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Final Status Survey Report #19 Documentation

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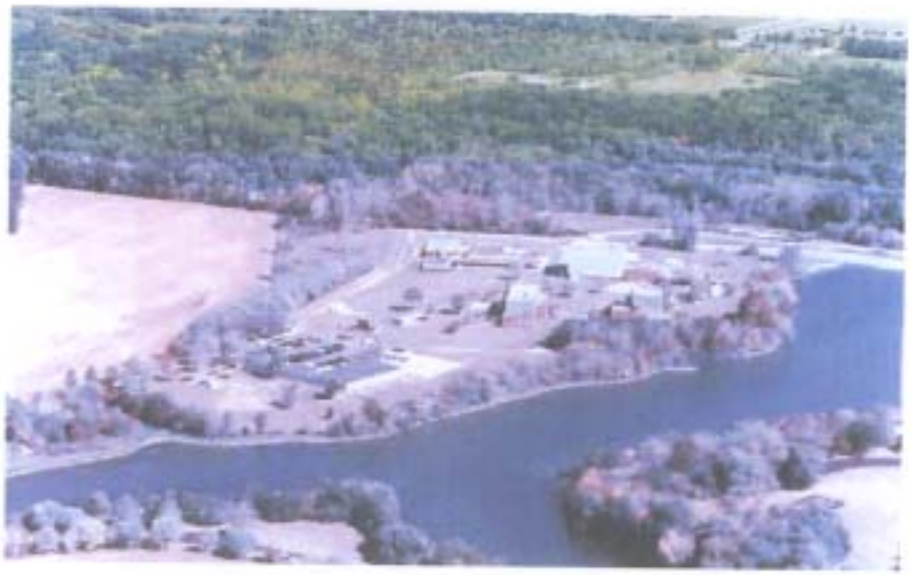

FINAL

COLUMBUS CLOSURE PROJECT CHARACTERIZATION AND FINAL STATUS SURVEY REPORT FOR THE JN-2 FOUNDATION AREA AND SANITARY LINE

Revision 2
June 16, 2006

Prepared by

ECC & E2 Closure Services
1425 State Route 142 East
West Jefferson, OH 43162

Contract Number: DE-AC24-04OH20171

Final Characterization and Final Status Report for the JN-2 Foundation Area and Sanitary Line

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Table of Contents

1.0 Introduction 1
1.1 Background 1
2.0 Site Description 3
2.1 Area Description 3
3.0 Decommissioning Activities 5
3.1 Decommissioning Objective 5
4.0 Final Status Survey Procedures 6
4.1 Sampling Parameters 6
4.2 Major Contaminants Identified 6
4.2.1 Guidelines Established 7
5.0 Equipment and Procedures 8
5.1 Equipment 8
5.2 Scanning Minimum Detectable Activities 8
5.3 Procedures 10
6.0 Survey Findings 11
6.1 Exposure Rate Surveys 11
6.2 Scanning Measurements 11
6.3 Excavation Sampling 11
6.4 Overburden Sampling 13
6.5 Sampling Analysis 14
7.0 Conclusions 15
8.0 References 16

Figures

Figure 1 Site Map
Figure 2 JN-2 Foundation Area Grid Map
Figure 3 JN-2 Sanitary Line Location Map
Figure 4 JN-2 Drain Lines and Dilution Sump Locations
Figure 5 JN-1 Foundation Location in Relation to the JN-2 Foundation and Sanitary Line

Tables

Table 1 BCLDP Guidelines for Residual Radioactivity Concentrations for Soil and Solid Volumes
Table 2 Cesium-137 Surrogate Analysis Data & Modified Cs-137 Screening Criteria
Table 3 JN-2 Foundation Grid Map Dose Rate Survey
Table 4 JN-2 Fuel Tank Vault Dose Rate Survey (Results in uR/hr)
Table 5 JN-2 Sanitation Line Section D Dose Rate Survey (300-400')
Table 6 JN-2 Sanitation Line Section E Dose Rate Survey (400-500')
Table 7 JN-2 Sanitation Line Section F Dose Rate Survey (500-580')
Table 8 JN-2 Sanitation Line Section G Dose Rate Survey (580-620')
Table 9 JN-2 Foundation Grid Map Walkover Scan Survey (cpm)
Table 10 JN-2 Fuel Tank Vault Walkover Survey

Table 11 JN-2 Sanitation Line Section D Walkover Results (300-400')
Table 12 JN-2 Sanitation Line Section E Walkover Survey Results (400-500')
Table 13 JN-2 Sanitation Line Section F Walkover Survey (500-580')
Table 14 JN-2 Sanitation Line Section G Walkover Survey (580-620')
Table 15 JN-2 Foundation Soil Sample Results
Table 16 JN-2 Fuel Tank Vault Soil Sample Results
Table 17 JN-2 Sanitation Line Section D Soil Sample Results (300-400')
Table 18 JN-2 Sanitation Line Section E Soil Sample Results (400-500')
Table 19 JN-2 Sanitation Line Section F Soil Sample Results (500-580')
Table 20 JN-2 Sanitation Line Section G Soil Sample Results (580-620')
Table 21 JN-2 Foundation Summary Table
Table 22 JN-2 Fuel Tank Vault Summary Table
Table 23 JN-2 Foundation Post Footer Removal FSS
Table 24 JN-2 Sanitation Line Trench "Sidewall" Comparison Value
Table 25 JN-2 Sanitation Line Section D Summary Table
Table 26 JN-2 Sanitation Line Section E Summary Table
Table 27 JN-2 Sanitation Line Section F Summary Table
Table 28 JN-2 Sanitation Line Section G Summary Table
Table 29 JN-2 Sanitation Line Trench Overburden "A" Comparison Value
Table 30 JN-2 Sanitation Line Trench Overburden "B" Comparison Value
Table 31 Routine Plant Perimeter Surveys

1.0 Introduction

This report contains the final status surveys (FSS) for the JN-2 foundation area located at the Columbus Closure Project (CCP), 1425 Plain City/Georgesville Road State Route 142 East, West Jefferson, OH 43162. Final status surveys were conducted according to the guidance presented in the *Manual for Conducting Surveys in Support of License Termination*, NUREG/CR-5849 (NUREG/CR-5849) (ORAU, 1992) and the *Radiological Characterization and Final Status Plan for Battelle Columbus Laboratories Decommissioning Project, West Jefferson Site*, DD-97-02 (Final Status Plan) (Battelle, 2000). The final status surveys were conducted in July of 2005 and performed under Work Instruction 2806 (Closure Services, 2004).

The intent of this final status survey report is to provide a complete and unambiguous record of the radiological status of the JN-2 Foundation and Sanitary Line excavations. Sufficient information and data is provided to enable an independent re-creation and evaluation at some future date of both the survey activities and the reported results for the excavations. Information in this report is also available in referenced technical basis documents, final status survey plans and procedures, and the *Battelle Memorial Institute Columbus Operations, Decommissioning Plan*, DD-93-19 (BMI Decommissioning Plan), and reporting and quality assurance procedures.

To the extent practicable, this final status survey report is presented with minimal information incorporated by reference. This final status survey report has been generated following the comprehensive, annotated outline presented in Chapter 9 of NUREG-5849 (ORAU, 1992).

1.1 Background

On April 16, 1943, BMI, acting through what is now its Battelle Columbus Operations (BCO), entered into Contract No. W-7405-ENG-92 with the Manhattan Engineering District to perform atomic energy research and development (R&D) activities. BCO performed nuclear materials research and development at privately-owned facilities for the Manhattan Engineering District and its successor agencies – the Atomic Energy Commission (AEC), the Energy Research and Development Agency (ERDA), and the Department of Energy (DOE). Research and development continued until 1988 (Battelle, 2003a).

The BCO facilities at the King Avenue Site, Columbus, Ohio, and the West Jefferson North (WJN) and South (WJS) Sites, West Jefferson, Ohio, became partially radiologically contaminated as a result of the R&D activities. Decontamination of the King Avenue and WJS Sites has been completed and activities continue at the WJN site. The DOE, as the successor to the AEC and the Government's earlier work, is the agreed party with predominant liability and responsibility for decontamination and decommissioning (D&D) of the BCO facilities (Battelle, 2003a). The Assistant Secretary for Nuclear Energy of the DOE accepted the decontamination and decommissioning (D&D) of the WJN into the DOE's Surplus Facilities Management Program as a major project (DOE, 1986). The DOE is the

agency funding and managing the cleanup of the WJN (Battelle. 2003a). However, the site is not a DOE-owned facility.

BMI holds U.S. Nuclear Regulatory Commission (NRC) license number SNM-7. BMI has continually operated and conducted D&D activities in full compliance with this NRC license. The BMI Decommissioning Plan for the WJN site does not serve as a declaration to terminate SNM-7, but establish the criteria for performing D&D activities. The end goal of the BMI Decommissioning Plan is to reach unrestricted use conditions for the site (Battelle, 2003a).

The DOE has contracted ECC&E2 Closure Services, LLC (Closure Services) to safely remove DOE radioactive materials and contamination from the WJN site. Removal of radioactive material will be to levels allowing future use of the site without radiological restrictions as described in the BMI Decommissioning Plan. Closure Services has conducted characterization and final status surveys of the JN-2 foundation and sanitary line excavations to demonstrate that the areas are available for unrestricted release.

2.0 Site Description

Created in 1984, the Battelle Columbus Decommissioning Project (BCLDP) is a remediation project that includes nine buildings at the King Avenue site and five at the WJN site. The CCP is the successor of the BCLDP. The WJN site has one permanent structure (the JN-1 Well House). Three former research facilities, JN-1, JN-2, and JN-3 have been demolished as well as JN-6, the guard house. Several outfalls, filter beds, and wells are also located at the site. The JN-2 foundation area is the area below and surrounding the JN-2 foundation slab. **Figure 1** presents the CCP.

2.1 Area Description

Building JN-2 was 120 feet long, 90 feet wide and 2 stories above ground. It was constructed of cement block, concrete walls, and faced with brick. Building JN-2 was demolished in 2004. Various drain lines as well as building areas were not expected to be contaminated above the volumetric release limits presented in DD-93-03, Rev. 0, "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratory Decommissioning Project" (Battelle, 1993). Due to restrictions associated with debris in backfill and costs associated with sampling and analysis, the piping and associated soils were removed and disposed of as low level waste. The remaining building components, foundation slab, walls, and footers were release per HP-OP-011, *Release of Materials from Controlled Areas*, and disposed of off-site as sanitary waste. The location of the JN-2 foundation area, available for unrestricted release, is highlighted as **Figure 2**.

The Sanitary Line extended from the JN-2 North Side for ~20 meters then veered east for ~40 meters, where it intercepted a manway. From the manway, the sanitary line extended to the South where it connected outside JN-1C. A second "dog leg" section of this line connected between JN-2 and JN-3. Portions of the line have been removed prior to this FSS, at both the JN-3 and JN-1C connections. The remaining sanitary line piping and associated soils (within the scope of this FSS) were removed and disposed of as low level waste. See **Figure 3**.

Also included as part of the original JN-2 Foundation was a Calibration Source Well, Source Storage Tubes, and several drains embedded below the floor slab. The building drain system emptied into a Dilution Sump located to the North of the building foundation. All these items have been removed during the remediation effort and disposed of as low level waste. See **Figure 4**.

Two classifications of areas are used in NUREG-5849 and are termed **affected** or **unaffected.** These classifications are defined as (NRC, 1992):

> **Affected Areas:** Areas that have potential radioactive contamination (based on plant operating history) or known radioactive contamination (based on past or preliminary radiological surveillance). This would normally include areas where radioactive materials were used and stored, where records indicate spills or other unusual occurrences that could have resulted in spread of contamination, and where

radioactive materials were buried. Areas immediately surrounding or adjacent to locations where radioactive materials were used, stored, or buried are included in this classification because of the potential for inadvertent spread of contamination.

Unaffected Areas: All areas not classified as affected. These areas are not expected to contain residual radioactivity, based on knowledge of site history and previous information.

The JN-2 foundation and sanitary line excavated trench bases were considered affected. The trench sidewalls and overburden were considered unaffected.

3.0 Decommissioning Activities

3.1 Decommissioning Objective

The objective of the final status survey performed on the JN-2 foundation area and sanitary line excavation was to statistically demonstrate that the remediation of the areas was successful and that the excavations are free from residual radioactive contamination that would not make it suitable for unrestricted release. The excavations are determined to be free of residual radioactive contamination when remaining soil contamination levels are below those presented in DD-93-03, Rev. 0, "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratory Decommissioning Project" (Battelle, 1993). **Table 1** presents the volumetric release criteria as presented in DD-93-03, Rev. 0.

4.0 Final Status Survey Procedures

Planning and implementation of the final status survey of the excavations adhered to the requirements of the Final Status Plan (Battelle, 2000) and Work Instruction 2806 (CS, 2004)

4.1 Sampling Parameters

Final status samples of the JN-2 foundation area were taken by dividing the area into ten by ten meter grids in four quadrants and taking samples from each quadrant. Additional samples were collected around the location of the Calibration Well. Samples were also collected around the location of the Dilution Sump, Source Storage Tubes, and drain locations as part of the excavation base final status surveying. See **Figure 2**. Additional samples were collected from the JN-2 foundation excavation following removal of the below grade footer beams and piers. Samples were collected at a rate of one additional sample per ten by ten meter grid. Analyses of samples by gamma spectroscopy were performed by the on-site Radioanalytical Laboratory (RAL).

Final status samples of the JN-2 sanitary line trench were taken by dividing the trench into sections and collecting samples from the overburden, trench side walls, and the trench base in accordance with WI-2806. See **Figure 3**.

4.2 Major Contaminants Identified

The characterization of the JN-2 foundation excavation identified Cs-137 as the primary radiological contaminant of concern (RCOC). Other RCOCs included Co-60, Eu-152 and 154, Am-241, Sr-90, Pu-238, and Pu-239. Cs-137 is used as a surrogate for the other RCOC present in the soils as it typically accounts for 64 percent of the total isotopic activity. Further, the release criteria set for Cs-137 is considered conservative for the decommissioning activities. The surrogate relationship of Cs-137 to other RCOCs was calculated using data presented in **Table 2**. **Table 2** presents the isotopic quantity and activity concentrations of samples collected from the filter bed area by BMI from March through September 2000. These data are not associated with the excavation of the JN-2 foundation. Average activities for the multiple samples were calculated for each RCOC prior to setting the ratios against Cs-137.[1] For each RCOC, the average activity concentration was set as a ratio against the average Cs-137 activity concentration as obtained from previous actions at the filter beds. Cs-137 activity ratios for each RCOC utilized to calculate the RCOCs for the JN-2 foundation are presented at the lower portion of **Table 2**.

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[1] Battelle, *Radiological Status of Abandoned Filter Bed Presentation*, http://www.ohio.doe.gov/ccp_scb/, Posted 7/15/2003. Presentation provided by DOE to the CCP website. Page titled "Radioactive Inventory of the Abandoned North Filter Beds & Limit Fractions" contains sampling data obtained from March through September 2000 from the filter beds. Average Cs-137 ratios were utilized to calculate the activity concentrations of the isotopes of concern.

4.2.1 *Guidelines Established*

Table 1 presents the guidelines for residual radioactivity concentrations for soil and solid volumes as applied to the excavation. Criteria for residual radioactivity concentrations in soil are defined in a number of references. DOE Order 5400.5, Section IV.a.2 provides generic guidelines for residual concentrations of Ra-226, Ra-228, Th-230, and Th-232. NRC Guidance has been received by the CCP which contains soil radioactivity concentration guidelines for Co-60, Sr-90, Cs-137, Ra-226, and Ra-228. NRC guidance for soil radioactivity concentration guidelines for natural, enriched and depleted uranium has also been utilized in developing the cleanup guidelines. **Table 1** compiles soil residual radioactivity concentration guidelines to be utilized by the CCP. **Table 1** values have been generated primarily from the various reference technical documents and from soil guidelines generated from computer pathway analyses. Pu-241 is calculated by applying a ratio to sum of Pu-238 and Pu-239 (obtained from ORIGEN 2.1 derived values, Battelle, 2003c), resulting in a Cs-137 to Pu-241 ratio of 2.8. Using the ratios from **Table 2** and the Cs-137 to Pu-241 ratio of 2.8, the sum of ratios of radionuclides will meet unity at Cs-137 concentrations of 11 pCi/g.

Exposure rates were compared to the 5 μR/hr above mean background limit listed in DD-97-02, Rev. 0. The calculated mean background exposure rate and the 95 percent confidence intervals used for the CCP grounds are 8 ± 2 μR/hr. Data collected from trench-like culverts located on Battelle property unassociated with site operations indicate a geometry effect, increasing the exposure rates inside the trenches by 3 to 5 μR/hr.

