Survey Unit Release Record				
Design #	EP-1.64	**Revision #**	Original	**Page 1 of 3**
Survey Unit #(s)	1.64			
Description	1) Embedded Pipe (EP) Survey Unit 1.64 meets the definition of embedded pipe for Plum Brook Reactor Facility (PBRF). 2) EP 1.64 is a Class 1, Group 2 survey unit as per the PBRF Final Status Survey Plan (FSSP) and Technical Basis Document (TBD)-06-004. 3) Surveys in EP 1.64 were performed using a scintillation detector optimized to measure gamma energies representative of Co-60. Sample #EP2-2 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	[signature]	10-26-07
Technical Reviewer (FSS/Characterization Engineer)	[signature]	11-5-07
FSS/Characterization Manager	R. Case [signature]	11/6/07

Form
CS-09/1
Rev 0

1.0 History/Description

1.1 The subject pipe system is the 4" header and risers for canal "K".

1.2 EP 1.64 consists of 4" diameter piping that is approximately 60 feet in length.

2.0 Survey Design Information

2.1 EP 1.64 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 60 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 58,373 cm^2 (5.8 m^2) for the entire length of (approximately 60') 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 1.64 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	60
Number of Measurements >MDC	0
Number of Measurements Above 50% of DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0603
Median	0.0390
Standard Deviation	0.0548
Maximum	0.2750
Minimum	0.0103

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 1.64 to be less than 1 mrem/yr. The dose contribution is estimated to be 0.060 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 1.64 & Spreadsheet

SECTION 7
ATTACHMENT 1
__4__ PAGE(S)

Babcock

BSI EP/BP SURVEY REPORT

Pipe ID	EP 1.64	**Survey Location**	Canal K -25' el.
Survey Date	1/10/2006, 1/11/2006	**2350-1 #**	134738
Survey Time	11:05,09:07	**Detector-Sled #**	1MG1 LVS-1 / 101
Pipe Size	4"	**Detector Efficiency**	0.00047
DCGL (dpm/100cm2)	2.41E+05	Pipe Area Incorporated by Detector Efficiency (in cm2)	973
Pipe Area Incorporated by Survey Data (m^2)	5.8	**Field BKG** (cpm)	22.3
Routine Survey	X	**Field MDCR** (cpm)	19.3
QA Survey		**Nominal MDC** (dpm/100cm2)	3,377

Survey Measurement Results	
Total Number of Survey Measurements	60
Number of Measurements >MDC	0
Number of Measurements Above 50% DCGL	0
Number of Measurements Above DCGL	0
Mean	0.0603
Median	0.0390
Standard Deviation	0.0548
Maximum	0.2750
Minimum	0.0103

Survey Technician(s)	ROSENHAGEN

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:
1. ACTIVITY VALUES NOT BACKGROUND CORRECTED

RP Engineer | Date	[signature] /10-26-07

EP 1.64
4" 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	31	31	59,615	6,128	3,177	51	36	3	176	0.027
2	12	12	23,077	2,372	1,230	20	14	1	68	0.010
3	26	26	50,000	5,139	2,665	43	30	3	148	0.022
4	16	16	30,769	3,163	1,640	26	19	2	91	0.014
5	22	22	42,308	4,349	2,255	36	25	2	125	0.019
6	27	27	51,923	5,337	2,767	44	31	3	154	0.023
7	26	26	50,000	5,139	2,665	43	30	3	148	0.022
8	16	16	30,769	3,163	1,640	26	19	2	91	0.014
9	19	19	36,538	3,756	1,947	31	22	2	108	0.016
10	20	20	38,462	3,953	2,050	33	23	2	114	0.017
11	26	26	50,000	5,139	2,665	43	30	3	148	0.022
12	62	62	119,231	12,255	6,355	102	72	6	353	0.053
13	28	28	53,846	5,535	2,870	46	32	3	159	0.024
14	27	27	51,923	5,337	2,767	44	31	3	154	0.023
15	35	35	67,308	6,918	3,587	57	40	3	199	0.030
16	39	39	75,000	7,709	3,997	64	45	4	222	0.033
17	75	75	144,231	14,825	7,687	123	87	7	427	0.064
18	38	38	73,077	7,511	3,895	62	44	4	216	0.033
19	34	34	65,385	6,721	3,485	56	39	3	193	0.029
20	34	34	65,385	6,721	3,485	56	39	3	193	0.029
21	40	40	76,923	7,907	4,100	66	46	4	228	0.034
22	48	48	92,308	9,488	4,920	79	56	5	273	0.041
23	43	43	82,692	8,500	4,407	70	50	4	245	0.037
24	37	37	71,154	7,314	3,792	61	43	4	210	0.032
25	22	22	42,308	4,349	2,255	36	25	2	125	0.019
26	66	66	126,923	13,046	6,765	108	76	6	375	0.057
27	71	71	136,538	14,034	7,277	116	82	7	404	0.061
28	82	82	157,692	16,209	8,405	134	95	8	466	0.070
29	38	38	73,077	7,511	3,895	62	44	4	216	0.033
30	57	57	109,615	11,267	5,842	93	66	5	324	0.049
31	31	31	59,615	6,128	3,177	51	36	3	176	0.027

