

**Final
CLOSEOUT REPORT**

**High Flux Beam Reactor
Fan Houses (Building 704 and Building 802)
Decontamination and Dismantlement (D&D)
Area of Concern 31**

**Brookhaven National Laboratory
Upton, New York**



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Executive Summary

The High Flux Beam Reactor (HFBR) Fan Houses (Building 704 and Building 802) are associated with Area of Concern (AOC) 31 at Brookhaven National Laboratory (BNL). Decontamination and Dismantlement (D&D) of the HFBR Fan Houses, the removal of the associated structures, ducts and piping, and the subsequent final status survey (FSS), referred to herein as the HFBR Fan Houses Project, are part of the actions described as near-term D&D in the *Record of Decision – Area of Concern 31, High Flux Beam Reactor* (BNL, February, 2009) (HFBR ROD). The project was performed with funding from the American Recovery and Reinvestment Act (ARRA) and in accordance with *Closeout Procedures at National Priority List Sites*, Office of Solid Waste and Emergency Response (OSWER) Directive 9320.2-09A-P (EPA, 2000a) and the *Remedial Design/Remedial Action Work Plan for the Decontamination and Dismantlement (D&D) of Fan Houses (Building 704 and Building 802)* (BNL, April 2010).

Remedial activities associated with the HFBR Fan Houses Project were divided into two work phases that commenced in March 2010 and were completed in June 2011. Upon completion of D&D activities, an FSS and independent verification survey (IVS) of the building footprints and associated excavations were completed to ensure that soil cleanup objectives were met in accordance with the HFBR ROD. The soil cleanup objectives for radiological contamination were based on a dose, to a resident (non-farmer) from remaining concentrations of all radionuclides present, of less than or equal to 15 millirem per year (mrem/year) above background after 50 years of institutional control by the Department of Energy (DOE), and industrial land use with no decay time (0 years).

The following summarizes the as-left conditions for the HFBR Fan Houses and how they satisfy the requirements of the HFBR ROD:

- The average cesium (Cs)-137 and radium (Ra)-226 concentrations remaining in the HFBR Fan Houses soils are 1.16 picocuries per gram (pCi/g) and 0.33 pCi/g, respectively. Strontium (Sr)-90 concentrations were below laboratory detection limits (1.2 pCi/g). The as-left average concentrations are well below the site cleanup goals (Cs-137 = 23 pCi/g, Sr-90 = 15 pCi/g and Ra-226 = 5 pCi/g). The maximum concentrations detected in soil samples were as follows: 14.9 pCi/g for Cs-137, less than laboratory detection limits (1.2 pCi/g) for Sr-90, and 0.80 pCi/g for Ra-226.
- The as-left average concentrations of the chemical contaminants of concern detected in soil samples are below the site cleanup goals (lead = 400 milligrams per kilogram (mg/kg), mercury = 1.84 mg/kg, polychlorinated biphenyls (PCBs) = 1 mg/kg). The maximum concentrations of lead, mercury and PCBs detected in soil samples were 19.2 mg/kg, 0.02 mg/kg and 0.22 mg/kg, respectively.
- For the HFBR Fan Houses, the maximum projected dose to a resident (non-farmer) after 50 years of institutional controls is 1.2 mrem/yr. For a resident with

no decay time (Year 0), the maximum projected annual dose is 2.6 mrem/year. The maximum projected dose to an industrial worker with no decay time is 0.7 mrem/yr. The results of the dose assessment are well below the limits established in the HFBR ROD, including the dose objective of 15 mrem/yr and the New York State Department of Environmental Conservation (NYSDEC) cleanup guideline of 10 mrem/yr from Technical and Administrative Guidance Memorandum (TAGM) 4003, which was adopted as an As Low As Reasonably Achievable (ALARA) goal.

- Site restoration for the HFBR Fan Houses Project was completed in July 2011. Restoration included backfilling, re-grading, re-paving and reseeding lawn areas with Long Island native grasses.

The HFBR Fan Houses Project meets all the completion requirements as specified in OSWER Directive 9320.2-09-A-P, *Closeout Procedures for National Priorities List Sites*.

The *HFBR Long Term Surveillance and Maintenance Manual* will be prepared to include the post remediation surveillance and maintenance activities for the HFBR Fan Houses area. These activities will include institutional controls (land use controls, notifications and restrictions, work planning controls such as digging permits, and government ownership). The topsoil cover, placed during site restoration, will also be inspected for signs of erosion.

BSA will perform surveillance and maintenance activities. In addition to maintaining institutional controls for the HFBR Fan Houses area, BSA will ensure that that routine monitoring/inspections are performed. DOE will ensure enforcement of all institutional controls.