5.0 Equipment and Procedures

5.1 Equipment

Survey instruments sensitive to gamma radiation are used to monitor excavation surfaces for residual radioactive materials. Ludlum Model 44-10 two-inch by two-inch sodium iodide detectors with Eberline ESP-2 meters were used to scan the excavations. Ludlum Model 19 exposure rate meters were used to obtain microRoentgen per hour measurements.

Other instrumentation used in the Onsite Radioanalytical Laboratory (RAL) to support the final status survey includes:

- A VMS based Canberra Procount data acquisition system in conjunction with high purity germanium detectors for gamma spectroscopy of soil samples.
- A Tennelec Model LB5100 Simultaneous Alpha and Beta Gas Proportional Counter to count smear samples

5.2 Scanning Minimum Detectable Activities

Scanning minimum detectable concentrations (MDC_{scan}) is determined to demonstrate that the MDC_{scan} is less than the modified Cs-137 screening criteria. The MDC_{scan} is calculated utilizing the methodology described in NUREG-1507 and the background count rate and a default detector response to Cs-137 (NRC, 1998). The equation during the walkover surveys of the CCP incorporates a d' of 1.38 and a surveyor efficiency of 0.5. The ambient background in the area was 26,000 counts per minute (cpm). This background is determined using an un-shielded probe. For this particular area, the JN-2 foundation and the Sanitary Line trenches, the background was significantly elevated due to the storage of radioactive material within a near distance. The following is the calculation of the MDC_{scan} using an un-shielded probe:

b_i = (26,000 cpm) x (1 sec) x (1 min/60 sec) = 433 counts

MDCR = (1.38) x ($\sqrt{433}\,counts$) x (60 sec/1min) = 1723 cpm

$MDCR_{surveyor}$ = 1723 cpm/$\sqrt{0.5}$ = 2437 cpm

MDER = 2437 cpm/(900 cpm/μR/hr) = 2.71 μR/hr

$$MDC_{scan} = (5pCi/g) * \frac{2.71\mu R/hr}{1.307\mu R/hr} = 10.36pCi/g$$

As described in section 3.2 of Work Instruction 2806, in order to detect Cs-137 at 75% of the cleanup criteria, the background count rate of the 2" x 2" detector must be less than 20,000 cpm. Where the background count rate exceeds 20,000 cpm, the use of a collimator may be necessary. Also, as stated in the attachment to WI-2806, "The use of collimators for

shielding probes in areas of elevated backgrounds is acceptable. The collimation shields the detector sides, not the bottom of the probe. The detector "view" will focus to the grounds and not be as impacted from the surrounding radiation field. The collimated probe typically reduces background fields by a factor of ten." For the area of JN-2 Foundation and the Sanitary Line trenches, a collimator (shielded probe) was used and the following MDC_{scan} applies.

The ambient background in the area using a shielded probe was 4,400 counts per minute (cpm). The following is the calculation of the MDC_{scan} using a shielded probe:

b_i	=	(4,400 cpm) x (1 sec) x (1 min/60 sec)	=	73 counts
MDCR	=	(1.38) x ($\sqrt{73}\,counts$) x (60 sec/1min)	=	707 cpm
$MDCR_{surveyor}$	=	707 cpm/ $\sqrt{0.5}$	=	1,000 cpm
MDER	=	1,000 cpm / (900/cpm/μR/hr)	=	1.11 μR/hr
MDC_{scan}	=	$(5\,pCi/g) * \frac{1.11\,\mu R/hr}{1.307\,\mu R/hr} = 4.25\,pCi/g$		

5.3 Procedures

The Characterization Team was formally trained and qualified to applicable procedures prior to the initiation of the characterization and final status surveys. Documentation of training is maintained by CCP Project Records.

The following plans and procedures were utilized for the surveys:

DD-93-19, Rev. 5	Decommissioning Plan, Battelle Memorial Institute Columbus Operations
DD-97-02, Rev. 0	Radiological Characterization and Final Status Plan for BCLDP West Jefferson Site
SC-OP-002, Rev. 0	Facility Post-Decontamination Final Status Survey for Baseline Areas
SC-SP-004.2, Rev. 3	Manual and Mechanical Collection of Surface and Subsurface Soil Samples in Support of Site Characterization
HP-OP-100, Rev. 4	Operation and Calibration of the Eberline Model ESP-2 Survey Meter
WI-2806	Excavation and Trench Sampling and Surveys

6.0 Survey Findings

6.1 Exposure Rate Surveys

The calculated mean background exposure rate and the 95 percent confidence intervals used for the CCP grounds are 8 ± 2 μR/hr. The exposure rate readings for the excavations are presented in the **Tables 3 through 8**. The exposure rate readings were individually compared to the mean background value of 8 ± 2 μR/hr in order to show compliance with the 5 μR /hr above background release criterion. Grounds exposure rate surveys must be less than or equal to13 μR/hr to be compliant: trenches must be less than or equal to 18 μR/hr. The average one meter measurement in the JN-2 Excavation was 19 μR/hr, the minimum measurement was 14 μR/hr and the maximum measurement was 28 μR/hr. The one meter measurements in the sanitary line trenches (D-G) indicated an average of 15 to 24 uR/hr with the highest average in trench section D and the lowest in trench section F. The data indicated a steady increase as the trenches approached the JN-1 foundation area. The minimum measurement was 15 uR/hr and the maximum measurement was 28 uR/hr.

Exposure rate surveys were consistent in that the measurements steadily increased as the trenches approached the JN-1 foundation area. The increased exposure rate in the area is directly attributable to it's proximity to the JN-1 foundation area that was roughly 185 feet to the east. JN-1 is the hot cell facility and is in active decontamination and decommissioning. Routine exposure rate surveys performed of the area west Building JN-1 and immediately east of the JN-2 foundation excavation averaged 33 ± 37 μR/hr as shown in **Table 31**, Routine Plant Perimeter Surveys. The location of the JN-1 foundation in relation to the JN-2 foundation and sanitary line trenches is shown in **Figure 5**.

Closure Services subsequently performed external exposure rate surveys of the JN-2 area grounds following the demolition and removal of Building JN-1. The results of these surveys are compliant with the exposure rate release criteria and are included in the Final Status Survey Report for *Remaining Land Areas Inside the WJN Site Restricted Area.*

6.2 Scanning Measurements

Scanning of the JN-2 foundation area and Fuel Tank Vault were performed with a two inch by two inch sodium iodide detector equipped with a collimator as described in Section 5.2. Walkover survey results are presented as **Table 9 and 10**. Scanning of the Sanitary Line trenches using a two inch by two inch sodium iodide detector were also performed. The probe was equipped with a collimator as described in Section 5.2. The JN-2 and sanitary line excavation surveys exceeded DLV, but exhibited uniformity and a direct correlation with the exposure rate surveys indicating the source of elevated background levels as the JN-1 area. Walkover scanning results for these areas are located in **Tables 11 through 14.**

6.3 Excavation Sampling

Samples of the JN-2 foundation excavation and the Fuel Tank Vault were taken at a rate of four per ten by ten meter grid in accordance with Section 6.3.3 of DD-97-02, Rev. 0. Soil sample results for the excavation are presented as **Table 15. Table 16** presents soil sample results for the Fuel Tank Vault.

The JN-2 sanitary line trenches were surveyed and sampled in accordance with WI-2806 which included sampling of overburden, trench side walls and the trench bottom. Sample results of the Sanitation Line Trench, by Section, are provided in **Tables 17 through 20**.

Sampling in and around the areas of the Calibration Source Well and the Source Storage Tubes was performed in conjunction with surveys of the JN-2 Foundation excavation. **Table 21** provides the sampling results of the JN-2 foundation with an additional column noting sample collection locations for these areas. **Table 22** provides sampling results for the JN-2 Fuel Tank Vault.

Additional samples were also collected following the removal of the footer beams and pier supports at a rate of one per ten meter grid. **Table 23** presents the results.

Cesium-137 is utilized as a surrogate for determining compliance to the cleanup criteria presented in **Table 1**. The CCP has consistently utilized Cs-137 as a surrogate for other radionuclides of concern as it is the predominate radionuclide present throughout the site and the buildings. Additionally, Cs-137 exhibits the lowest cleanup criteria of 15 pCi/g. The calculation of the Cs-137 surrogate value is performed utilizing sample results obtained prior to remediation of the area in question. **Table 2** presents the results of the pre-remediation samples of the filter bed and are not associated with the excavation of the JN2 foundation.

Compliance to the cleanup criteria presented in **Table 1** is demonstrated through a "fraction of limit." The total quantity and activity concentrations are calculated using the average isotopic ratios of radionuclides to Cs-137 as obtained for the filter beds, with the exception of Pu-241 (Battelle, 2003b). Pu-241 is calculated by applying a ratio to sum of Pu-238 and Pu-239 (obtained from ORIGEN 2.1 derived values, Battelle, 2003c), resulting in a Cs-137 to Pu-241 ratio of 2.8. See **Table 2**. Results for Co-60, Cs-137, Sr-90, Eu-152 and 154, Pu-239, 240 and 241, and Am-241 are compared to the respective release criteria and a "fraction of limit" calculated. The "fraction of limit" is determined by summing the ratios of each isotopic concentration to the respective release limit. The sum of ratios must be less than one to meet sample release criteria. This ratio has been used in past technical basis documents which have been reviewed and approved by the NRC and licensee. Modified screening criteria for CS-137 is set at 11 pCi/g by calculating a sum of ratios for the RCOCs using the Cs-137 surrogate ratios presented in **Table 2**.

When soil sample results begin to approach detected Cs-137 levels above 4 pCi/g, CS applies a "fraction of limit" calculation to verify the original assumptions. Additionally, when Cs-137 levels begin to approach the modified screening criteria of 11 pCi/g, CS typically conducts further remediation as an administrative conservatism. The "fraction of limit" for the JN-2 foundation samples was not calculated due to the low concentrations of Cs-137 in respect to the modified screening criteria (maximum soil sample activity for the JN-2 Foundation is 2.75E-01 pCi/g). The "fraction of limit" for the JN-2 Sanitary Line Trench

Base and Sidewalls was also not calculated due to the low concentrations of Cs-137 in respect to the modified screening criteria (maximum soil sample activity for the sanitary line is 1.32E-01 pCi/g, and 7.14E-02 pCi/g, respectively). The following table summarizes the Cs-137 results for these three areas:

Location	Number of Samples	Average (pCi/g)	Standard Deviation (pCi/g)	Range (pCi/g)	Comparison Value (pCi/g)	Modified Screening Criteria (pCi/g)
JN-2 Foundation	84	6.69E-02	0.048	1.49E-02 to 2.75E-01	0.08	11
Sanitary Line Trench Base (sections D-G)	89	3.16E-02	0.02	9.30E-03 to 1.32E-01	0.04	11
Sanitary Line Trench Sidewalls (sections D-G)	32	3.84E-02	0.01	1.36E-02 to 7.14E-02	0.04	11

Statistical analyses were performed on the sample data in accordance with Section 6.4.3 of DD-97-02, Rev. 0. Statistical analysis was performed according to NUREG/CR-5849, §8.5. As stated in §8.5, the EPA has recommended applying the calculated value of μ_a, relative to a guideline value, at a desired level of confidence. The value of μ_a is compared to the guideline value; if the μ_a is less than the guideline, the area meets the guideline at a 95% confidence level. This in turn means that the probability is less than 5% that the μ_a will pass the test, when the true mean activity level exceeds the guideline value. The calculated μ_a, for Cs-137, ranging from 0.04 to 0.08 pCi/g, was less than the modified screening criteria of 11 pCi/g. An example calculation is presented as **Table 24**.

6.4 Overburden Sampling

Samples were taken from the excavation overburden, "A" and "B" in accordance with Section 6.4.3 of DD-97-02, Rev. 0 and Work Instruction 2806. Summary tables of the Cs-137 results in relation to the sample location is presented as **Tables 25 through 28**. The following is a summary Table of the Cs-137 results.

Location	Number of Samples	Average (pCi/g)	Standard Deviation (pCi/g)	Range (pCi/g)	Comparison Value (pCi/g)	Modified Screening Criteria (pCi/g)
Sanitary Line Overburden A Soil (D – G)	32	5.50E-02	0.07	1.45E-02 to 4.32E-01	0.08	11
Sanitary Line Overburden B Soil (D – G)	32	3.73E-02	0.02	1.63E-02 to 1.57E-01	0.04	11

Statistical analyses were performed on the overburden sample data, Overburden "A" and Overburden "B", in the same manner as Section 6.2 of this document. The calculation of the

Cs-137 comparison values, 0.08 and 0.04 pCi/g, was less than the modified Cs-137 screening criteria of 11 pCi/g. The comparison values are presented as **Tables 29 and 30**.

6.5 Sampling Analysis

Summary tables presented in this report indicate Cs-137 results as listed. Given the low levels of activity detected and moreover the even lower levels of the other gamma spectroscopy detectable radionuclides, radionuclides other than cesium are below the instrument's Minimum Detectable Activity (MDA). The following is a summary table of the typical instrument MDAs for the radionuclides being sampled for:

Typical MDAs:

Cs-137 MDA (pCi/g)	Co-60 MDA (pCi/g)	Eu-152 MDA (pCi/g)	Eu-154 MDA (pCi/g)	Am-241 MDA (pCi/g)
0.024 +/- 0.013	0.022 +/- 0.012	0.067 +/- 0.030	0.055 +/- 0.039	0.451 +/- 0.30

7.0 Conclusions

The characterization and final status survey results demonstrate that the radiological endpoint criteria objectives of the NRC-approved Decommissioning Plan have been met for the excavation addressed by this effort. (Battelle, 2003) Reported analytical results for media samples obtained from the excavation and overburden are below the residual radioactivity concentrations for soil and solid volumes as presented in **Table 1**.

Remaining soil contamination levels are below those presented in DD-93-03, Rev. 0, "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratory Decommissioning Project" (Battelle, 1993). The decommissioning objective has been satisfied. The final status survey performed on the JN-2 foundation area, and sanitary line excavations, statistically demonstrates that the remediation of the area was successful and that the excavations are free from residual radioactive contamination making them suitable for unrestricted release.

8.0 References

Battelle, 2003a. "Decommissioning Plan for the Battelle Memorial Institute Columbus Operations." DD-93-19.

Battelle, 2003b. Radiological Status of Abandoned Filter Bed Presentation. http://www.ohio.doe.gov/ccp_seb/. Posted 7/15/2003. Presentation provided by DOE to the CCP website. Page titled "Radioactive Inventory of the Abandoned North Filter Beds & Limit Fractions" contains sampling data obtained from March through September 2000 from the filter beds. Average Cs-137 ratios were utilized to calculate the activity concentrations of the isotopes of concern.

Battelle, 2003c. Waste Characterization, Classification, and Shipping Support Technical Basis Document, Rev. 5 for BCLDP West Jefferson Facility, November 2003. Isotopic mixture for Pu-241 is calculated using the values obtained from the ORIGEN2.1-derived data values presented in the technical basis document.

Battelle, 2000. "Radiological Characterization and Final Status Survey Plan for Battelle Columbus Laboratory Decommissioning Project West Jefferson Site." DD-97-02.

Battelle, 1993. "Volumetric Release Criteria Technical Basis Document for Battelle Columbus Laboratories Decommissioning Project." DD-93-03.

ECC&E2 Closure Services, LLC (Closure Services, 2004). Work Instruction 2806, Excavation and Trench Sampling and Survey.

U.S. Department of Energy (DOE), 1990. Finding of No Significant Impact. Decontamination and Decommissioning of the Battelle Columbus Laboratories in Columbus and West Jefferson, Ohio.

U.S. Department of Energy (DOE), 1986. May 29, 1986 memorandum, Voight to Vaughan, approved by Vaughan, June 10, 1986.

U.S. Nuclear Regulatory Commission (NRC), 1998. "Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions" NUREG-1507.

Oak Ridge Associated Universities (ORAU), 1992. "Manual for Conducting Radiological Surveys in Support of License Termination. Draft Report for Comment" NUREG/CR-5849. ORAU-92/C57, prepared for the Nuclear Regulatory Commission by the Environmental Survey and Assessment Program, Energy/Environmental Systems Division, ORAU, 1992.