EP 1.64
4" 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
32	61	61	117,308	12,058	6,252	100	71	6	347	0.052
33	91	91	175,000	17,988	9,327	149	105	9	518	0.078
34	67	67	128,846	13,244	6,867	110	78	6	381	0.057
35	88	88	169,231	17,395	9,020	144	102	8	501	0.075
36	81	81	155,769	16,011	8,302	133	94	8	461	0.069
37	72	72	138,462	14,232	7,380	118	83	7	410	0.062
38	96	96	184,615	18,976	9,840	157	111	9	546	0.082
39	106	106	203,846	20,953	10,865	174	123	10	603	0.091
40	123	123	236,538	24,313	12,607	202	142	12	700	0.105
41	109	109	209,615	21,546	11,172	179	126	11	620	0.093
42	139	139	267,308	27,476	14,247	228	161	13	791	0.119
43	103	103	198,077	20,360	10,557	169	119	10	586	0.088
44	215	215	413,462	42,499	22,037	352	249	21	1,223	0.184
45	176	176	338,462	34,790	18,040	289	204	17	1,001	0.151
46	192	192	369,231	37,952	19,680	315	222	19	1,092	0.165
47	208	208	400,000	41,115	21,320	341	241	20	1,183	0.178
48	274	274	526,923	54,161	28,085	449	317	26	1,559	0.235
49	321	321	617,308	63,452	32,902	526	371	31	1,826	0.275
50	104	104	200,000	20,558	10,660	170	120	10	592	0.089
51	55	55	105,769	10,872	5,637	90	64	5	313	0.047
52	98	98	188,462	19,372	10,045	161	113	9	558	0.084
53	23	23	44,231	4,546	2,357	38	27	2	131	0.020
54	76	76	146,154	15,023	7,790	125	88	7	432	0.065
55	26	26	50,000	5,139	2,665	43	30	3	148	0.022
56	29	29	55,769	5,732	2,972	48	34	3	165	0.025
57	61	61	117,308	12,058	6,252	100	71	6	347	0.052
58	42	42	80,769	8,302	4,305	69	49	4	239	0.036
59	17	17	32,692	3,360	1,742	28	20	2	97	0.015
60	22	22	42,308	4,349	2,255	36	25	2	125	0.019

EP 1.64
4" 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
									MEAN	0.060
									MEDIAN	0.039
									STD DEV	0.055
									MAX	0.275
									MIN	0.010

SECTION 7
ATTACHMENT 2
__6__ PAGE(S)

Pipe Interior Radiological Survey Form

Date: 1-10-06 Time: 1105

Building: RX Elevation -25 Access Point Area: CANAL K

System: CANAL JK overflow Pipe Diameter: 4" Pipe ID # 1.64

Type of Survey Investigation Characterization (Final Survey) Other ✓

Sled Size 4" DOG BONE inch

Detector: IMGI Detector ID #: LVS-1-101

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 21 cpm

$MDCR_{static}$ 19 cpm

Efficiency Factor for Pipe Diameter 0.00047 (taken from detector calibration certificate)

MDC_{static} 3377 dpm/100cm^2

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

Comments: INITIAL SURVEY - MSP

BEGAN SURVEY MEASUREMENTS AT END OF PIPE MSP/NET DONE

Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-10-06 Time: 1105

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm^2
1	51	1	31	31	n/a	n/a
2	50	1	12	12		
3	49	1	26	26		
4	48	1	16	16		
5	47	1	22	22		
6	46	1	27	27		
7	45	1	26	26		
8	44	1	16	16		
9	43	1	19	19		
10	42	1	20	20		