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ACRONYM LIST

AC	Alternating Current
ACM	Asbestos-Containing Material
ALARA	As Low As Reasonably Achievable
Am	Americium
ANL	Argonne National Laboratory
AOC	Area of Concern
ARRA	American Recover and Reinvestment Act
BNL	Brookhaven National Laboratory
BGRR	Brookhaven Graphite Research Reactor
BSA	Brookhaven Science Associates
C&D	Construction and Demolition
CDM	CDM Federal Programs
CPM	Counts Per Minute
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
Ci	Curies
Co	Cobalt
Cs	Cesium
DAC	Derived Air Concentration
DC	Direct Current
D&D	Decontamination and Dismantlement
DOE	Department Of Energy
DQO	Data Quality Objective
EABFF	Exit Air Bypass Filter Facility
EM	Environmental Management
EPA	United States Environmental Protection Agency
EPD	Environmental Protection Division
ERP	Environmental Restoration Projects
ES	Energy Solutions of Utah
Eu	Europium
F&O	Facility and Operations
FRDP	Facility Review Disposition Project
FS	Feasibility Study
FSS	Final Status Survey
GPS	Global Positioning System
HFBR	High Flux Beam Reactor
IAG	Interagency Agreement
IH	Industrial Hygiene
IVS	Independent Verification Survey
JRA	Job Risk Assessment
LLRW	Low-Level Radioactive Waste
mg/kg	Milligrams per Kilograms
MARSSIM	Multi-Agency Radiological Survey and Site Investigation Manual
mrem/yr	Millirem Per Year

NaI	Sodium Iodide
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
Ni	Nickel
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
ORISE	Oak Ridge Institute for Science and Education
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
pCi/g	Picocuries per Gram
PCBs	Polychlorinated Biphenyls
PRAP	Proposed Remedial Action Plan
Pu	Plutonium
PWGC	P.W. Grosser Consulting, Inc.
QA	Quality Assurance
QC	Quality Control
Ra	Radium
RCD	Radiological Controls Division
RCT	Radiological Controls Technician
RESRAD	Residual Radioactivity Computer Code
RI	Remedial Investigation
RMA	Radioactive Materials Area
ROD	Record of Decision
RWP	Radiological Work Permit
SCDHS	Suffolk County Department of Health Services
SBMS	Standards Based Management System
SCO	Soil Cleanup Objective
SOP	Standard Operating Procedure
Sr	Strontium
SU	Survey Unit
SWP	Simple Work Procedure
TAGM	Technical and Administrative Guidance Memorandum
TLD	Thermoluminescent Dosimeter
U	Uranium
UIC	Underground Injection Control
USC	United States Code
VCP	Vitrified Clay Pipe
WAC	Waste Acceptance Criteria
WP	Work Procedure

1.0 INTRODUCTION

1.1 Purpose

The purpose of this closeout report is to document the completed actions associated with the decontamination and dismantlement (D&D) of two High Flux Beam Reactor (HFBR) ancillary buildings, Building 704 (Fan House and underground plenum) and Building 802 (Fan House and Tritiated Water Evaporator Facility). This closeout report also documents the removal the associated tanks, ducts, piping, underground structures and contaminated soil, as well as the subsequent final status survey (FSS). This work is referred to herein as the “HFBR Fan Houses Project.” The HFBR is designated as Area of Concern (AOC) 31 at Brookhaven National Laboratory (BNL). The HFBR Fan Houses Project is part of the actions described as near-term D&D in the *Record of Decision – Area of Concern 31, High Flux Beam Reactor* (BNL, February, 2009) (HFBR ROD). The project was performed with funding under the American Recovery and Reinvestment Act (ARRA) and in accordance with *Closeout Procedures at National Priority List Sites, OSWER Directive 9320.2-09A-P* (EPA, 2000a).

Remedial activities associated with the HFBR Fan Houses Project were performed by BNL’s Environmental Restoration Projects (ERP), ERP-seconded and task order subcontractors, Brookhaven Science Associates (BSA) Radiological Control Division (RCD), and Environmental Protection Division (EPD) personnel. Verification radiological surveys and sampling were performed by DOE’s independent verification contractor, Oak Ridge Institute for Science and Education (ORISE).