Figures

Figure 1
Site Map

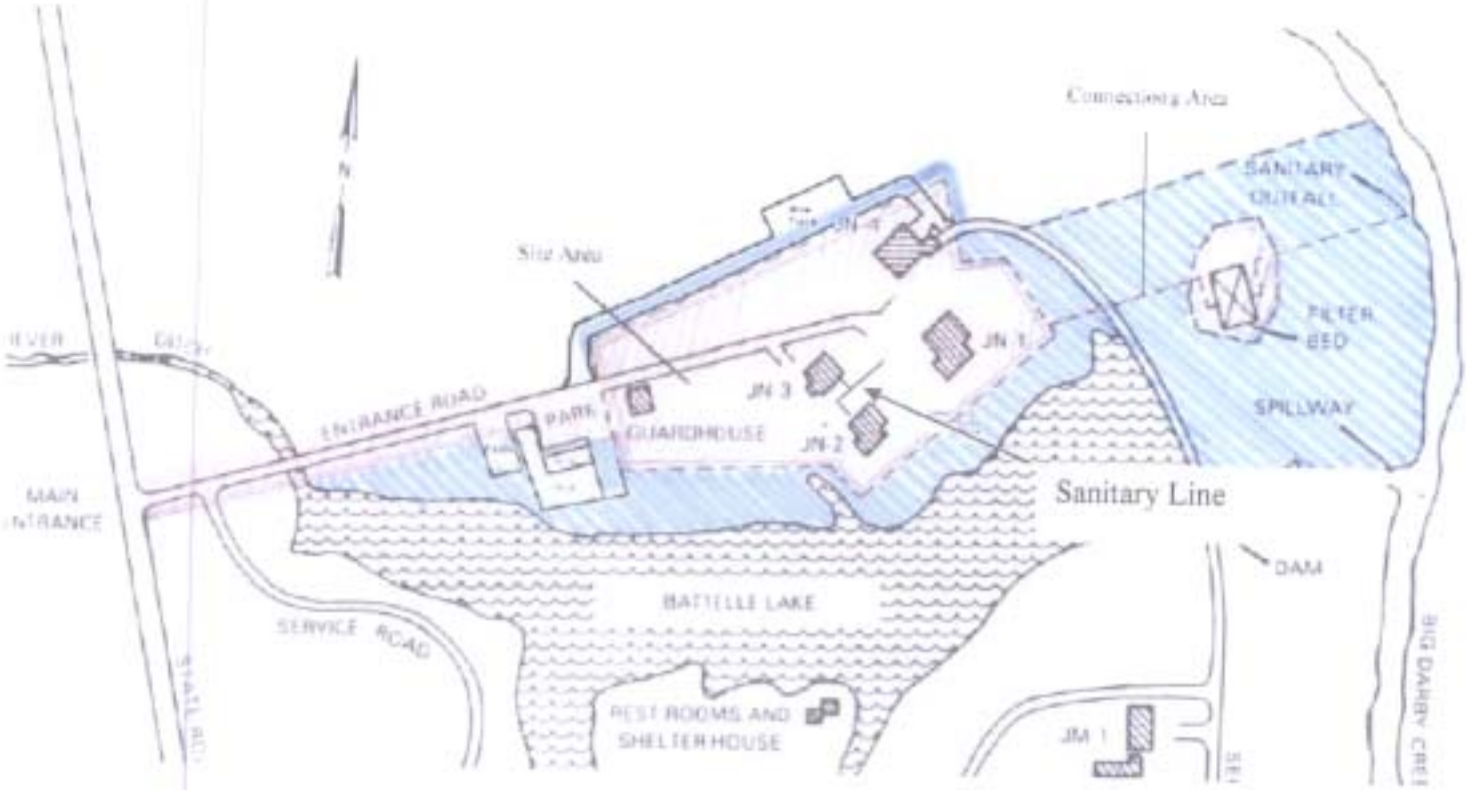
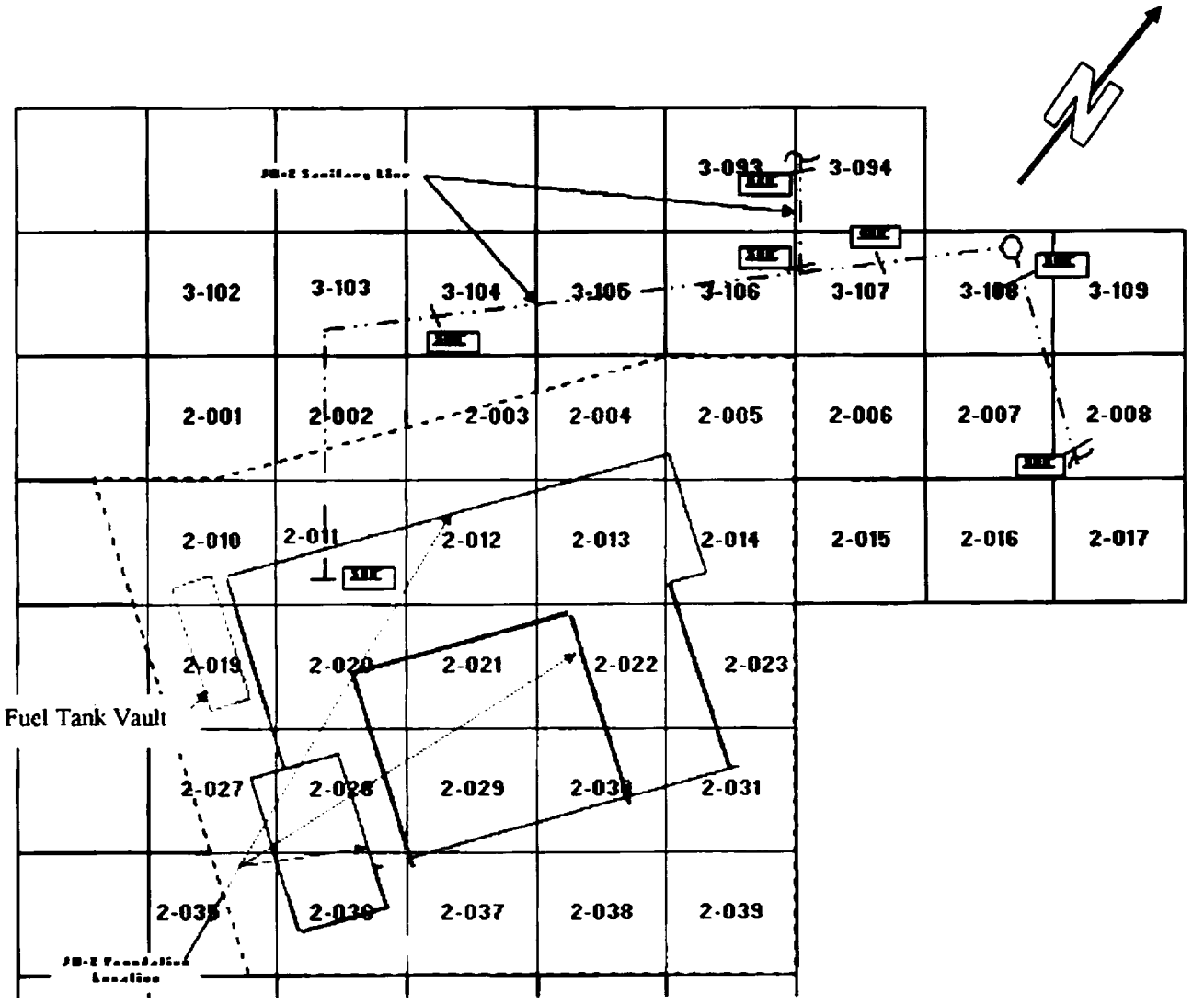


Figure 2

JN-2 Foundation Area Grid Map



The location of the JN-2 foundation area. available for unrestricted release. is highlighted in the above figure. Areas not highlighted are not included in this FSS.

Figure 3

JN-2 Sanitary Line Location Map

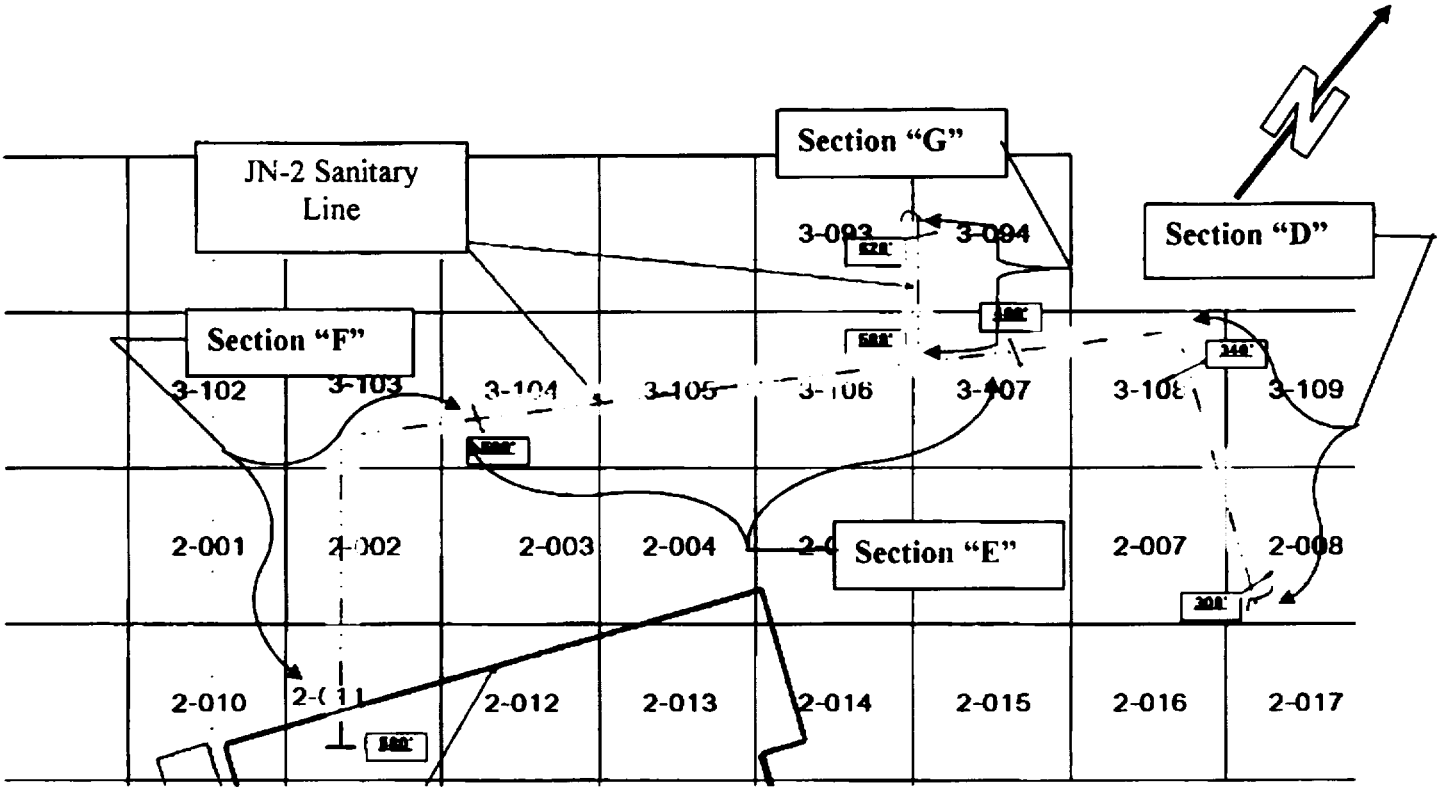
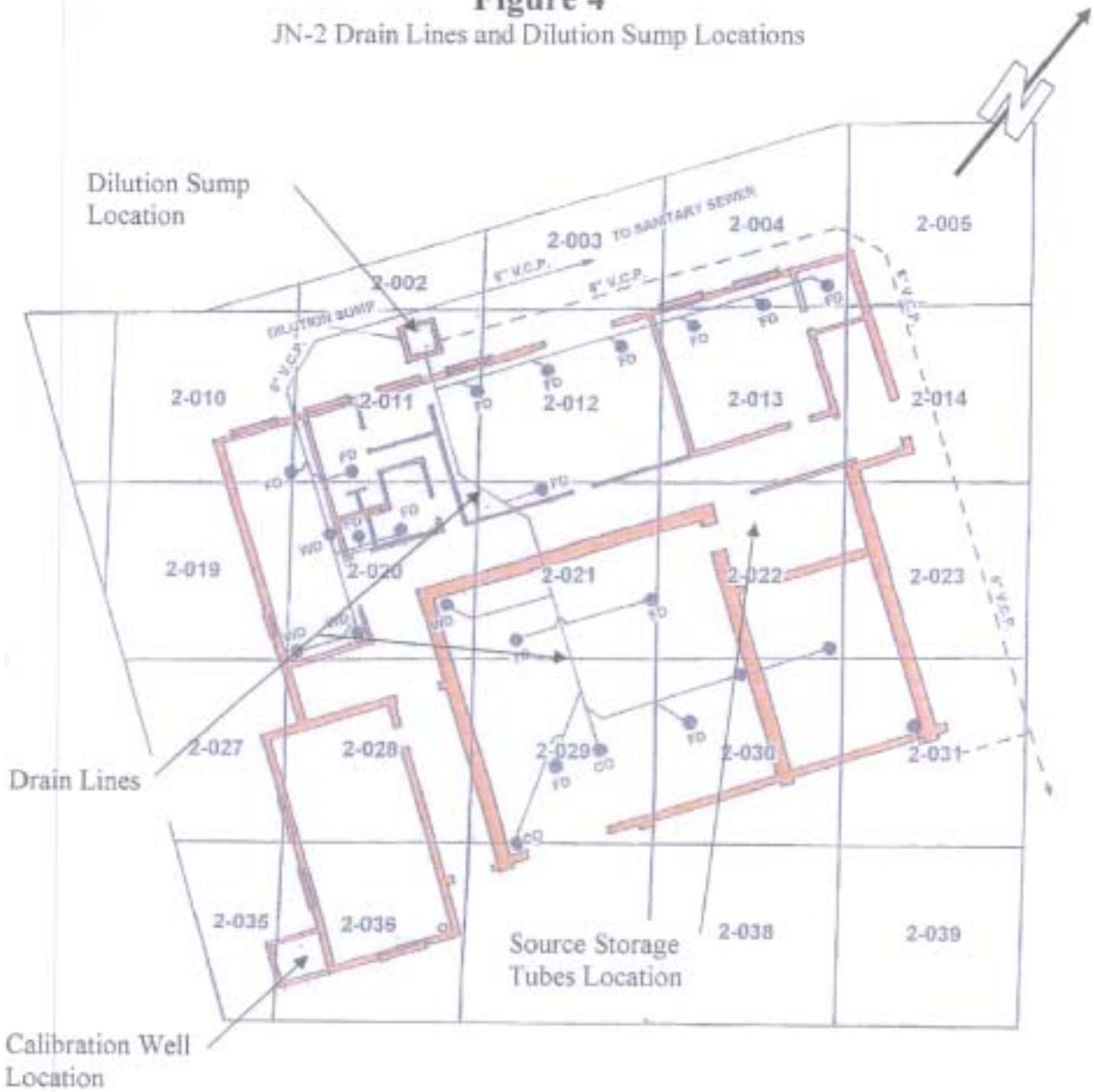


Figure 4

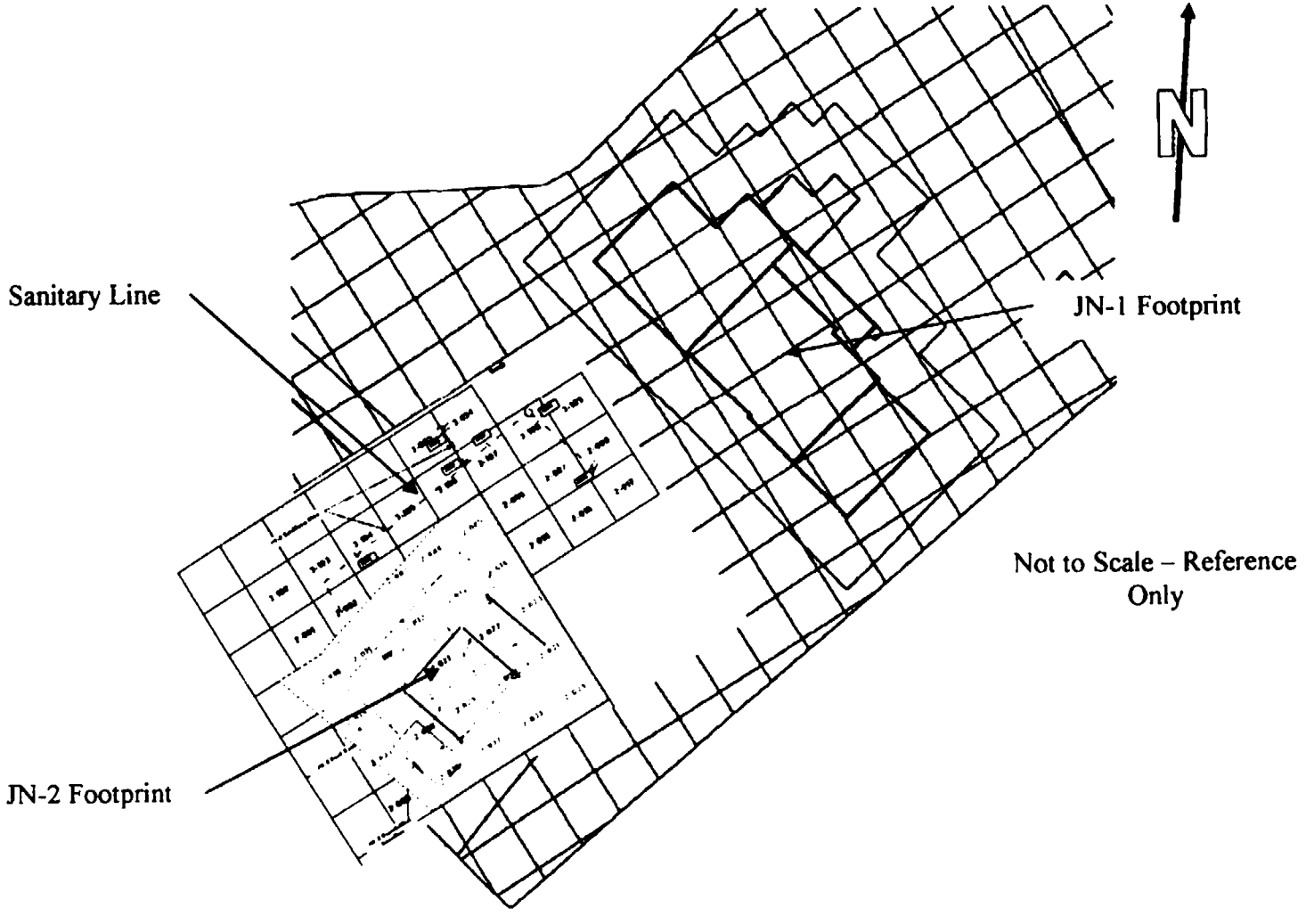
JN-2 Drain Lines and Dilution Sump Locations



NOTE:
All removed during remediation. Informational purposes only.

