕ HOT DRAIN TO - 1" PER 10'-0"
DISCHARGE FROM LOCKHEED CAVE SUMP (EL.-25'-0")
4" FLOOR DRAIN
2"ϕ DRAIN RISER - FOR CONTINUATION SEE DWG PF-00259
1½"ϕ ST. HD. EL. -10'-0"
SECTION
SCALE ½" = 1'-0"
PITCH 4"ϕ HOT - COLD DRAIN ½"
Sump A
Sump B
JOSAM "55EG" WITH CHROME GATE
FOR TYPICAL PURGE
JOSAM TYPE 0412 ANGLE DRAIN
FOR CONTINUATION SEE DWG. PF-00406
1"ϕ DRAIN (EL.-23'-11") SEE PF-00427
18" x 32" ELECTRICAL PIT BOTTOM ELEVATION -29'-6"
Elect. Junction Box - pt. D
PF-00375

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DQA Check Sheet				
Design #	EP 1.51C-4	Revision #	Original	
Survey Unit #	EP 1.51C-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 $DCGL_W$ for Class 1 and 2 survey units, or below 0.5 $DCGL_W$ for Class 3 survey units?			X
3. Is the instrumentation MDC for embedded/buried piping static measurements below the $DCGL_W$?	X		
4. Was the instrumentation MDC for structure scan measurements, soil scan measurements, and embedded/buried piping scan measurements below the $DCGL_W$, or, if not, was the need for additional static measurements or soil samples addressed in the survey design?			X
5. Was the instrumentation MDC for volumetric measurements and smear analysis < 10% $DCGL_W$?			X
6. Were the MDCs and assumptions used to develop them appropriate for the instruments and techniques used to perform the survey?	X		
7. Were the survey methods used to collect data proper for the types of radiation involved and for the media being surveyed?	X		
8. Were "Special Methods" for data collection properly applied for the survey unit under review?	X		
9. Is the data set comprised of qualified measurement results collected in accordance with the survey design, which accurately reflects the radiological status of the facility?	x		
Graphical Data Review			
1. Has a posting plot been created?			X
2. Has a histogram (or other frequency plot) been created?			X
3. Have other graphical data tools been created to assist in analyzing the data?			X
Data Analysis			
1. Are all sample measurements below the $DCGL_W$ (Class 1 & 2), or 0.5 $DCGL_W$ (Class 3)?	X		
2. Is the mean of the sample data < $DCGL_W$?	X		
3. If elevated areas have been identified by scans and/or sampling, is the average activity in each elevated area < $DCGL_{EMC}$ (Class 1), < $DCGL_W$ (Class 2), or <0.5 $DCGL_W$ (Class 3)?			X
4. Is the result of the Elevated Measurements Test < 1.0?			X
5. Is the result of the statistical test ($S+$ for Sign Test or W_r for WRS Test) ≥ the critical value?			X

Comments:

FSS/Characterization Engineer (print/sign)	Dale Randall / Dale Randall	Date	11-29-07
FSS/ Characterization Manager (print/sign)	R. Case	Date	12/10/07

Form CS-09/2 Rev 0

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1 DISC