Work was performed in accordance with the HFBR ROD, the *Remedial Design/Remedial Action Work Plan for the Decontamination and Dismantlement (D&D) of Fan Houses (Building 704 and Building 802)* (BNL, April 2010) and the *Excavation Plan for Building 704 (Fan House) and Building 802 (Fan House/Tritiated Water Evaporator Facility)*, Rev 1 (BNL, March, 2011). The FSS was performed in accordance with the *Field Sampling Plan for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, Update: July 2010) and the *Field Sampling Plan Addendum for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, July 2010); as well as the *Field Sampling Plan for Building 705 (Stack) and Remaining HFBR Outside Areas* (BNL, December 2010).

The scope of work for the HFBR Fan Houses Project included the following:

- Dismantlement and removal of Buildings 704 and 802, including structures, systems and components, to at least 2 feet below grade;
- Removal of the Building 704 underground plenum leading to the Building 705 (Stack) silencer and the Exit Air Bypass Filter Facility (EABFF);
- Removal of the cable trench and investigation of the trench drain located beneath Building 704;

- Removal of the Building 704 transformers for reuse/recycling and demolition of the concrete pad;
- Characterization and abandonment in-place of an Underground Injection Control (UIC) system south of Building 704;
- Removal of 165 feet of 30-inch steel duct from Building 704 to the bypass valve pit at the base of the Stack;
- Removal of 60-feet of 42-inch steel secondary cooling air return duct below Building 704 from the Below Ground Duct west to its transition from steel to concrete, placing a cap on the remaining line;
- Removal of 48 feet of underground 18-inch vitrified clay pipe (VCP) north of Building 802 and abandonment in-place of 32 feet of 18-inch VCP where it was overlain by an active high pressure steam line, verifying a cap previously placed on the remaining line;
- Removal of 22 feet of underground 18-inch steel duct from Building 901A just south of Building 802, placing a cap on the remaining line;
- Removal of underground 42-inch duct and 14-inch acid off-gas duct just northwest and beneath Building 802;
- Removal of the Building 802 plenums (36-inch and 14-inch) leading above ground to the Stack;
- Removal of ducts from inside the Bypass Valve Pit and, demolition of the concrete structure to at least 2-feet below grade;
- Characterization of the asphalt, curbing and road base material surrounding Buildings 704 and 802, as well as the soil beneath the buildings, and if necessary, removal of associated contaminated asphalt, curbing, road base material and soil;
- Packaging, transport, and disposal of radiologically and chemically contaminated project waste at an off-site permitted facility;
- Performing a final status survey (FSS) of the areas that encompass the footprints of Building 704, the underground plenum, EABFF;
- Performing a FSS of excavations associated with Building 802 footprint and associated ducts and piping;
- An independent verification survey (IVS) performed by ORISE;
- Restoration of the areas; and
- Preparing a dose assessment and a closeout report.

It should be noted that the pipes and ducts removed as part of the HFBR Fan Houses Project, as specified above and further described in Section 3.1, completes the removal of the pipes and ducts listed in Table 8.2 of the HFBR ROD. The balance of pipes and ducts listed in Table 8.2 were previously addressed during the Waste Transfer Lines Project, HFBR Stabilization Project and HFBR Underground Utilities Project; and are addressed by the applicable closeout report.

It should also be noted that this closeout report addresses Survey Units (SU) 4, 5 and the excavation portion of SU-6, as described in Section 3.2 and the following documents:

- *Field Sampling Plan for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, Update: July 2010)
- *Field Sampling Plan Addendum for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, June 2010);
- *Field Sampling Plan for Building 705 (Stack) and Remaining HFBR Outside Areas* (BNL, December 2010).

For SU-6, the FSS of the overall SU (surface) was not included in the scope of work for the HFBR Fan Houses Project.

1.2 Site Description and Operational History

The BNL site covers almost 5,300 acres, much of which is wooded. It is an irregular polygon, and each side is approximately 2.5 miles long. The developed portion of the BNL site includes the principal facilities, which are located near the center of the BNL site on relatively high ground. The developed portion is approximately 1,650 acres, 500 acres of which were originally developed for U.S. Army use. Large, specialized research facilities occupy 200 acres and another 400 acres are occupied by roads, parking lots and connecting areas. The remaining 550 acres are occupied by outlying facilities including an apartment area, Biology Field, Former Hazardous Waste Management Area, Sewage Treatment Plant, firebreaks, and the Former Landfill Area. The terrain is gently rolling, with elevations varying between 40 to 120 ft above mean sea level. The land lies on the western rim of the shallow Peconic River watershed, with a tributary of the Peconic River rising in marshy areas in the northern section of the tract. The sole-source aquifer beneath BNL comprises three water-bearing units: the upper glacial deposits, the Magothy Formation, and the Lloyd Sand Member of the Raritan Formation. These units are hydraulically connected and make up a single zone of saturation with varying physical properties extending from a depth of 5 to 1,500 ft below the land surface. These three water-bearing units are designated as a “sole source aquifer” by the U.S. Environmental Protection Agency (EPA) and serve as the primary source of drinking water for Nassau and Suffolk counties.