Figure 5

JN-1 Foundation Location in Relation to the JN-2 Foundation and Sanitary Line



Tables

Table 1

BCLDP GUIDELINES FOR RESIDUAL
RADIOACTIVITY CONCENTRATIONS FOR SOIL AND SOLID VOLUMES

Radionuclide[a]	King Avenue Concentration (pCi/g)[b]	West Jefferson Concentration (pCi/g)[b]
Natural Uranium	10[1]	na[c]
Enriched Uranium	30[1]	30[1]
Depleted Uranium	35[1]	35[1]
Ac-227	19	19
Am-241	na[c]	30[4]
Am-243	na	30[4]
Ce-144	na	2,100
Cm-243	na	0.79
Cm-244	na	1.0
Co-60	8[2]	8[2]
Cs-134	na	33
Cs-137	15[2]	15[2]
C-14	940	940
Eu-152	na	36
Eu-154	na	32
Eu-155	na	1,800
Fe-55	na	2.7E+07
H-3[d]	41,000	38,000
I-129	na	13
Mn-54	na	61
Ni-59	na	1.3E+07
Ni-63	na	4.9E+06
Np-237	na	0.58
Pa-231	18	18
Pb-210	140	na
Pu-238	na	25[4]
Pu-239	na	25[4]
Pu-240	na	25[4]
Pu-241	na	25[4]
Pu-242	na	25[4]

Radionuclide[a]	King Avenue Concentration (pCi/g)[b]	West Jefferson Concentration (pCi/g)[b]
Ra-226 (0-15 cm of soil)	5[2,3]	na
Ra-226 (>15 cm of soil)	15[2,3]	na
Ra-228	5[2,3]	na
Ru-106	na	180
Sb-125	na	118
Sm-151	na	6,700
Sr-90	5[2]	5[2]
Th-228	29	na
Th-230	5[3]	na
Th-232	5[3]	na

Table 1 Notes and References

Notes:

a. Activity concentrations above natural background concentrations. Where more than one radionuclide is present, the sum of the ratios of the individual radionuclide concentrations to their respective concentration limits shall not exceed 1.

b. Concentrations for which no specific reference is cited have been derived from RESRAD calculations and are the more restrictive values calculated for soil deposition at a depth of 5 meters.

c. Indicates that this radionuclide is not expected to be found at the indicated site.

d. Difference in tritium activity concentrations are due to the difference in depths of the water tables at two sites. The water table depth at King Avenue is deeper than that at West Jefferson.

References:

1. Options 1 and 2 of the Branch Technical Position, "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" (46 FR 52061, October 23, 1981).

2. NRC Memorandum, "Acceptable Cleanup Criteria and Practices for Decontamination and Decommissioning (License No. SNM-7)" dated April 17, 1992, to Harley L. Toy, License Coordinator and Manager, Nuclear Sciences, Battelle Memorial Institute from J.W.N. Hickey, Chief, Fuel Cycle Safety Branch, Division of Industrial and Medical Nuclear Safety, Office of Nuclear Material Safety and Safeguards.

3. DOE Order 5400.5, "Radiation Protection of the Public and the Environment".

4. NRC Policy and Guidance Directive FC83-23, "Termination of Byproduct, Source, and Special Nuclear Material Licenses".

Table 2
Cesium-137 Surrogate Analysis Data & Modified Cs-137 Screening Criteria

Sample ID (a,b)	Cs-137 Activity (pCi/g)	Co-60 Activity (pCi/g)	Eu-152 Activity (pCi/g)	Eu-154 Activity (pCi/g)	Am-241 Activity (b) (pCi/g)	Sr-90 Activity (pCi/g)	Pu-238 Activity (pCi/g)	Pu-239 Activity (pCi/g)
16741	40 1	0 05	<0 096	<0 053	1 36 g	<0 172	<0 009	0 053
16746	21 8	0 04	<0 079	<0 051	1 29 a	<0 184	0 026	0 9
16747	26 1	0 06	<0.077	<0 046	0 89 g	<0.175	<0 011	0 116
16751	8	<0 024	<0 068	<0 047	0 93g	<0.151	0 021	0.496
16752	39 1	0 06	<0 086	<0 046	10 74 a	<0 167	0 131	5.822
16607	74 2	0.28	7 26	0.65	1 18 a	0 59	0 0213	0.629
16608	18 7	0 07	4 03	0 26	0 47 a	<0.180	0 016	0 287
16668	41.6	0 08	<0.098	<0 061	2 59 a	NA	0 036	1 846
16686	38 1	0.07	<0 050	<0 031	4 71 a	NA	0 135	3 84
19079	11.7	0.17	8.02	0.64	0 018	4.39	<0 016	0.034
19080	32.4	<0.016	0 562	<0.053	<0.016	0.21	<0 019	<0.017
Average	*31.99*	*0 084*	*1 857*	*0 176*	*2.2*	*0.691*	*0 04*	*1 276*

Calculated Cs-137 Surrogate Ratio (c)	
Cs-137/Co-60	381
Cs-137/Eu-152	17
Cs-137/Eu-154	182
Cs-137Am-241	15
Cs-137/Sr-90	46
Cs-137/Pu-238	800
Cs-137/Pu-239	25
Cs-137/Pu-241 (d)	2 8

Modified Cs-137 Screening Criteria			
Cleanup Criteria (pCi/g)		*Surrogate Activity (pCi/g)*	*Summed Ratio*
Cs-137	15	11	0 73
Co-60	8	0.028884026	0 00
Eu-152	36	0 638543295	0 02
Eu 154	32	0 060518912	0 00
Am-241	30	0 756486402	0 03
Sr-90	5	0 237605502	0 05
Pu-238	25	0 013754298	0 00
Pu-239	25	0 438782113	0 02
Pu-241	25	3 928571429	0 16
		Unity Rule (e)	*1.00*

Notes:

(a) Battelle reported analytical results of samples obtained from the filter bed area between March and September 2000

(b) Reported data obtained from gamma spectroscopy analyses

(c) Surrogate ratio calculated by dividing average Cs-137 activity by average activity of isotope of concern

(d) Pu-241 is calculated by applying a ratio to sum of Pu-238 and Pu-239 (obtained from ORIGEN 2 1 derived values, Battelle, 2003c), resulting in a Cs-137 to Pu-241 ratio of 2 8.

(e) Unity Rule applied to surrogate calculated activity resulting in modified Cs-137 screening level of 11 pCi/g

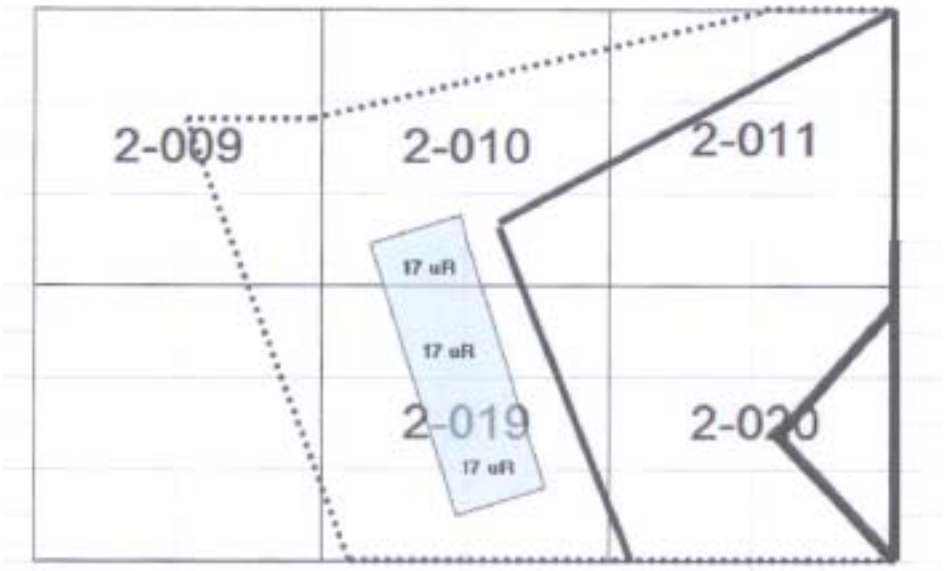
Table 3

JN-2 Foundation Grid Map Dose Rate Survey (uR/hr)

JN-2 Foundation Dose Rate Survey (µR/hr)

Table 4

JN-2 Fuel Tank Vault Dose Rate Survey (Results in uR/hr)



*Fuel Tank removed previously

Table 5
JN-2 Sanitation Line Section D Dose Rate Survey (300-400')

Trench	
1	N/A
2	28
3	N/A
4	N/A
5	25
6	N/A
7	N/A
8	24
9	N/A
10	N/A
11	26
12	N/A
13	N/A
14	24
15	N/A
16	N/A
17	24
18	N/A
19	N/A
20	23
21	N/A
22	N/A
23	24
24	N/A
25	N/A
26	22
27	N/A
28	N/A
29	22
30	N/A

100'

Results in μR/hr

Table 6
JN-2 Sanitation Line Section E Dose Rate Survey (400-500')

	Trench	
	1	N/A
	2	26
	3	N/A
	4	N/A
	5	24
	6	N/A
	7	N/A
	8	24
	9	N/A
	10	N/A
	11	26
	12	N/A
	13	N/A
	14	22
100'	15	N/A
	16	N/A
	17	22
	18	N/A
	19	N/A
	20	23
	21	N/A
	22	N/A
	23	21
	24	N/A
	25	N/A
	26	18
	27	N/A
	28	N/A
	29	20
	30	N/A

Results in μR/hr

Table 7
JN-2 Sanitation Line Section F Dose Rate Survey (500-580')

Trench	
1	N/A
2	15
3	N/A
4	N/A
5	15
6	N/A
7	N/A
8	16
9	N/A
10	N/A
11	15
12	N/A
13	N/A
14	16
15	N/A
16	N/A
17	16
18	N/A
19	N/A
20	15
21	N/A
22	N/A
23	N/A

80'

Results in μR/hr

Table 8
JN-2 Sanitation Line Section G Dose Rate Survey (580-620')

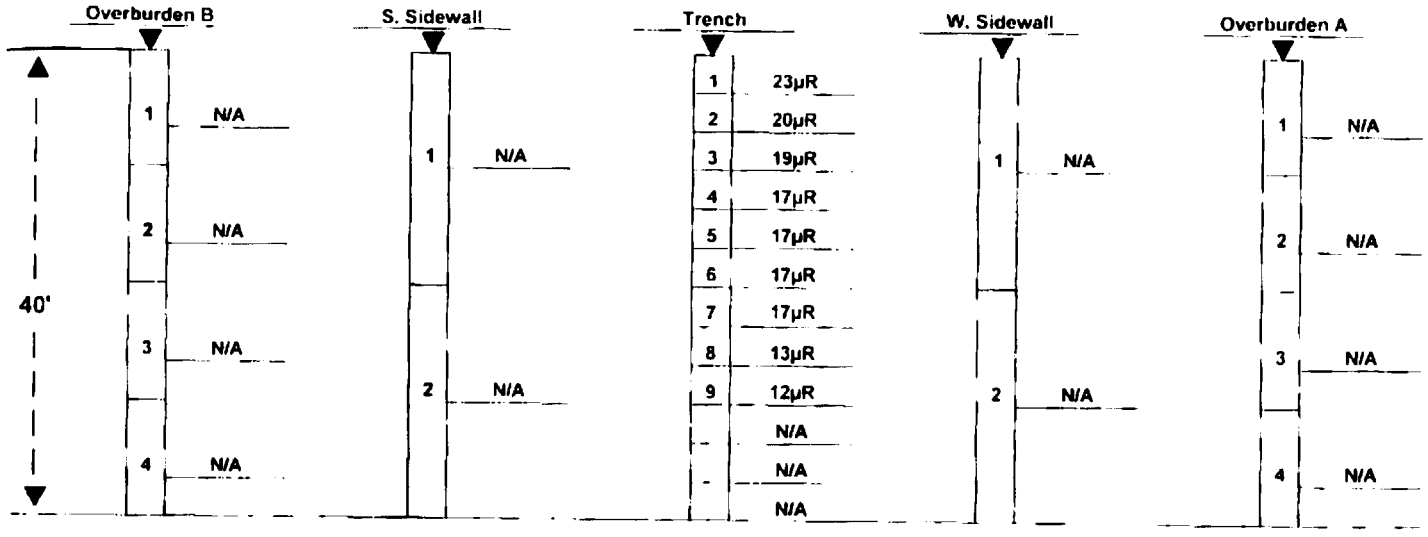


Table 9

JN-2 Foundation Grid Map Walkover Scan Survey (cpm)

JN-2 Foundation Grid Map Walkover Scan Survey (cpm)