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Pipe Interior Radiological Survey Form (Continuation Form)

#1.64 CANAL K 1-10-06

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm^2
11	41	1	26	26	n/a	n/a
12	40	1	62	62		
13	39	1	28	28		
14	38	1	27	27		
15	37	1	35	35		
16	36	1	39	39		
17	35	1	75	75		
18	34	1	38	38		
19	33	1	34	34		
20	32	1	34	34		
21	~~30~~ 31	1	40	40		
22	30	1	48	48		
23	29	1	43	43		
24	28	1	37	37		
25	27	1	22	22		
26	26	1	66	66		
27	25	1	71	71		
28	24	1	82	82		
29	23	1	38	38		
30	22	1	57	57		
31	21	1	31	31		
32	20	1	61	61		
33	19	1	91	91		
34	18	1	67	67		
35	17	1	88	88		
36	16	1	81	81		
37	15	1	72	72		
38	14	1	96	96		
39	13	1	106	106		
40	12	1	123	123		
41	11	1	109	109		
42	10	1	139	139		
43	9	1	103	103		
44	8	1	215	215		
45	7	1	176	176		
46	6	1	192	192		
47	5	1	208	208		

Package Page 2 of 3

REFERENCE COPY

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Pipe Interior Radiological Survey Form (Continuation Form)

#1.64 CANAL K 1-10-06

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm^2
48	4	1	274	274	n/a	n/a
49	3	1	321	321	↓	↓
50	2	1	104	104		
51	1	1	55	55		

n a

REFERENCE COPY

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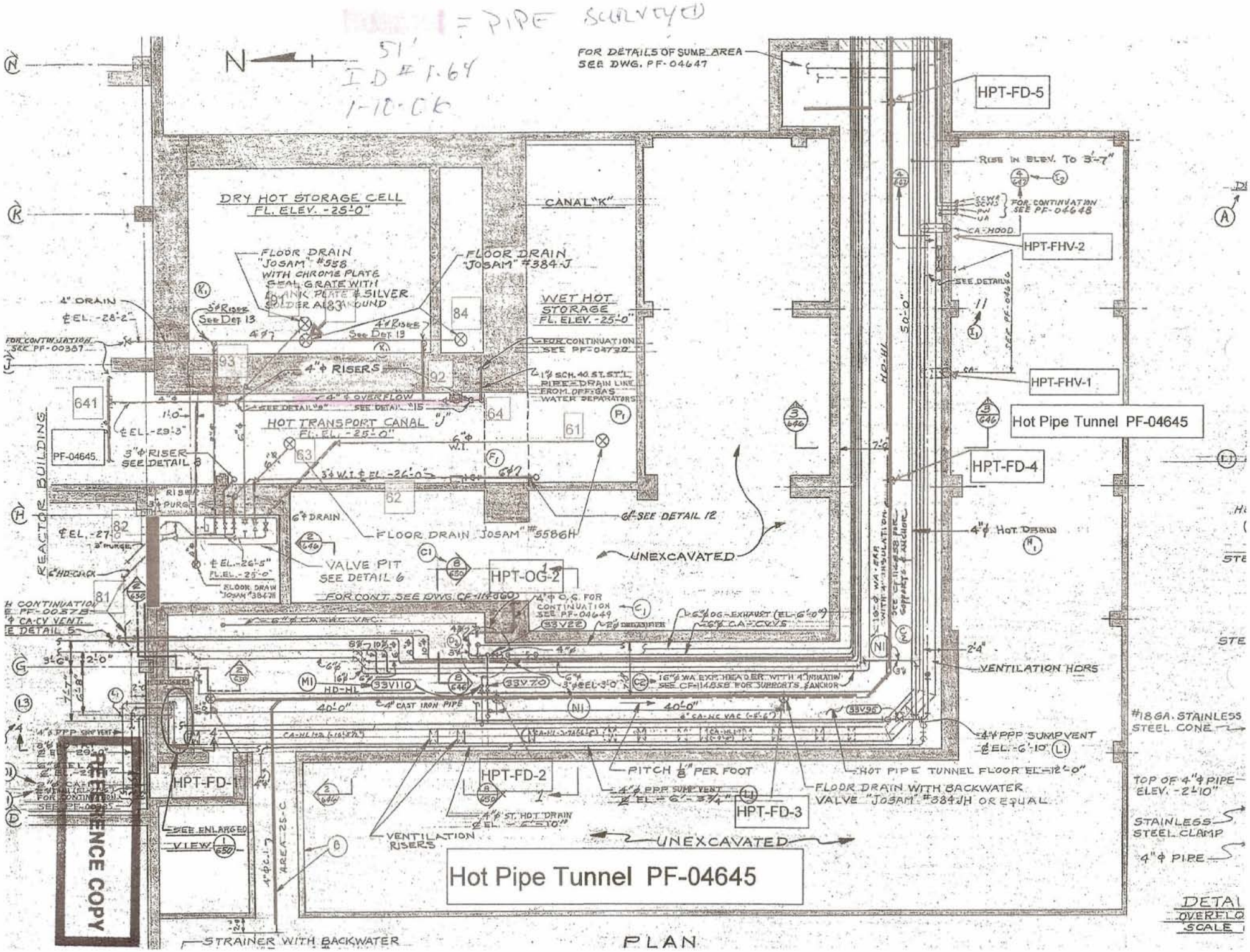