A map illustrating the location of the BNL site is presented as Figure 1-1.

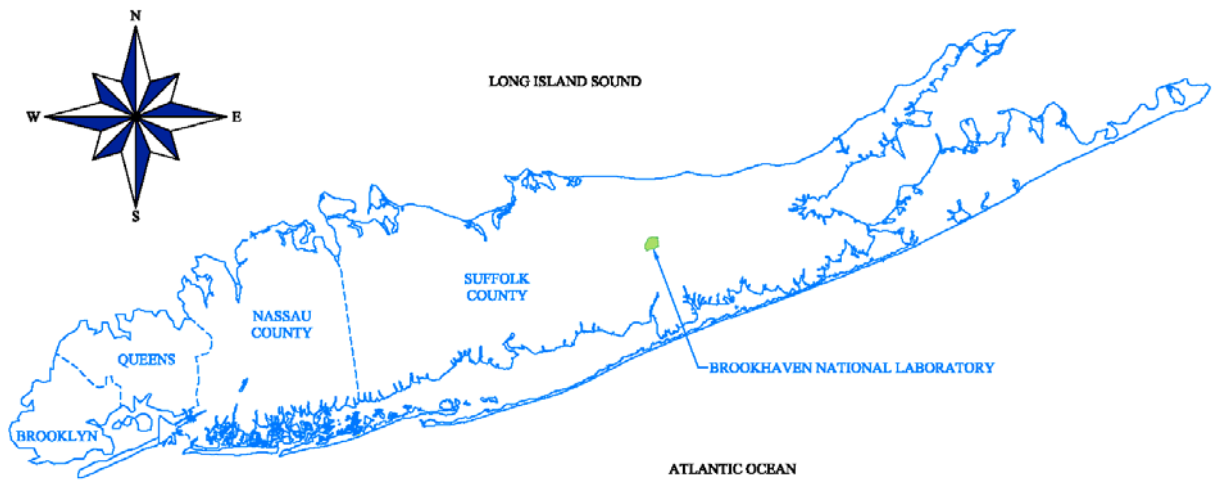


Figure 1-1 Location of Brookhaven National Laboratory

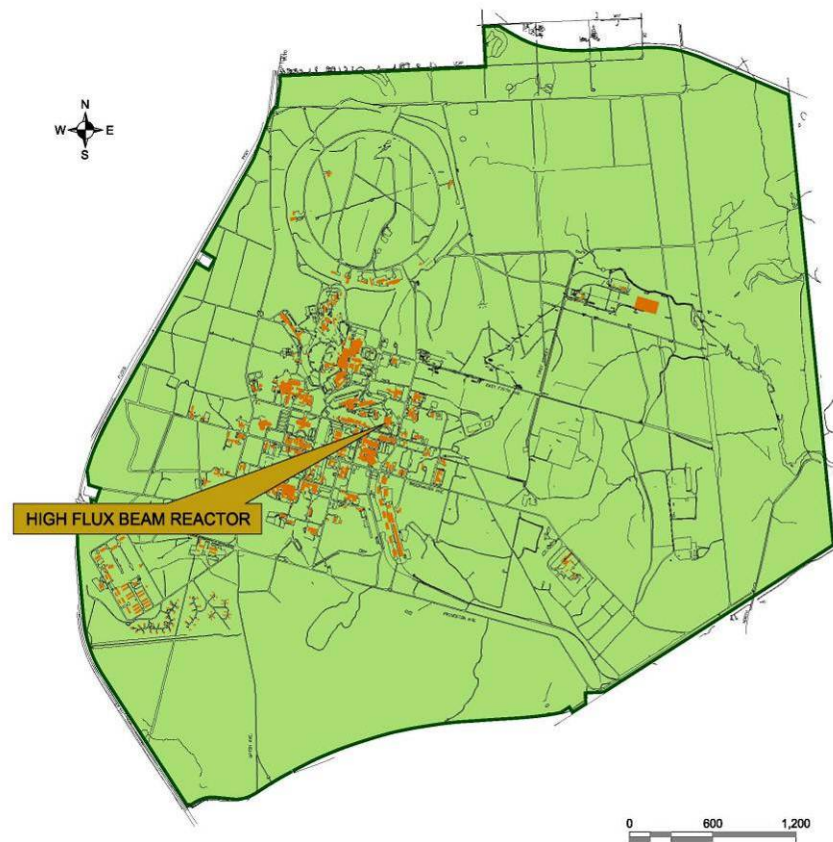


Figure 1-2 HFBR Complex Location at BNL

The HFBR complex is centrally located within the BNL site, as shown in Figure 1-2. The HFBR (Building 750) was designed and constructed for basic experimental research. During its operating lifetime from 1965 to 1996, it provided neutrons for materials science, chemistry, biology, and physics experiments. The Brookhaven Graphite Research Reactor (BGRR) (Building 701) was the first reactor in the United States built solely to perform experiments. It operated from 1950 to 1968. The locations of the HFBR, BGRR, Building 704 and Building 802 are illustrated in Figure 1-3.

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LAWRENCE DR.

815

RUTHERFORD ST.

ABBREVIATIONS

S.S.	STAINLESS STEEL
INV	INVERT ELEVATION
RCP	REINFORCED CONCRETE PIPE
ABAND.	ABANDONED
C.I.	CAST IRON PIPE
VCP	VITRIFIED CLAY PIPE
CONC	CONCRETE
A.G.	ACID GAS
STL	STEEL
Dn	DOWN
NIC	NOT IN CONTRACT

LEGEND

	OFF GAS LINE
	ABANDONED OFF GAS LINE
	HEAD WALL
	STORM TRENCH
	CATCH BASIN
	MANHOLE
	DRY WELL
	CLEAN OUT
	STORM GRATES
	LEACHING POOL
	SEWAGE PUMPING STATION
	HORIZONTAL WELL

COLOR CODES

	IN SCOPE OF WORK
	NOT PART OF WORK

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DRAWN BY:	LLG	SCALE:	AS SHOWN

SHEET TITLE

HFBR FAN HOUSES
SITE PLAN

FIGURE NO
FIGURE 1-3

SHEET

- OF -

0 50 100
SCALE: 1" = 50'

CORNELL AVE.

RAILROAD ST.

D/F WASTE LINE

D/F WASTE LINE

D/F WASTE LINE

80' 18" VCP EXHAUST DUCT
FROM BLDG 815 / 830

22' 18" STL. EXHAUST
DUCT FROM BLDG. 901A
TRANSITIONS
TO ABOVE GRADE

36" CONC.
EXHAUST
DUCT
Dn 7'

24" CONC.
EXHAUST
DUCT

14" S.S. ACID WASTE DUCT Dn 5'

42" CONC. DUCT
Dn 9'

30' 42" STEEL DUCT
FROM BLDG. 801

BLDG. 802 PLENUM

30" STL
Dn 6'

BUILDING 705 PLENUM

165' 30" STEEL DUCT

30" CONC.
Dn 6'

BGRX EXHAUST DUCT

60' 42" I.D. STL. SEC. AIR DUCT