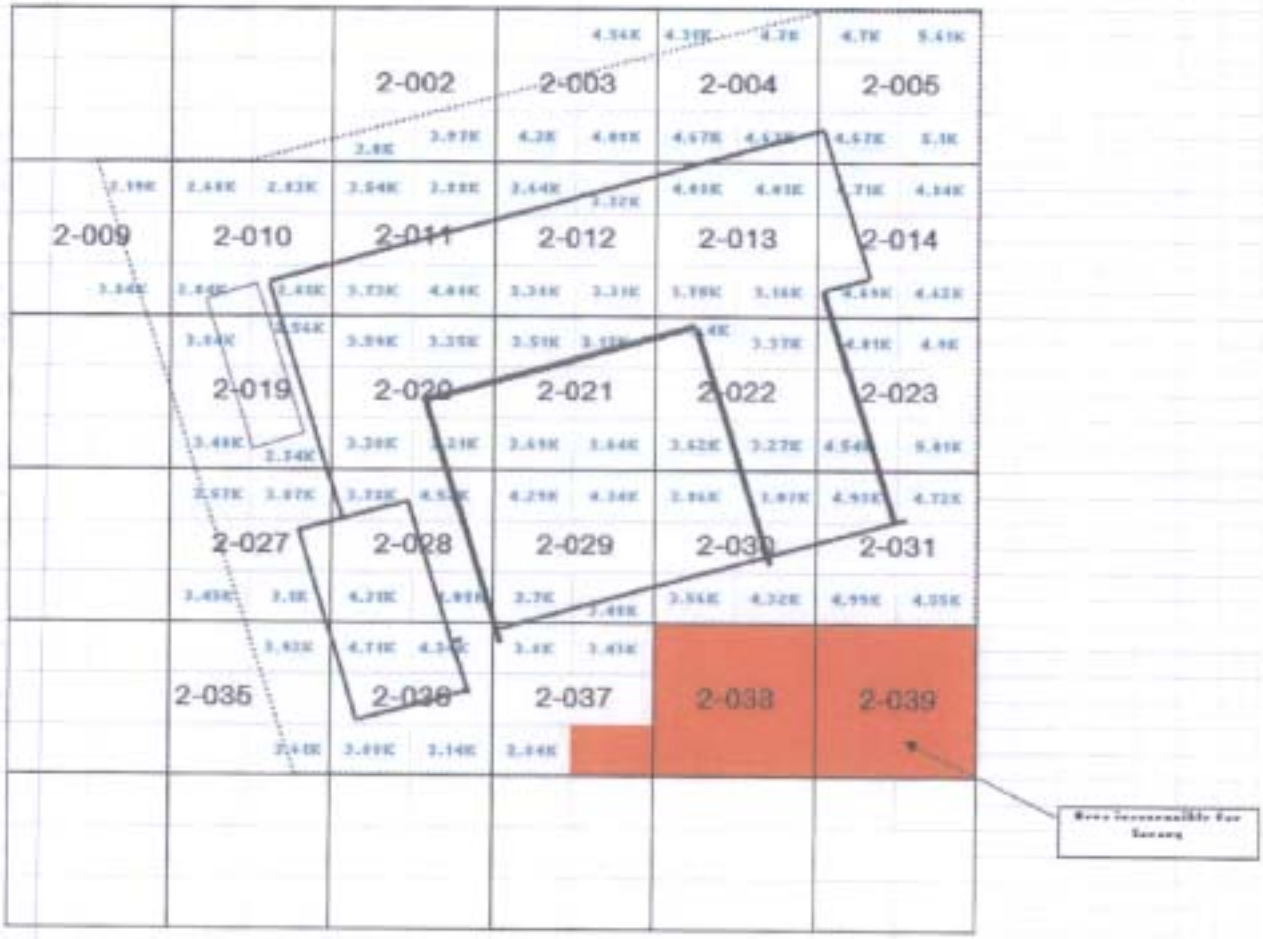
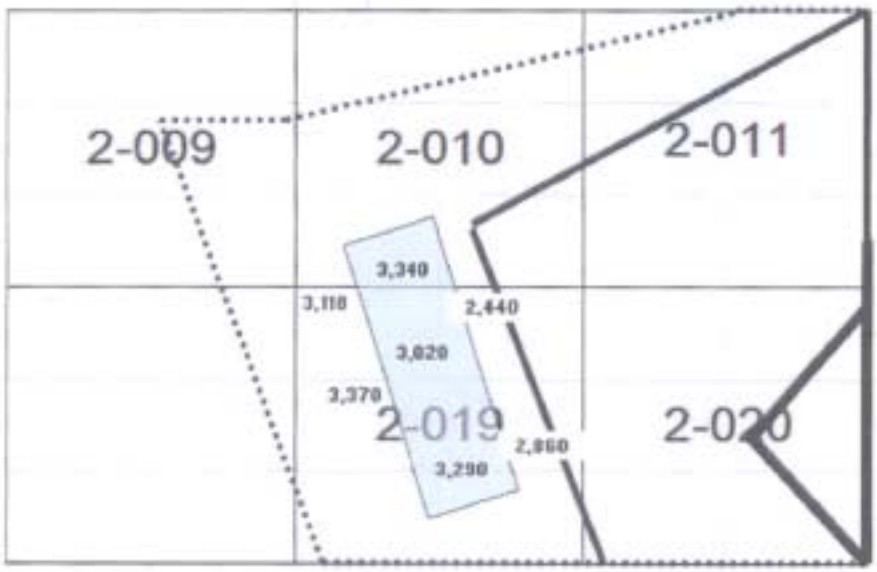


Table 10

JN-2 Fuel Tank Vault Walkover Survey
Results in (cpm)



Walkover survey performed using a collimator.

Table 11

JN-2 Sanitation Line Section D Walkover Results (300-400')

100'

Overburden B		S. Sidewall		Trench		N. Sidewall		Overburden A	
1	5970	1	5600	1	4930	1	4870	1	6610
2	5280			2	4770			2	6340
3	5560	2	5540	3	5040	2	5060	3	5750
4	5970			4	5500			4	5200
5	5080	3	5170	5	5040	3	4780	5	4950
6	4850			6	5020			6	5220
7	4870	4	5110	7	4680	4	5740	7	5400
8	4700			8	4600			8	6000
9	4640	5	5130	9	5200	5	5440	9	5640
10	4440			10	5060			10	5480
				11	5250				
				12	5120				
				13	5020				
				14	4820				
				15	5320				
				16	4750				
				17	4820				
				18	4830				
				19	4900				
				20	4520				
				21	5270				
				22	5520				
				23	4390				
				24	4620				
				25	4920				
				26	4960				
				27	4730				
				28	4580				
				29	4570				
				30	4410				

Walkover survey performed using [illegible]

Results in cpm

Table 12

JN-2 Sanitation Line Section E Walkover Survey Results (400-500')

100'

Overburden B		S. Sidewall		Trench		N. Sidewall		Overburden A	
1	4190	1	4450	1	5160	1	4560	1	4850
2	5030	2	4090	2	4550	2	4290	2	4880
3	4310	3	4800	3	4130	3	4020	3	5460
4	4850	4	4490	4	4090	4	4290	4	4500
5	5460	5	4400	5	5790	5	4150	5	4990
6	5760			6	4110			6	4820
7	4460			7	3810			7	4270
8	4280			8	4320			8	4200
9	5040			9	3600			9	3970
10	5160			10	4010			10	4040
				11	4440				
				12	4380				
				13	4550				
				14	4610				
				15	4460				
				16	4430				
				17	4500				
				18	4380				
				19	4360				
				20	4140				
				21	4070				
				22	4420				
				23	3630				
				24	4480				
				25	4320				
				26	4070				
				27	3980				
				28	4030				
				29	4150				
				30	4560				

Walkover survey performed using a collimator

Results in cpm

Table 13

JN-2 Sanitation Line Section F Walkover Survey (500-580')

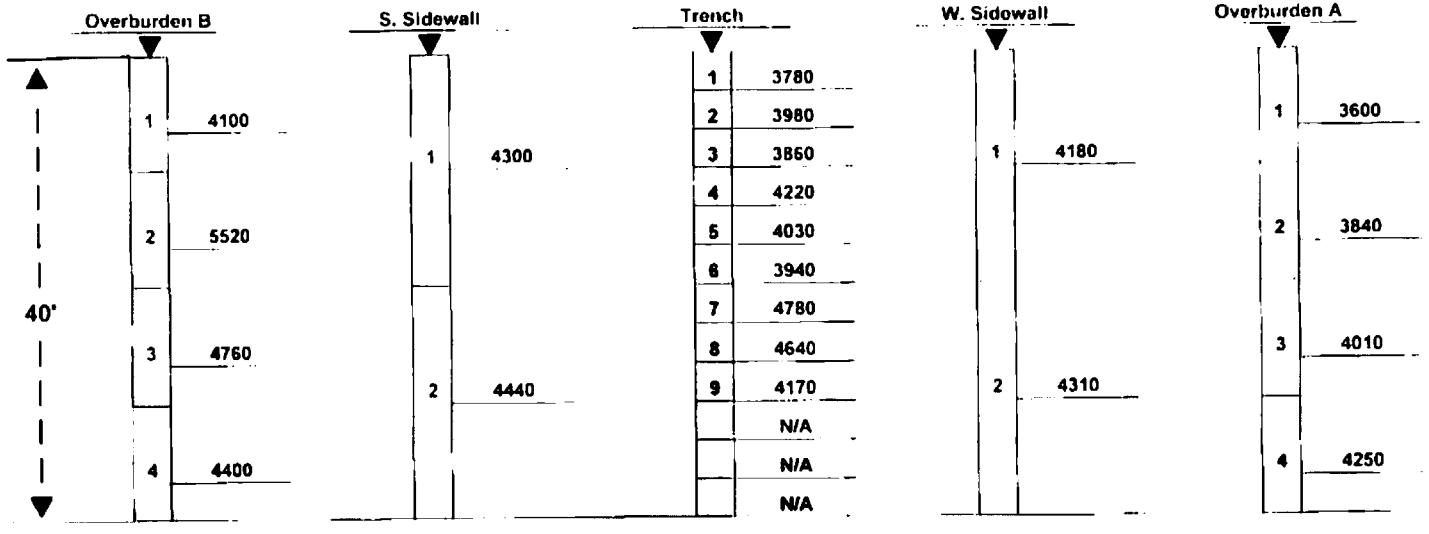
Overburden B		S. Sidewall		Trench		N. Sidewall		Overburden A	
1	4130	1	4370	1	4410	1	3950	1	4450
2	3520			2	4270			2	4470
3	3410	2	3760	3	4430	2	3770	3	4480
4	3790			4	5140			4	3920
5	3860	3	3000	5	4040	3	4680	5	4390
6	3920			6	3860			6	2900
7	2820	4	3440	7	3950	4	4560	7	5150
8	3250			8	3920			8	4080
				9	4200				
				10	3560				
				11	3660				
				12	4190				
				13	3720				
				14	4370				
				15	3740				
				16	3860				
				17	3880				
				18	3720				
				19	3530				
				20	3050				
				21	N/A				
				22	N/A				
				23	N/A				

80'

Walkover survey performed using a collimator

Results in cpm

Table 14
JN-2 Sanitation Line Section G Walkover Survey (580-620')



Walkover survey performed using a collimator.

Results in cpm

Table 15

JN-2 Foundation Soil Sample Results

JN-2 Foundation Soil Sample Results (pCi/g)

Table 16

JN-2 Fuel Tank Vault Soil Sample Results
Results in (pCi/g)

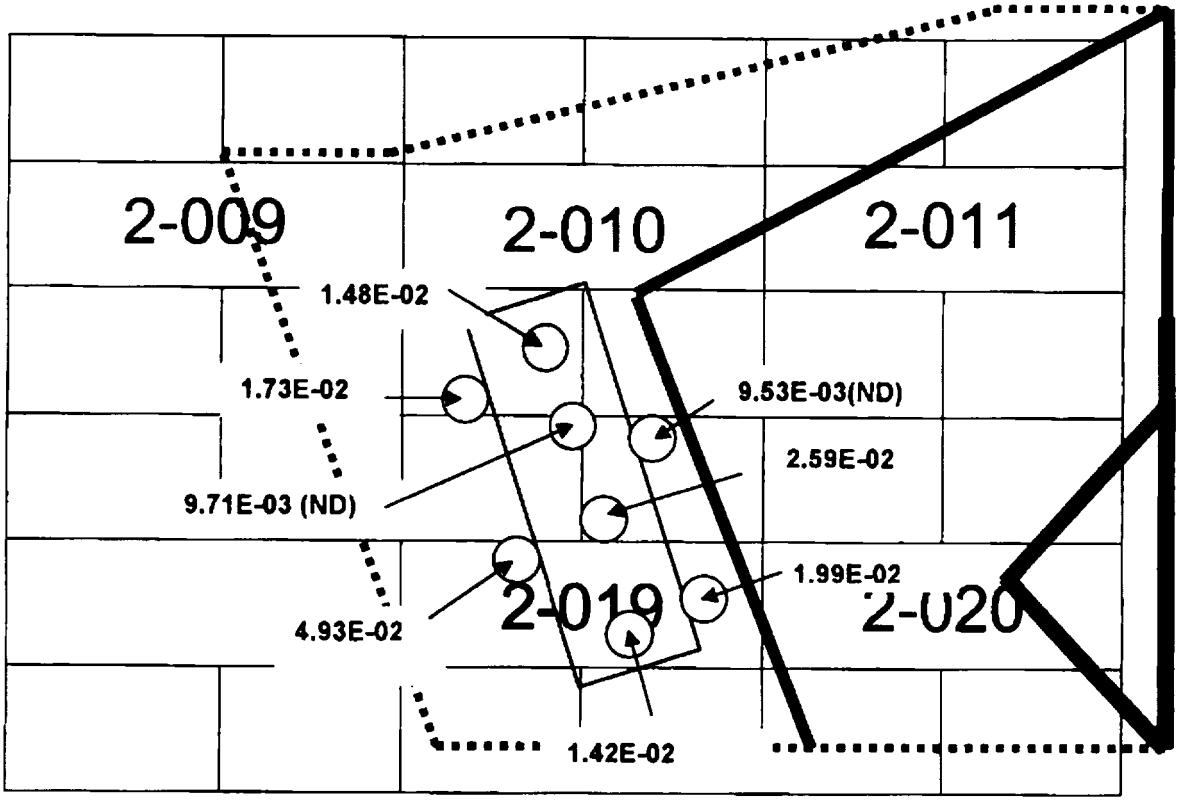


Table 17
JN-2 Sanitation Line Section D Soil Sample Results (300-400')

100'

Overburden B		S. Sidewall		Trench		N. Sidewall		Overburden A	
1	2.96E-02(ND)	1	2.84E-02(ND)	1	3.08E-02(ND)	1	2.56E-02(ND)	1	1.70E-01
2	3.44E-02(ND)			2	3.24E-02(ND)			2	3.31E-02(ND)
				3	2.45E-02(ND)				
				4	3.71E-02(ND)				
				5	2.48E-02(ND)				
				6	3.29E-02(ND)				
3	2.61E-02(ND)			7	2.46E-02(ND)			3	5.14E-02(ND)
		2	3.43E-02(ND)	8	3.21E-02(ND)	2	2.59E-02(ND)		
				9	3.32E-02(ND)				
				10	2.81E-02(ND)				
4	3.14E-02(ND)			11	2.88E-02(ND)			4	3.44E-02(ND)
				12	4.31E-02(ND)				
				13	3.37E-02(ND)				
5	3.00E-02(ND)			14	3.31E-02(ND)			5	4.06E-02(ND)
		3	3.29E-02(ND)	15	3.07E-02(ND)	3	2.69E-02(ND)		
				16	4.06E-02(ND)				
6	2.83E-02(ND)			17	2.28E-02(ND)			6	4.18E-02(ND)
				18	4.76E-02(ND)				
				19	2.84E-02(ND)				
7	2.63E-02(ND)			20	3.24E-02(ND)			7	4.61E-02(ND)
		4	3.09E-02(ND)	21	2.95E-02(ND)	4	3.18E-02(ND)		
				22	1.65E-02(ND)				
8	2.79E-02(ND)			23	1.62E-02(ND)			8	3.42E-02(ND)
				24	1.65E-02(ND)				
				25	2.84E-02				
9	2.80E-02(ND)			26	2.05E-02(ND)			9	4.18E-02(ND)
		5	2.56E-02(ND)	27	1.44E-02(ND)	5	3.11E-02(ND)		
				28	1.49E-02(ND)				
10	3.64E-02(ND)			29	1.42E-02(ND)			10	4.08E-02(ND)
				30	1.67E-02(ND)				

Results in pCi/g

Table 18
JN-2 Sanitation Line Section E Soil Sample Results (400-500')

	Overburden B	S. Sidewall	Trench	N. Sidewall	Overburden A
100'	1 3.41E-01(ND)	1 4.42E-02(ND)	1 1.56E-02(ND)	1 3.32E-02(ND)	1 4.02E-02
	2 4.46E-02(ND)		2 1.34E-02(ND)		2 3.17E-02(ND)
	3 3.36E-02(ND)	2 4.56E-02(ND)	3 1.26E-02(ND)	2 3.98E-02(ND)	3 4.94E-02
	4 3.16E-02(ND)		4 1.56E-02(ND)		4 2.87E-02
	5 3.93E-02(ND)	3 4.16E-02(ND)	5 1.42E-02(ND)	3 4.71E-02	5 3.70E-02(ND)
	6 2.87E-02(ND)		6 1.53E-02(ND)		6 5.25E-02(ND)
	7 3.76E-02(ND)	4 4.87E-02(ND)	7 1.48E-02(ND)	4 3.80E-02(ND)	7 3.58E-02(ND)
	8 3.71E-02(ND)		8 2.78E-02(ND)		8 5.02E-02(ND)
	9 1.87E-02(ND)	5 2.56E-02(ND)	9 2.66E-02	5 5.17E-02	9 7.87E-02
	10 1.68E-02(ND)		10 2.73E-02(ND)		10 3.61E-02
			11 2.53E-02(ND)		
			12 2.79E-02(ND)		
			13 3.34E-02(ND)		
			14 2.33E-02(ND)		
			15 2.62E-02(ND)		
			16 2.83E-02(ND)		
			17 2.55E-02(ND)		
			18 2.72E-02(ND)		
			19 2.76E-02(ND)		
			20 4.79E-02(ND)		
			21 2.72E-02(ND)		
			22 3.30E-02(ND)		
			23 3.13E-02(ND)		
			24 3.72E-02(ND)		
			25 2.84E-02(ND)		
			26 3.53E-02(ND)		
			27 2.86E-02(ND)		
			28 4.12E-02(ND)		
			29 3.06E-02(ND)		
			30 3.79E-02(ND)		