= PIPE SURVEYED
51'
ID # 1.64
1-10-06
N
FOR DETAILS OF SUMP AREA SEE DWG. PF-04647
HPT-FD-5
RISE IN ELEV. TO 3'-7"
FOR CONTINUATION SEE PF-04648
CA-HOOD
HPT-FHV-2
SEE DETAIL
HPT-FHV-1
Hot Pipe Tunnel PF-04645
HPT-FD-4
4"φ HOT DRAIN
DRY HOT STORAGE CELL FL. ELEV. -25'-0"
CANAL "K"
FLOOR DRAIN "JOSAM" #558 WITH CHROME PLATE SEAL GRATE WITH BLANK PLATE & SILVER SOLDER AROUND
FLOOR DRAIN "JOSAM" #384-J
WET HOT STORAGE FL. ELEV. -25'-0"
FOR CONTINUATION SEE PF-04730
4" DRAIN
℄ EL. -28'-2"
FOR CONTINUATION SEE PF-00387
4"φ RISERS
1"φ SCH. 40 ST. ST'L PIPE - DRAIN LINE FROM OFF-GAS WATER SEPARATORS
4"φ OVERFLOW
SEE DETAIL "9"
SEE DETAIL "15"
HOT TRANSPORT CANAL "J" FL. EL. -25'-0"
℄ EL. -29'-3"
PF-04645
3"φ RISER SEE DETAIL 8
3"φ W.I. ℄ EL. -26'-0"
6"φ W.I.
6"φ DRAIN
FLOOR DRAIN "JOSAM" #5586H
6" SEE DETAIL 12
UNEXCAVATED
REACTOR BUILDING
℄ EL. -27'-0"
3" PURGE
6" HD-CACK
℄ EL. -26'-5" FL. EL. -25'-0"
FLOOR DRAIN "JOSAM" #384JH
VALVE PIT SEE DETAIL 6
HPT-OG-2
FOR CONT. SEE DWG. CF-114060
4"φ O.G. FOR CONTINUATION SEE PF-04649
6"φ OG-EXHAUST (EL. 6'-0")
6"φ CA-CVVS
6"φ CA-HC VAC.
16"φ WA EXP. HEADER WITH 4" INSULATION SEE CF-114858 FOR SUPPORTS & ANCHOR
VENTILATION HDRS
4" CAST IRON PIPE
40'-0"
4"φ PPP SUMP VENT ℄ EL. -6'-10"
#18 GA. STAINLESS STEEL CONE
HPT-FD-1
HPT-FD-2
HPT-FD-3
PITCH 1/8" PER FOOT
4"φ PPP SUMP VENT ℄ EL. -6'-3 3/4"
HOT PIPE TUNNEL FLOOR EL. -12'-0"
FLOOR DRAIN WITH BACKWATER VALVE "JOSAM" #384JH OR EQUAL
TOP OF 4"φ PIPE ELEV. -2'-10"
STAINLESS STEEL CLAMP
4"φ PIPE
SEE ENLARGED VIEW
VENTILATION RISERS
UNEXCAVATED
Hot Pipe Tunnel PF-04645
STRAINER WITH BACKWATER
PLAN
DETAI
OVERFLO
SCALE
REFERENCE COPY