Results in pCi/g

Table 19

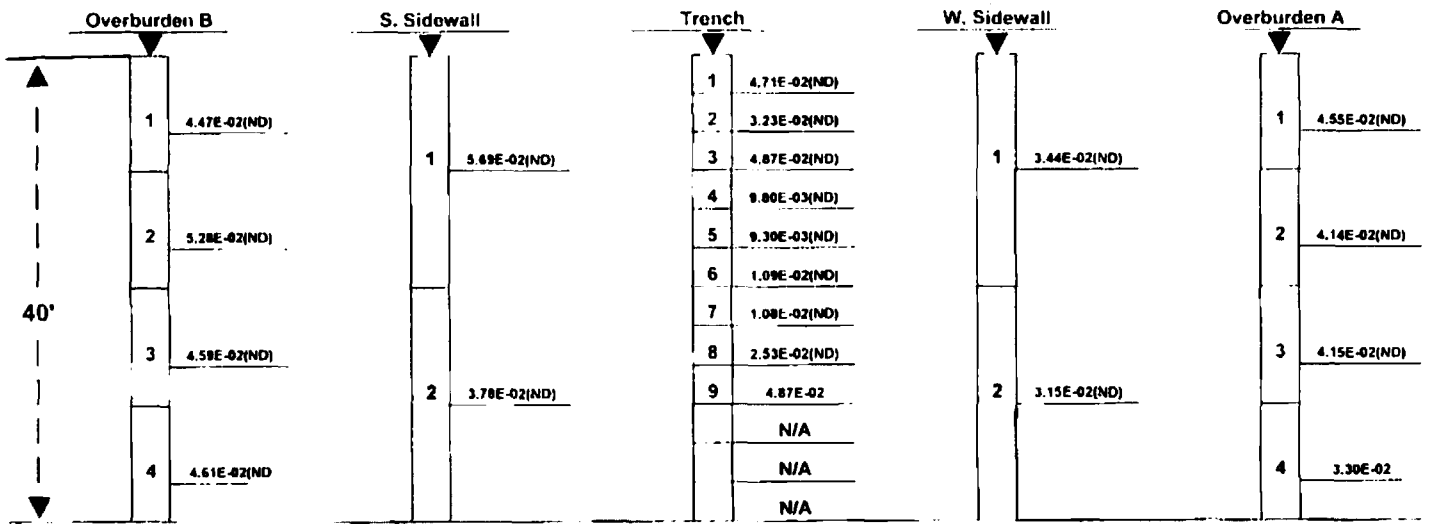
JN-2 Sanitation Line Section F Soil Sample Results (500-580')

Overburden B		S. Sidewall		Trench		N. Sidewall		Overburden A	
1	1.63E-02(ND)	1	5.45E-02	1	2.65E-02(ND)	1	1.97E-02(ND)	1	1.71E-02(ND)
2	4.88E-02(ND)	2	6.10E-02	2	3.38E-02(ND)	2	4.22E-02	2	1.45E-02(ND)
3	4.77E-02(ND)	3	1.60E-02(ND)	3	3.56E-02(ND)	3	7.14E-02	3	3.26E-02(ND)
4	2.90E-02(ND)	4	1.38E-02(ND)	4	4.94E-02(ND)	4	5.95E-02	4	2.40E-02
5	3.93E-02(ND)			5	6.19E-02			5	4.82E-02(ND)
6	2.19E-02(ND)			6	5.23E-02(ND)			6	3.75E-02(ND)
7	1.57E-01			7	3.37E-02(ND)			7	2.09E-02(ND)
8	2.09E-02			8	5.73E-02(ND)			8	4.32E-01
				9	4.60E-02(ND)				
				10	1.32E-01				
				11	4.84E-02(ND)				
				12	4.26E-02(ND)				
				13	3.96E-02(ND)				
				14	4.62E-02(ND)				
				15	3.30E-02(ND)				
				16	5.41E-02(ND)				
				17	3.61E-02(ND)				
				18	5.13E-02(ND)				
				19	3.74E-02(ND)				
				20	3.30E-02(ND)				
				21	N/A				
				22	N/A				
				23	N/A				
				24	N/A				

80'

Results in pCi/g

Table 20
JN-2 Sanitation Line Section G Soil Sample Results (580-620')



Results in pCi/g

Table 21
JN-2 FOUNDATION SUMMARY TABLE

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)		Notes
RL05-2467-2736	Grid 2-002 SW	7/12/2005	7190	3000	17	5.89E-02		
RL05-2468-2737	Grid 2-002 SE	7/12/2005	7850	3970	18	3.86E-02	ND	
RL05-2469-2738	Grid 2-003 NE	7/12/2005	7520	4560	21	5.01E-02	ND	
RL05-2470-2739	Grid 2-003 SW	7/12/2005	7990	4200	19	2.90E-02		
RL05-2471-2740	Grid 2-003 SE	7/12/2005	7840	4080	21	5.26E-02		
RL05-2472-2741	Grid 2-004 NW	7/12/2005	7620	4310	20	3.99E-02	ND	
RL05-2473-2742	Grid 2-004 NE	7/12/2005	7490	4700	21	5.56E-02		
RL05-2476-2745	Grid 2-004 SW	7/12/2005	7700	4670	21	6.36E-02		
RL05-2477-2746	Grid 2-004 SE	7/12/2005	7360	4630	23	5.84E-02		
RL05-2474-2743	Grid 2-005 NW	7/12/2005	7830	4700	24	4.42E-02		
RL05-2475-2744	Grid 2-005 NE	7/12/2005	7730	5610	28	9.94E-02		
RL05-2478-2747	Grid 2-005 SW	7/12/2005	7680	4670	25	1.01E-01		
RL05-2491-2748	Grid 2-005 SE	7/12/2005	8060	5100	28	1.09E-01		
RL05-2548-2805	Grid 2-009 NE	7/13/2005	7080	3190	14	3.33E-02		
RL05-2549-2806	Grid 2-009 SE	7/13/2005	7100	3840	16	1.42E-01		
RL05-2550-2807	Grid 2-010 NW	7/13/2005	6680	2680	14	5.32E-02		
RL05-2551-2808	Grid 2-010 NE	7/13/2005	6530	2830	16	1.49E-02	ND	
RL05-2552-2809	Grid 2-010 SW	7/13/2005	7120	2840	15	1.05E-01		
RL05-2553-2810	Grid 2-010 SE	7/13/2005	6350	2810	16	3.52E-02		
RL05-2502-2759	Grid 2-011 NW	7/12/2005	7940	3540	18	3.89E-02	ND	
RL05-2503-2760	Grid 2-011 NE	7/12/2005	7510	3880	17	6.25E-02		
RL05-2504-2761	Grid 2-011 SW	7/12/2005	7420	3730	17	2.78E-02	ND	
RL05-2505-2762	Grid 2-011 SE	7/12/2005	7310	4080	18	3.66E-02	ND	
RL05-2493-2750	Grid 2-012 NW	7/12/2005	7350	3640	17	1.11E-01		
RL05-2494-2751	Grid 2-012 NE	7/12/2005	7380	3320	19	7.39E-02		
RL05-2495-2752	Grid 2-012 SW	7/12/2005	7140	3380	19	2.81E-02	ND	
RL05-2496-2753	Grid 2-012 SE	7/12/2005	7480	3310	20	2.64E-02	ND	
RL05-2497-2754	Grid 2-013 NW	7/12/2005	7210	4080	20	2.84E-02	ND	
RL05-2498-2755	Grid 2-013 NE	7/12/2005	7380	4010	20	2.60E-02	ND	
RL05-2499-2756	Grid 2-013 SW	7/12/2005	7360	3750	19	2.90E-02	ND	
RL05-2500-2757	Grid 2-013 SE	7/12/2005	7330	3160	19	2.66E-02	ND	
RL05-2501-2758	Grid 2-014 NW	7/12/2005	7520	4710	21	1.81E-01		
RL05-2492-2749	Grid 2-014 NE	7/12/2005	7870	4840	25	9.97E-02		
RL05-2514-2771	Grid 2-014 SW	7/12/2005	7210	4690	23	1.40E-01		
RL05-2515-2772	Grid 2-014 SE	7/12/2005	7570	4620	23	8.14E-02		
RL05-2554-2811	Grid 2-019 NW	7/13/2005	7100	3840	14	5.47E-02		
RL05-2555-2812	Grid 2-019 NE	7/13/2005	6690	2560	16	5.89E-02		
RL05-2556-2813	Grid 2-019 SW	7/13/2005	6690	3480	15	1.24E-01		
RL05-2557-2814	Grid 2-019 SE	7/13/2005	6750	2740	17	1.95E-02	ND	
RL05-2506-2763	Grid 2-020 NW	7/12/2005	7350	3590	16	4.00E-02	ND	
RL05-2507-2764	Grid 2-020 NE	7/12/2005	7080	3350	16	3.86E-02	ND	
RL05-2508-2765	Grid 2-020 SW	7/12/2005	7470	3380	15	3.02E-02	ND	
RL05-2509-2766	Grid 2-020 SE	7/12/2005	7170	3210	16	3.48E-02	ND	
RL05-2516-2773	Grid 2-021 NW	7/12/2005	7200	3510	18	2.77E-02	ND	
RL05-2517-2774	Grid 2-021 NE	7/12/2005	7230	3170	18	4.24E-02	ND	Source Storage Tubes FSS Survey
RL05-2518-2775	Grid 2-021 SW	7/12/2005	7230	3690	17	3.12E-02	ND	Source Storage Tubes FSS Survey
RL05-2519-2776	Grid 2-021 SE	7/12/2005	7200	3640	19	4.26E-02	ND	Source Storage Tubes FSS Survey
RL05-2520-2777	Grid 2-022 NW	7/12/2005	7010	3400	19	3.40E-02	ND	Source Storage Tubes FSS Survey
RL05-2521-2778	Grid 2-022 NE	7/12/2005	6900	3370	21	3.92E-02	ND	Source Storage Tubes FSS Survey

Table 21
JN-2 FOUNDATION SUMMARY TABLE

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)		Notes
RL05-2522-2779	Grid 2-022 SW	7/12/2005	7130	3620	20	3.01E-02	ND	Source Storage Tubes FSS Survey
RL05-2523-2780	Grid 2-022 SE	7/12/2005	6730	3270	21	3.99E-02	ND	Source Storage Tubes FSS Survey
RL05-2924-3075	Grid 2-021	8/3/2005	6370	N/A	N/A	1.41E-02		Source Storage Tubes Supplemental
RL05-2925-3076	Grid 2-022	8/3/2005	5910	N/A	N/A	1.66E-02	ND	Source Storage Tubes Supplemental
RL05-2524-2781	Grid 2-023 NW	7/12/2005	7790	4810	25	1.06E-01		
RL05-2525-2782	Grid 2-023 NE	7/12/2005	7640	4900	25	7.15E-02		
RL05-2526-2783	Grid 2-023 SW	7/12/2005	7260	4540	25	8.28E-02		
RL05-2527-2784	Grid 2-023 SE	7/12/2005	7550	5010	25	9.09E-02		
RL05-2558-2815	Grid 2-027 NW	7/13/2005	7400	3570	17	2.75E-01		
RL05-2559-2816	Grid 2-027 NE	7/13/2005	6950	3870	16	1.19E-01		
RL05-2560-2817	Grid 2-027 SW	7/13/2005	6980	3450	15	2.04E-01		
RL05-2561-2818	Grid 2-027 SE	7/13/2005	6930	3100	15	6.54E-02		
RL05-2528-2785	Grid 2-028 NW	7/12/2005	7420	3780	17	2.78E-02	ND	
RL05-2529-2786	Grid 2-028 NE	7/12/2005	7110	4520	18	3.62E-02	ND	
RL05-2530-2787	Grid 2-028 SW	7/12/2005	7250	4310	17	1.05E-01		
RL05-2531-2788	Grid 2-028 SE	7/12/2005	7550	4080	16	4.22E-02	ND	
RL05-2532-2789	Grid 2-029 NW	7/12/2005	6780	4290	19	4.05E-02	ND	
RL05-2533-2790	Grid 2-029 NE	7/12/2005	6580	4340	17	4.48E-02	ND	
RL05-2534-2791	Grid 2-029 SW	7/12/2005	6880	3700	17	6.70E-02		
RL05-2535-2792	Grid 2-029 SE	7/12/2005	7120	3480	19	4.03E-02	ND	
RL05-2536-2793	Grid 2-030 NW	7/12/2005	5990	3860	19	3.94E-02	ND	
RL05-2537-2794	Grid 2-030 NE	7/12/2005	6190	3070	20	3.63E-02	ND	
RL05-2538-2795	Grid 2-030 SW	7/12/2005	6500	3560	20	2.81E-02	ND	
RL05-2539-2796	Grid 2-030 SE	7/12/2005	6640	4320	20	5.02E-02	ND	
RL05-2540-2797	Grid 2-031 NW	7/12/2005	7320	4930	24	1.19E-01		
RL05-2541-2798	Grid 2-031 NE	7/12/2005	7490	4720	25	5.77E-02	ND	
RL05-2542-2799	Grid 2-031 SW	7/12/2005	7050	4990	24	4.91E-02		
RL05-2543-2800	Grid 2-031 SE	7/12/2005	7540	4550	25	5.17E-02	ND	
RL05-2562-2819	Grid 2-035 NE	7/13/2005	7410	3920	15	1.76E-01		Calibration Source Well FSS Survey
RL05-2563-2820	Grid 2-035 SE	7/13/2005	7270	3610	15	2.17E-01		Calibration Source Well FSS Survey
RL05-2510-2767	Grid 2-036 NW	7/12/2005	7700	4710	16	1.11E-01		Calibration Source Well FSS Survey
RL05-2511-2768	Grid 2-036 NE	7/12/2005	7840	4340	16	6.29E-02		Calibration Source Well FSS Survey
RL05-2512-2769	Grid 2-036 SW	7/12/2005	7220	3880	16	1.16E-01		Calibration Source Well FSS Survey
RL05-2513-2770	Grid 2-036 SE	7/12/2005	7050	3140	16	2.57E-02	ND	Calibration Source Well FSS Survey
RL05-2406-2649	Source Well	7/11/2005	6540	N/A	N/A	1.74E-01		Base of Calibration Source Well
RL05-2407-2650	Source Well	7/11/2005	6690	N/A	N/A	3.30E-02	ND	Base of Calibration Source Well
RL05-2544-2801	Grid 2-037 NW	7/12/2005	7650	3800	17	4.93E-02	ND	
RL05-2545-2802	Grid 2-037 NE	7/12/2005	6550	3430	17	6.18E-02		
RL05-2546-2803	Grid 2-037 SW	7/12/2005	6520	2840	17	6.21E-02	ND	
			Max 8060	Max 5610	Max 28	Max 2.75E-01		
			Min 5910	Min 2560	Min 14	Min 1.41E-02		
		Sample # 68	Average 7196	Average 3885	Average 19	Average 6.66E-02		
			St Dev 456.751	St Dev 675.696	St Dev 3.427	St Dev 0.040		

* Walkover survey performed using calibrated

Table 22
JN-2 Fuel Tank Vault Summary Table

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2873	Bottom 1	7/15/2005	7650	3340	17	1.42E-02	
RL05-2874	Bottom 2	7/15/2005	7740	N/A	N/A	2.59E-02	
RL05-2875	Bottom 3	7/15/2005	6670	3020	17	9.71E-03	ND
RL05-2876	Bottom 4	7/15/2005	6720	3290	17	1.48E-02	
RL05-2877	E.Sidewall 1	7/15/2005	7190	2440	N/A	1.99E-02	
RL05-2878	E.Sidewall 2	7/15/2005	6730	2860	N/A	9.53E-03	ND
RL05-2879	W.Sidewall 1	7/15/2005	7640	3110	N/A	4.93E-02	
RL05-2880	W.Sidewall 2	7/15/2005	6710	3370	N/A	1.73E-02	
			Max: 7740	Max: 3370	Max: 17	Max: 4.93E-02	
			Min: 6670	Min: 2440	Min: 17	Min: 9.53E-03	
		Sample #: 8	Average: 7131	Average: 3061	Average: 17	Average: 2.01E-02	
			St Dev: 481.410	St Dev: 330.627	St Dev: 0.000	St Dev: 0.013	

* Walkover survey performed using a collimator.