Pipe Interior Radiological Survey Form

Date: 1-11-06 Time: 0907

Building: RX Elevation -25 Access Point Area: CANAL F, G+H RISERS

System: CANAL J+K OVERFLOW Pipe Diameter: 4" Pipe ID # 1.64

Type of Survey Investigation Characterization (Final Survey) Other A

Sled Size DOG BONE 101 inch

Detector: BICRON 1MG1 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

$MDCR_{static}$ 19.3 cpm

Efficiency Factor for Pipe Diameter 0.00047 (taken from detector calibration certificate)

MDC_{static} 3377 dpm/100cm^2

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

Comments: CONTINUATION SURVEY FROM 1-10-06 - SURVEY POS #1-3 TAKEN I/S CANAL J RISER / POS # 4-6 TAKEN I/S CANAL F RISER / POS # 7-10 TAKEN I/S CANAL G RISER

Pipe Interior Radiological Survey

Radiological Survey Commenced: Date: 1-11-06 Time: 0907

Position #	Feet into Pipe from Opening	Count Time (min)	Gross Counts	Gross cpm	Net cpm	dpm/100cm^2
1	1	1	98	98	n/a	n/a
2	2	1	23	23		
3	3	1	76	76		
4	1	1	26	26		
5	2	1	29	29		
6	3	1	61	61		
7	1	1	42	42		
8	2	1	17	17		
9	3	1	22	22		
10	n/a	n/a	n/a	n/a	n/a	n/a

REFERENCE COPY

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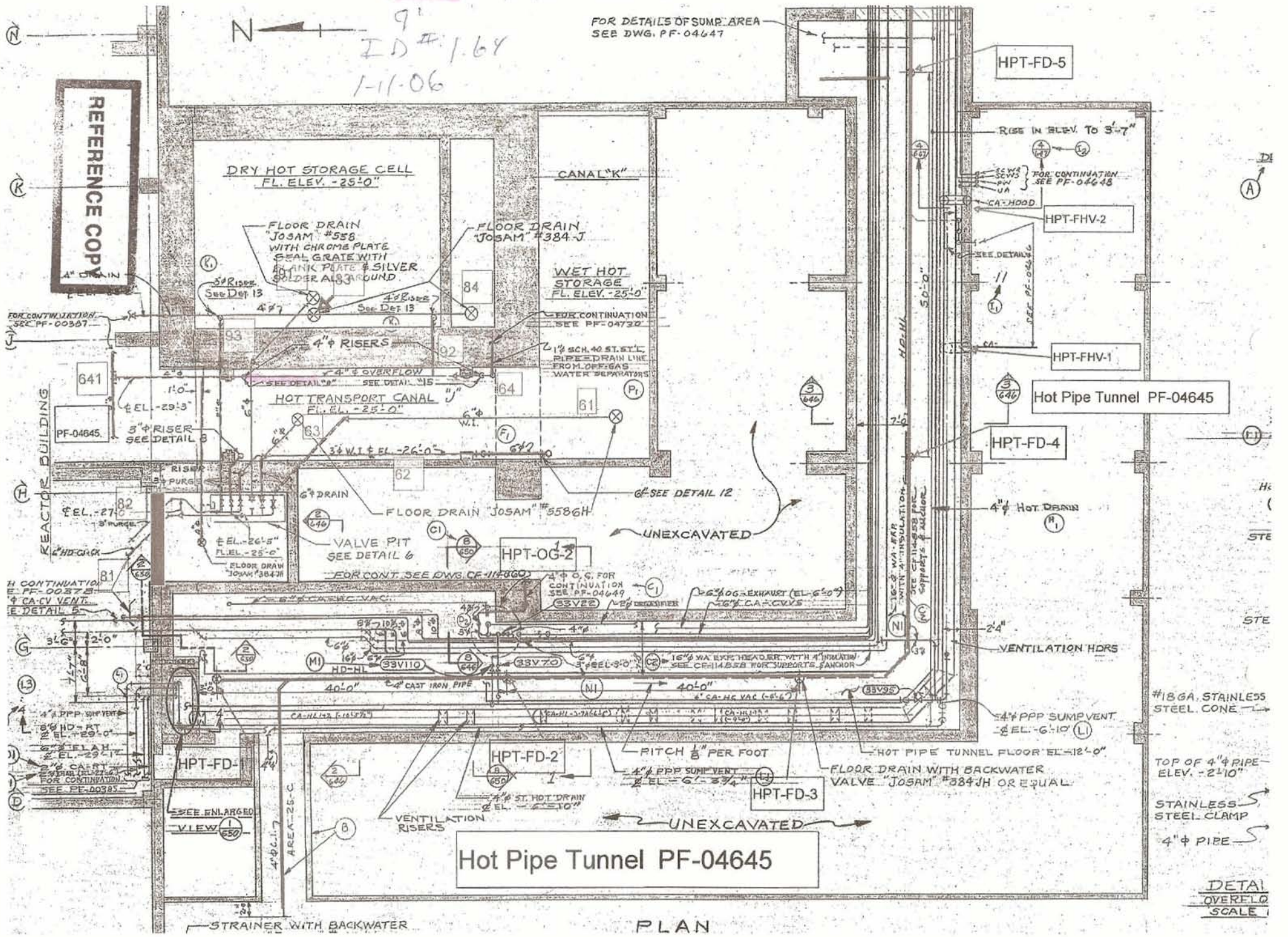