Table 23
JN-2 Foundation Post Footer Removal FSS

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan (Results in cpm)	Cs-137 Content (Results in pCi/g)	
RL05-2916-3067	Grid 2-005	8/3/2005	6150	N/A	1.52E-02	ND
RL05-2917-3068	Grid 2-010	8/3/2005	6120	N/A	1.58E-02	ND
RL05-2918-3069	Grid 2-011	8/3/2005	6020	N/A	1.28E-02	ND
RL05-2919-3070	Grid 2-012	8/3/2005	6040	N/A	1.60E-02	ND
RL05-2920-3071	Grid 2-013	8/3/2005	6230	N/A	3.11E-02	
RL05-2921-3072	Grid 2-014	8/3/2005	6110	N/A	1.74E-02	ND
RL05-2922-3073	Grid 2-019	8/3/2005	6200	N/A	1.61E-02	ND
RL05-2923-3074	Grid 2-020	8/3/2005	6270	N/A	1.58E-02	ND
RL05-2924-3075	Grid 2-021	8/3/2005	6370	N/A	1.41E-02	
RL05-2925-3076	Grid 2-022	8/3/2005	5910	N/A	1.66E-02	ND
RL05-2926-3077	Grid 2-023	8/3/2005	5700	N/A	1.35E-02	ND
RL05-2927-3078	Grid 2-027	8/3/2005	5460	N/A	1.54E-02	ND
RL05-2928-3079	Grid 2-028	8/3/2005	6070	N/A	1.69E-02	
RL05-2929-3080	Grid 2-029	8/3/2005	5740	N/A	1.65E-02	ND
RL05-2930-3081	Grid 2-030	8/3/2005	5520	N/A	3.38E-02	ND
RL05-2931-3082	Grid 2-031	8/3/2005	5690	N/A	2.92E-02	ND
RL05-2932-3083	Grid 2-035	8/3/2005	6270	N/A	1.44E-01	
RL05-2933-3084	Grid 2-036	8/3/2005	5690	N/A	2.97E-02	ND
RL05-2934-3085	Grid 2-037	8/3/2005	5830	N/A	9.79E-02	
			Max: 6370		Max: 1.44E-01	
			Min: 5460		Min: 1.28E-02	
		Sample #: 19	Average: 5968		Average: 2.99E-02	
			St Dev: 270.875		St Dev: 3.36E-02	

Table 24

JN-2 Sanitation Line Trench "Sidewall" Comparison Value

Area/Volume ID	JN-2 Sanitary Line	Number of Data Points	t95% (n-1) Value from Table B-1 of NUREG/CR-5849
	Sidewalls	32	1.697

Number	Section	Sample Number	Cs-137 Result (pCi/g)	
1	D	RL05-2296-2613	2.56E-02	ND
2	D	RL05-2298-2615	2.59E-02	ND
3	D	RL05-2300-2617	2.69E-02	ND
4	D	RL05-2302-2619	3.18E-02	ND
5	D	RL05-2304-2621	3.11E-02	ND
6	D	RL05-2297-2614	2.84E-02	ND
7	D	RL05-2299-2616	3.43E-02	ND
8	D	RL05-2301-2618	3.29E-02	ND
9	D	RL05-2303-2620	3.09E-02	ND
10	D	RL05-2305-2622	2.56E-02	ND
11	E	RL05-2341-2627	3.32E-02	ND
12	E	RL05-2343-2629	3.98E-02	ND
13	E	RL05-2345-2631	4.71E-02	
14	E	RL05-2347-2633	3.80E-02	ND
15	E	RL05-2349-2635	5.17E-02	
16	E	RL05-2342-2628	4.42E-02	ND
17	E	RL05-2344-2630	4.56E-02	ND
18	E	RL05-2346-2632	4.16E-02	ND
19	E	RL05-2348-2634	4.87E-02	ND
20	E	RL05-2350-2636	4.85E-02	ND
21	F	RL05-2479-2723	1.97E-02	ND
22	F	RL05-2481-2725	4.22E-02	
23	F	RL05-2483-2727	7.14E-02	
24	F	RL05-2485-2729	5.95E-02	
25	F	RL05-2480-2724	5.45E-02	
26	F	RL05-2482-2726	6.10E-02	
27	F	RL05-2484-2728	1.60E-02	ND
28	F	RL05-2486-2730	1.36E-02	ND
29	G	RL05-2614-2863	3.44E-02	ND

Area/Volume ID	JN-2 Sanitary Line	Number of Data Points	t95% (n-1) Value from Table B-1 of NUREG/CR-5849
Sidewalls		32	1.697

Number	Section	Sample Number	Cs-137 Result (pCi/g)	
30	G	RL05-2616-2865	3.15E-02	ND
31	G	RL05-2615-2864	5.69E-02	ND
32	G	RL05-2681-2913	3.78E-02	ND
			Max: 7.14E-02	
			Min: 1.36E-02	

Comparison Value Equation $\mu_\alpha = \bar{x} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n}}$

Average	Comparison Value
3.84E-02	0.04
Standard Deviation	**Modified Screening Criteria**
0.01	11
	Comparison < Criteria
	Yes

Table 25
JN-2 Sanitation Line Section D Summary Table
SECTION D (300 - 400')

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2252-2540	C @ 91 meters	7/7/2005	8940	4930	N/A	3.08E-02	ND
RL05-2253-2541	C @ 92 meters	7/7/2005	8220	4770	28	3.24E-02	ND
RL05-2254-2542	C @ 93 meters	7/7/2005	8170	5040	N/A	2.45E-02	ND
RL05-2255-2543	C @ 94 meters	7/7/2005	8220	5500	N/A	3.71E-02	ND
RL05-2256-2544	C @ 95 meters	7/7/2005	8140	5040	25	2.48E-02	ND
RL05-2257-2545	C @ 96 meters	7/7/2005	8280	5020	N/A	3.29E-02	ND
RL05-2258-2546	C @ 97 meters	7/7/2005	8300	4680	N/A	2.46E-02	ND
RL05-2259-2547	C @ 98 meters	7/7/2005	8080	4600	24	3.21E-02	ND
RL05-2260-2548	C @ 99 meters	7/7/2005	7870	5200	N/A	3.32E-02	ND
RL05-2262-2549	C @ 100 meters	7/7/2005	8360	5060	N/A	2.81E-02	ND
RL05-2263-2550	C @ 101 meters	7/7/2005	8060	5250	26	2.88E-02	ND
RL05-2264-2551	C @ 102 meters	7/7/2005	8030	5120	N/A	4.31E-02	ND
RL05-2265-2552	C @ 103 meters	7/7/2005	7790	5020	N/A	3.37E-02	ND
RL05-2266-2553	C @ 104 meters	7/7/2005	8290	4820	24	3.31E-02	ND
RL05-2267-2554	C @ 105 meters	7/7/2005	7950	5320	N/A	3.07E-02	ND
RL05-2268-2555	C @ 106 meters	7/7/2005	7710	4750	N/A	4.05E-02	ND
RL05-2269-2556	C @ 107 meters	7/7/2005	7250	4820	24	2.28E-02	ND
RL05-2270-2557	C @ 108 meters	7/7/2005	7440	4830	N/A	4.76E-02	ND
RL05-2271-2558	C @ 109 meters	7/7/2005	7910	4900	N/A	2.84E-02	ND
RL05-2272-2559	C @ 110 meters	7/7/2005	7920	4520	23	3.24E-02	ND
RL05-2273-2560	C @ 111 meters	7/7/2005	7960	5270	N/A	2.95E-02	ND
RL05-2276-2561	C @ 112 meters	7/7/2005	8150	5520	N/A	1.65E-02	ND
RL05-2277-2562	C @ 113 meters	7/7/2005	7740	4390	24	1.62E-02	ND
RL05-2278-2563	C @ 114 meters	7/7/2005	7750	4620	N/A	1.65E-02	ND
RL05-2279-2564	C @ 115 meters	7/7/2005	7620	4920	N/A	2.84E-02	
RL05-2410-2668	C @ 116 meters	7/11/2005	10500	4960	22	2.05E-02	ND
RL05-2411-2669	C @ 117 meters	7/11/2005	10400	4730	N/A	1.44E-02	ND
RL05-2412-2670	C @ 118 meters	7/11/2005	11000	4580	N/A	1.49E-02	ND
RL05-2413-2671	C @ 119 meters	7/11/2005	10700	4570	22	1.42E-02	ND
RL05-2414-2672	C @ 120 meters	7/11/2005	11600	4410	N/A	1.67E-02	ND
RL05-2211-2503	A O/B @ 310'	7/6/2005	8200	6610	N/A	1.70E-01	
RL05-2212-2504	A O/B @ 320'	7/6/2005	7990	6340	N/A	3.31E-02	ND
RL05-2213-2505	A O/B @ 330'	7/6/2005	7790	5750	N/A	5.14E-02	ND
RL05-2214-2506	A O/B @ 340'	7/6/2005	7610	5200	N/A	3.44E-02	ND
RL05-2215-2507	A O/B @ 350'	7/6/2005	8300	4950	N/A	4.06E-02	ND
RL05-2216-2508	A O/B @ 360'	7/6/2005	6790	5220	N/A	4.18E-02	ND
RL05-2217-2509	A O/B @ 370'	7/6/2005	7640	5400	N/A	4.61E-02	ND

Table 25
JN-2 Sanitation Line Section D Summary Table
SECTION D (300 - 400')

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2218-2510	A O/B @ 380'	7/6/2005	7210	6000	N/A	3.42E-02	ND
RL05-2219-2515	A O/B @ 390'	7/6/2005	7490	5640	N/A	4.18E-02	ND
RL05-2220-2516	A O/B @ 400'	7/6/2005	6760	5480	N/A	4.08E-02	ND
RL05-2226-2511	B O/B @ 310'	7/6/2005	7610	5970	N/A	2.96E-02	ND
RL05-2227-2512	B O/B @ 320'	7/6/2005	7290	5280	N/A	3.44E-02	ND
RL05-2228-2513	B O/B @ 330'	7/6/2005	6970	5560	N/A	2.61E-02	ND
RL05-2229-2514	B O/B @ 340'	7/6/2005	7450	5970	N/A	3.14E-02	ND
RL05-2230-2518	B O/B @ 350'	7/6/2005	7920	5080	N/A	3.00E-02	ND
RL05-2231-2520	B O/B @ 360'	7/6/2005	6960	4850	N/A	2.83E-02	ND
RL05-2232-2521	B O/B @ 370'	7/6/2005	7710	4870	N/A	2.83E-02	ND
RL05-2233-2522	B O/B @ 380'	7/6/2005	7530	4700	N/A	2.79E-02	ND
RL05-2234-2523	B O/B @ 390'	7/6/2005	7640	4640	N/A	2.80E-02	ND
RL05-2238-2527	B O/B @ 400'	7/6/2005	7380	4440	N/A	3.64E-02	ND
RL05-2296-2613	N. Side @ 310'	7/8/2005	7790	4870	N/A	2.56E-02	ND
RL05-2298-2615	N. Side @ 330'	7/8/2005	8160	5060	N/A	2.59E-02	ND
RL05-2300-2617	N. Side @ 350'	7/8/2005	7090	4780	N/A	2.69E-02	ND
RL05-2302-2619	N. Side @ 370'	7/8/2005	7480	5740	N/A	3.18E-02	ND
RL05-2304-2621	N. Side @ 390'	7/8/2005	7690	5440	N/A	3.11E-02	ND
RL05-2297-2614	S. Side @ 320'	7/8/2005	7760	5600	N/A	2.84E-02	ND
RL05-2299-2616	S. Side @ 340'	7/8/2005	7310	5540	N/A	3.43E-02	ND
RL05-2301-2618	S. Side @ 360'	7/8/2005	7380	5170	N/A	3.29E-02	ND
RL05-2303-2620	S. Side @ 380'	7/8/2005	7390	5110	N/A	3.09E-02	ND
RL05-2305-2622	S. Side @ 400'	7/8/2005	7970	5130	N/A	2.56E-02	ND
			Max 11600	Max 6610	Max 28	Max 1.70E-01	
			Min 6760	Min 4390	Min 22	Min 1.42E-02	
		Sample #: 60	Average: 8010	Average: 5126	Average: 24	Average: 3.26E-02	
			St Dev: 964.069	St Dev: 471.335	St Dev: 1.814	St Dev: 1.98E-02	

* Walkover survey performed using a collimator.

Table 26
JN-2 Sanitation Line Section E Summary Table
SECTION E (400 - 500')

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2415-2673	C @ 121 meters	7/11/2005	11400	5160	N/A	1.55E-02	ND
RL05-2416-2674	C @ 122 meters	7/11/2005	10600	4550	26	1.34E-02	ND
RL05-2417-2675	C @ 123 meters	7/11/2005	10700	4130	N/A	1.26E-02	ND
RL05-2418-2676	C @ 124 meters	7/11/2005	10700	4090	N/A	1.55E-02	ND
RL05-2419-2677	C @ 125 meters	7/11/2005	11000	5790	24	1.42E-02	ND
RL05-2420-2678	C @ 126 meters	7/11/2005	10700	4110	N/A	1.53E-02	ND
RL05-2421-2679	C @ 127 meters	7/11/2005	11000	3810	N/A	1.48E-02	ND
RL05-2422-2680	C @ 128 meters	7/11/2005	10800	4320	24	2.78E-02	ND
RL05-2423-2681	C @ 129 meters	7/11/2005	10900	3600	N/A	2.66E-02	
RL05-2424-2682	C @ 130 meters	7/11/2005	10400	4010	N/A	2.73E-02	ND
RL05-2425-2683	C @ 131 meters	7/11/2005	10500	4440	26	2.53E-02	ND
RL05-2426-2684	C @ 132 meters	7/11/2005	10800	4380	N/A	2.79E-02	ND
RL05-2427-2685	C @ 133 meters	7/11/2005	11300	4550	N/A	3.34E-02	ND
RL05-2428-2686	C @ 134 meters	7/11/2005	10900	4610	22	2.33E-02	ND
RL05-2429-2687	C @ 135 meters	7/11/2005	11000	4460	N/A	2.62E-02	ND
RL05-2430-2688	C @ 136 meters	7/11/2005	11000	4430	N/A	2.83E-02	ND
RL05-2431-2689	C @ 137 meters	7/11/2005	11200	4500	22	2.55E-02	ND
RL05-2432-2690	C @ 138 meters	7/11/2005	10900	4380	N/A	2.72E-02	ND
RL05-2433-2691	C @ 139 meters	7/11/2005	10600	4360	N/A	2.76E-02	ND
RL05-2434-2692	C @ 140 meters	7/11/2005	10300	4140	23	4.79E-02	ND
RL05-2435-2693	C @ 141 meters	7/11/2005	10900	4070	N/A	2.72E-02	ND
RL05-2436-2694	C @ 142 meters	7/11/2005	10900	4420	N/A	3.30E-02	ND
RL05-2437-2695	C @ 143 meters	7/11/2005	11000	3830	21	3.13E-02	ND
RL05-2438-2696	C @ 144 meters	7/12/2005	11100	4480	N/A	3.72E-02	ND
RL05-2439-2697	C @ 145 meters	7/12/2005	11100	4320	N/A	2.84E-02	ND
RL05-2440-2698	C @ 146 meters	7/12/2005	10800	4070	18	3.53E-02	ND
RL05-2441-2699	C @ 147 meters	7/12/2005	10800	3980	N/A	2.86E-02	ND
RL05-2442-2700	C @ 148 meters	7/12/2005	10900	4030	N/A	4.12E-02	ND
RL05-2443-2701	C @ 149 meters	7/12/2005	10900	4150	20	3.06E-02	ND
RL05-2444-2702	C @ 150 meters	7/12/2005	11100	4560	N/A	3.79E-02	ND
RL05-2221-2517	A O/B @ 410'	7/6/2005	6680	4850	N/A	4.02E-02	
RL05-2222-2519	A O/B @ 420'	7/6/2005	7150	4880	N/A	3.17E-02	ND
RL05-2235-2524	A O/B @ 430'	7/6/2005	7430	5460	N/A	4.94E-02	

Table 26
JN-2 Sanitation Line Section E Summary Table
SECTION E (400 - 500')

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2236-2525	A O/B @ 440'	7/6/2005	7520	4500	N/A	2.87E-02	
RL05-2237-2526	A O/B @ 450'	7/6/2005	8210	4990	N/A	3.70E-02	ND
RL05-2242-2531	A O/B @ 460'	7/6/2005	7920	4820	N/A	5.25E-02	ND
RL05-2243-2532	A O/B @ 470'	7/6/2005	7680	4270	N/A	3.58E-02	ND
RL05-2244-2533	A O/B @ 480'	7/6/2005	7760	4200	N/A	5.02E-02	ND
RL05-2251-2539	A O/B @ 490'	7/7/2005	7130	3970	N/A	7.87E-02	
RL05-2280-2565	A O/B @ 500'	7/7/2005	6810	4040	N/A	3.61E-02	
RL05-2239-2528	B O/B @ 410'	7/6/2005	7260	4190	N/A	3.41E-02	ND
RL05-2240-2529	B O/B @ 420'	7/6/2005	7700	5030	N/A	4.46E-02	ND
RL05-2241-2530	B O/B @ 430'	7/6/2005	8180	4310	N/A	3.35E-02	ND
RL05-2245-2534	B O/B @ 440'	7/6/2005	7670	4850	N/A	3.16E-02	ND
RL05-2246-2535	B O/B @ 450'	7/6/2005	7540	5460	N/A	3.93E-02	ND
RL05-2247-2536	B O/B @ 460'	7/6/2005	7610	5760	N/A	2.87E-02	ND
RL05-2249-2537	B O/B @ 470'	7/7/2005	7790	4460	N/A	3.76E-02	ND
RL05-2250-2538	B O/B @ 480'	7/7/2005	7250	4280	N/A	3.71E-02	ND
RL05-2281-2566	B O/B @ 490'	7/7/2005	6740	5040	N/A	1.87E-02	ND
RL05-2283-2568	B O/B @ 500'	7/7/2005	7640	5160	N/A	1.68E-02	ND
RL05-2341-2627	N. Side @ 410'	7/8/2005	7670	4560	N/A	3.32E-02	ND
RL05-2343-2629	N. Side @ 430'	7/8/2005	7420	4290	N/A	3.98E-02	ND
RL05-2345-2631	N. Side @ 450'	7/8/2005	7140	4020	N/A	4.71E-02	
RL05-2347-2633	N. Side @ 470'	7/8/2005	6510	4290	N/A	3.80E-02	ND
RL05-2349-2635	N. Side @ 490'	7/8/2005	7350	4150	N/A	5.17E-02	
RL05-2342-2628	S. Side @ 420'	7/8/2005	7890	4450	N/A	4.42E-02	ND
RL05-2344-2630	S. Side @ 440'	7/8/2005	8000	4090	N/A	4.56E-02	ND
RL05-2346-2632	S. Side @ 460'	7/8/2005	7670	4800	N/A	4.16E-02	ND
RL05-2348-2634	S. Side @ 480'	7/8/2005	7360	4490	N/A	4.87E-02	ND
RL05-2350-2636	S. Side @ 500'	7/8/2005	7340	4400	N/A	4.85E-02	ND
			Max: 11400	Max: 5790	Max: 26	Max: 7.87E-02	
			Min: 6510	Min: 3600	Min: 18	Min: 1.26E-02	
		Sample #: 60	Average: 9170	Average: 4463	Average: 23	Average: 3.35E-02	
			St Dev: 1751.140	St Dev: 458.781	St Dev: 2.547	St Dev: 1.21E-02	

* Walkover survey performed using a collimator.