= PIPE SURVEYED
9'
ID # 1.64
1-11-06
REFERENCE COPY
N
FOR DETAILS OF SUMP AREA SEE DWG. PF-04647
HPT-FD-5
RISE IN ELEV. TO 3'-7"
FOR CONTINUATION SEE PF-04648
CA-HOOD
HPT-FHV-2
SEE DETAIL
HPT-FHV-1
Hot Pipe Tunnel PF-04645
HPT-FD-4
4"φ HOT DRAIN
DRY HOT STORAGE CELL
FL. ELEV. -25'-0"
CANAL "K"
FLOOR DRAIN "JOSAM" #558 WITH CHROME PLATE SEAL GRATE WITH BLANK PLATE & SILVER SOLDER ALL AROUND
FLOOR DRAIN "JOSAM" #384-J
WET HOT STORAGE
FL. ELEV. -25'-0"
FOR CONTINUATION SEE PF-04730
FOR CONTINUATION SEE PF-00387
4"φ RISERS
4"φ OVERFLOW
HOT TRANSPORT CANAL "J"
FL. EL. -25'-0"
3"φ RISER SEE DETAIL 8
6"φ SEE DETAIL 12
FLOOR DRAIN "JOSAM" #5586H
UNEXCAVATED
VALVE PIT SEE DETAIL 6
HPT-OG-2
FOR CONT. SEE DWG. CF-114860
4"φ O.G. FOR CONTINUATION SEE PF-04649
6"φ OG-EXHAUST (EL. -6'-0")
6"φ CA-CVVS
REACTOR BUILDING
PF-04645
VENTILATION HDRS
4"φ PPP SUMP VENT
HOT PIPE TUNNEL FLOOR EL. -12'-0"
FLOOR DRAIN WITH BACKWATER VALVE "JOSAM" #384JH OR EQUAL
PITCH 1/8" PER FOOT
HPT-FD-1
HPT-FD-2
HPT-FD-3
VENTILATION RISERS
SEE ENLARGED VIEW
UNEXCAVATED
Hot Pipe Tunnel PF-04645
STRAINER WITH BACKWATER
PLAN
#18 GA. STAINLESS STEEL CONE
TOP OF 4"φ PIPE ELEV. -2'-10"
STAINLESS STEEL CLAMP
4"φ PIPE
DETAI
OVERFLO
SCALE

SECTION 7
ATTACHMENT 3
__1__ PAGE(S)

DQA Check Sheet				
Design #	EP 1.64	Revision #	Original	
Survey Unit #	EP 1.64			

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 measur4ments 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) $\geq$ the critical value?			X

Comments:

FSS/Characterization Engineer (print/sign)	Dale Randall / [signature]	Date	10-26-07
FSS/ Characterization Manager (print/sign)	R. Case [signature]	Date	11/6/07

Form
CS-09/2
Rev 0

SECTION 7
ATTACHMENT 4
1 DISC