Table 27
JN-2 Sanitation Line Section F Summary Table
SECTION F (500 - 580')

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2445-2703	C @ 151 meters	7/12/2005	11000	4410	N/A	2.65E-02	ND
RL05-2446-2704	C @ 152 meters	7/12/2005	11200	4270	15	3.38E-02	ND
RL05-2447-2705	C @ 153 meters	7/12/2005	10700	4430	N/A	3.56E-02	ND
RL05-2448-2706	C @ 154 meters	7/12/2005	10600	5140	N/A	4.94E-02	ND
RL05-2449-2707	C @ 155 meters	7/12/2005	10600	4040	15	5.19E-02	
RL05-2452-2708	C @ 156 meters	7/12/2005	10600	3860	N/A	5.23E-02	ND
RL05-2453-2709	C @ 157 meters	7/12/2005	10900	3950	N/A	3.37E-02	ND
RL05-2454-2710	C @ 158 meters	7/12/2005	10400	3920	16	5.73E-02	ND
RL05-2455-2711	C @ 159 meters	7/12/2005	10400	4200	N/A	4.60E-02	ND
RL05-2456-2712	C @ 160 meters	7/12/2005	10300	3560	N/A	1.32E-01	
RL05-2457-2713	C @ 161 meters	7/12/2005	10500	3660	15	4.84E-02	ND
RL05-2458-2714	C @ 162 meters	7/12/2005	10500	4190	N/A	4.25E-02	ND
RL05-2459-2715	C @ 163 meters	7/12/2005	10400	3720	N/A	3.96E-02	ND
RL05-2460-2716	C @ 164 meters	7/12/2005	10600	4370	16	4.52E-02	ND
RL05-2461-2717	C @ 165 meters	7/12/2005	10700	3740	N/A	3.30E-02	ND
RL05-2462-2718	C @ 166 meters	7/12/2005	10600	3860	N/A	5.41E-02	ND
RL05-2463-2719	C @ 167 meters	7/12/2005	10500	3880	16	3.51E-02	ND
RL05-2464-2720	C @ 168 meters	7/12/2005	10700	3720	N/A	5.13E-02	ND
RL05-2465-2721	C @ 169 meters	7/12/2005	10600	3530	N/A	3.74E-02	ND
RL05-2466-2722	C @ 170 meters	7/12/2005	10900	3050	15	3.30E-02	ND
RL05-2282-2567	A O/B @ 510'	7/7/2005	7040	4450	N/A	1.71E-02	ND
RL05-2285-2570	A O/B @ 520'	7/7/2005	6550	4470	N/A	1.45E-02	ND
RL05-2287-2572	A O/B @ 530'	7/7/2005	6760	4480	N/A	3.26E-02	ND
RL05-2295-2612	A O/B @ 540'	7/8/2005	7540	3920	N/A	2.40E-02	
RL05-2340-2624	A O/B @ 550'	7/8/2004	7130	4390	N/A	4.62E-02	ND
RL05-2351-2637	A O/B @ 560'	7/8/2005	6380	2900	N/A	3.75E-02	ND
RL05-2490-2734	A O/B @ 570'	7/12/2005	10200	5150	N/A	2.09E-02	ND
RL05-2491-2735	A O/B @ 580'	7/12/2005	10200	4080	N/A	4.32E-01	
RL05-2284-2569	B O/B @ 510'	7/7/2005	7650	4130	N/A	1.63E-02	ND
RL05-2286-2571	B O/B @ 520'	7/7/2005	8700	3520	N/A	4.88E-02	ND
RL05-2288-2573	B O/B @ 530'	7/7/2005	7590	3410	N/A	4.77E-02	ND
RL05-2306-2623	B O/B @ 540'	7/8/2005	8250	3790	N/A	2.90E-02	ND
RL05-2307-2625	B O/B @ 550'	7/12/2005	6830	3860	N/A	3.93E-02	ND

Table 27
JN-2 Sanitation Line Section F Summary Table
SECTION F (500 - 580')

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2487-2731	B O/B @ 560'	7/12/2005	10600	3920	N/A	2.19E-02	ND
RL05-2488-2732	B O/B @ 570'	7/12/2005	9790	2820	N/A	1.57E-01	
RL05-2489-2733	B O/B @ 580'	7/12/2005	10300	3250	N/A	2.09E-02	
RL05-2479-2723	N. Side @ 510'	7/12/2005	10600	3950	N/A	1.97E-02	ND
RL05-2481-2725	N. Side @ 530'	7/12/2005	10700	3770	N/A	4.22E-02	
RL05-2483-2727	N. Side @ 550'	7/12/2005	10100	4680	N/A	7.14E-02	
RL05-2485-2729	N. Side @ 570'	7/12/2005	10000	4560	N/A	5.95E-02	
RL05-2480-2724	S. Side @ 520'	7/12/2005	10600	4370	N/A	5.45E-02	
RL05-2482-2726	S. Side @ 540'	7/12/2005	10200	3760	N/A	6.10E-02	
RL05-2484-2728	S. Side @ 560'	7/12/2005	10000	3000	N/A	1.60E-02	ND
RL05-2486-2730	S. Side @ 580'	7/12/2005	9730	3440	N/A	1.36E-02	ND
			Max: 11200	Max: 5150	Max: 16	Max: 4.32E-01	
			Min: 6360	Min: 2820	Min: 15	Min: 1.36E-02	
		Sample #: 44	Average: 9685	Average: 3945	Average: 15	Average: 5.19E-02	
			St Dev: 1456.642	St Dev: 524.659	St Dev: 0.535	St Dev: 6.44E-02	

* Walkover survey performed using a collimator

Table 28
JN-2 Sanitation Line Section G Summary Table
SECTION G (580 - 620')

Sample ID	Location	Collection Date	Field Screen Result (cpm)	Walkover Scan* (Results in cpm)	Dose Rates (Results in µR/hr)	Cs-137 Content (Results in pCi/g)	
RL05-2617-2866	C @ 171 meters	7/15/2005	7970	3780	23	4.71E-02	ND
RL05-2618-2867	C @ 172 meters	7/15/2005	7960	3980	20	3.23E-02	ND
RL05-2619-2868	C @ 173 meters	7/15/2005	7800	3860	19	4.87E-02	ND
RL05-2620-2869	C @ 174 meters	7/15/2005	8130	4220	17	9.80E-03	ND
RL05-2621-2870	C @ 175 meters	7/15/2005	7990	4030	17	9.30E-03	ND
RL05-2622-2871	C @ 176 meters	7/15/2005	7320	3940	17	1.09E-02	ND
RL05-2623-2872	C @ 177 meters	7/15/2005	7890	4780	17	1.08E-02	ND
RL05-2682-2914	C @ 178 meters	7/21/2005	6690	4640	13	2.53E-02	ND
RL05-2683-2915	C @ 179 meters	7/21/2005	6530	4170	12	4.87E-02	
RL05-2608-2857	A O/B @ 590'	7/15/2005	8020	3600	N/A	4.55E-02	ND
RL05-2609-2858	A O/B @ 600'	7/15/2005	7830	3840	N/A	4.14E-02	ND
RL05-2612-2861	A O/B @ 610'	7/15/2005	7660	4010	N/A	4.15E-02	ND
RL05-2679-2911	A O/B @ 620'	7/21/2005	6800	4250	N/A	3.30E-02	
RL05-2610-2859	B O/B @ 590'	7/15/2005	7580	4100	N/A	4.47E-02	ND
RL05-2611-2860	B O/B @ 600'	7/15/2005	7770	5520	N/A	5.28E-02	ND
RL05-2613-2862	B O/B @ 610'	7/15/2005	7020	4760	N/A	4.59E-02	ND
RL05-2680-2912	B O/B @ 620'	7/21/2005	6970	4400	N/A	4.61E-02	ND
RL05-2614-2863	W. Side @ 590'	7/15/2005	7600	4180	N/A	3.44E-02	ND
RL05-2616-2865	W. Side @ 610'	7/15/2005	7750	4310	N/A	3.15E-02	ND
RL05-2615-2864	E. Side @ 600'	7/15/2005	7260	4300	N/A	5.69E-02	ND
RL05-2681-2913	E. Side @ 620'	7/21/2005	6810	4440	N/A	3.78E-02	ND
			Max: 8130	Max 5520	Max: 23	Max: 5.69E-02	
			Min: 6530	Min 3600	Min: 12	Min: 9.30E-03	
		Sample # 21	Average 7493	Average 4243	Average: 17	Average 3.59E-02	
			St Dev 501.579	St Dev 426.794	St Dev 3.346	St Dev 1.49E-02	

* Walkover survey performed using a collimator.

Table 29

JN-2 Sanitation Line Trench Overburden "A" Comparison Value

Area/Volume ID	JN-2 Sanitary Line	Number of Data Points	t95% (n-1) Value from Table B-1 of NUREG/CR-5849
Overburden A		32	1.697

Number	Section	Sample Number	Cs-137 Result (pCi/g)	
1	D	RL05-2211-2503	1.70E-01	
2	D	RL05-2212-2504	3.31E-02	ND
3	D	RL05-2213-2505	5.14E-02	ND
4	D	RL05-2214-2506	3.44E-02	ND
5	D	RL05-2215-2507	4.06E-02	ND
6	D	RL05-2216-2508	4.18E-02	ND
7	D	RL05-2217-2509	4.61E-02	ND
8	D	RL05-2218-2510	3.42E-02	ND
9	D	RL05-2219-2515	4.18E-02	ND
10	D	RL05-2220-2516	4.08E-02	ND
11	E	RL05-2221-2517	4.02E-02	
12	E	RL05-2222-2519	3.17E-02	ND
13	E	RL05-2235-2524	4.94E-02	
14	E	RL05-2236-2525	2.87E-02	
15	E	RL05-2237-2526	3.70E-02	ND
16	E	RL05-2242-2531	5.25E-02	ND
17	E	RL05-2243-2532	3.58E-02	ND
18	E	RL05-2244-2533	5.02E-02	ND
19	E	RL05-2251-2539	7.87E-02	
20	E	RL05-2280-2565	3.61E-02	
21	F	RL05-2282-2567	1.71E-02	ND
22	F	RL05-2285-2570	1.45E-02	ND
23	F	RL05-2287-2572	3.26E-02	ND
24	F	RL05-2295-2612	2.40E-02	
25	F	RL05-2340-2624	4.62E-02	ND
26	F	RL05-2351-2637	3.75E-02	ND
27	F	RL05-2490-2734	2.09E-02	ND
28	F	RL05-2491-2735	4.32E-01	
29	G	RL05-2608-2857	4.55E-02	ND

Area/Volume ID	JN-2 Sanitary Line	Number of Data Points	t95% (n-1) Value from Table B-1 of NUREG/CR-5849
Overburden A		32	1.697

Number	Section	Sample Number	Cs-137 Result (pCi/g)	
30	G	RL05-2609-2858	4.14E-02	ND
31	G	RL05-2612-2861	4.15E-02	ND
32	G	RL05-2679-2911	3.30E-02	

Max: 4.32E-01
Min: 1.45E-02

Comparison Value Equation

Average	Comparison Value
5.50E-02	0.08

Standard Deviation	Modified Screening Criteria
0.07	11

Comparison < Criteria
Yes

Table 30

JN-2 Sanitation Line Trench Overburden "B" Comparison Value

Area/Volume ID	JN-2 Sanitary Line	Number of Data Points	t95% (n-1) Value from Table B-1 of NUREG/CR-5849
Overburden B		32	1.697

Number	Section	Sample Number	Cs-137 Result (pCi/g)	
1	D	RL05-2226-2511	2.96E-02	ND
2	D	RL05-2227-2512	3.44E-02	ND
3	D	RL05-2228-2513	2.61E-02	ND
4	D	RL05-2229-2514	3.14E-02	ND
5	D	RL05-2230-2518	3.00E-02	ND
6	D	RL05-2231-2520	2.83E-02	ND
7	D	RL05-2232-2521	2.83E-02	ND
8	D	RL05-2233-2522	2.79E-02	ND
9	D	RL05-2234-2523	2.80E-02	ND
10	D	RL05-2238-2527	3.64E-02	ND
11	E	RL05-2239-2528	3.41E-02	ND
12	E	RL05-2240-2529	4.46E-02	ND
13	E	RL05-2241-2530	3.35E-02	ND
14	E	RL05-2245-2534	3.16E-02	ND
15	E	RL05-2246-2535	3.93E-02	ND
16	E	RL05-2247-2536	2.87E-02	ND
17	E	RL05-2249-2537	3.76E-02	ND
18	E	RL05-2250-2538	3.71E-02	ND
19	E	RL05-2281-2566	1.87E-02	ND
20	E	RL05-2283-2568	1.68E-02	ND
21	F	RL05-2284-2569	1.63E-02	ND
22	F	RL05-2286-2571	4.88E-02	ND
23	F	RL05-2288-2573	4.77E-02	ND
24	F	RL05-2306-2623	2.90E-02	ND
25	F	RL05-2307-2625	3.93E-02	ND
26	F	RL05-2487-2731	2.19E-02	ND
27	F	RL05-2488-2732	1.57E-01	
28	F	RL05-2489-2733	2.09E-02	

Area/Volume ID	JN-2 Sanitary Line	Number of Data Points	t95% (n-1) Value from Table B-1 of NUREG/CR-5849
Overburden B		32	1.697

Number	Section	Sample Number	Cs-137 Result (pCi/g)	
29	G	RL05-2610-2859	4.47E-02	ND
30	G	RL05-2611-2860	5.28E-02	ND
31	G	RL05-2613-2862	4.59E-02	ND
32	G	RL05-2680-2912	4.61E-02	ND
			Max: 1.57E-01	
			Min: 1.63E-02	

Comparison Screening Value $\mu_\alpha = \bar{x} + t_{1-\alpha,df} \frac{s_x}{\sqrt{n}}$

Average	Comparison Value
3.73E-02	0.04

Standard Deviation	Modified Screening Criteria
0.02	11

Comparison < Criteria
Yes

Table 31

Routine Plant Perimeter Surveys

Routine Plant Perimeter Surveys

Date	Mar/Apr 05					
			Reference Survey #			
		micro rem/hr	HPS #	J-28473	J-28553	J-28588
				J-28613	J-28791	J-28936
Readings in micro rem/hr.		103		J-28975		
		7				
		20				
		30				
		20				
		30				
		130				
		10				
		10				
		10				
		10				
		10				
		10				
		30				
		60				
	Avg.	33				
	SD	37				