BLDG. 704 UNDERGROUND DUCT

BLDG. 704 UNDERGROUND PLENUM

EXIT AIR FILTER FACILITY

901

901A

750

751

TR737

TR513

FILTER
ROOM

MH232

SANITARY
LINE

Dn 9'

703

701

TR897

1.2.1 Building 704

Building 704 was a one-story, above-grade structure approximately 150-feet long by 60-feet wide. Concrete block, brick walls, and a flat built-up roof covered structural steel supports. The building was constructed in 1950 and was originally designed to support operations at the BGRR. Following shutdown of the BGRR, the building was designated as an HFBR Balance of Plant System because it housed electrical switchgear for alternating current (AC) and direct current (DC) power to the HFBR complex, as well as for the BGRR facility. However, the fans never supported the HFBR. The building housed five primary fans and a secondary fan, which took suction through ducts that penetrated the roof and connected to the aboveground duct bottom. The fans discharged into the underground plenum directly below the fan compartments. The underground plenum ran under and along the northern portion of the building before exiting to the east. The 12-feet wide by 12-feet tall concrete plenum ran underground east of Building 704 for approximately 52 feet before transitioning above ground. The EABFF, located just south of the underground plenum, consisted of an underground, 45-foot long concrete structure, approximately 20-feet wide by 11-feet tall. As a result of past operations and the presence of Radioactive Material Areas (RMAs), Building 704 was posted as a radiologically controlled area. Both the underground plenum and EABFF became radiologically contaminated as the result of past operations.



Photograph 1 – View of Building 704 Looking West

Building 704 also housed a 1,000 gallon temporary stack drain tank, sump and associated piping. The temporary stack drain tank replaced the old stack drain system for the HFBR Stack. The piping for the old stack drain system remained in-place and was suspended from the basement ceiling along the north side of the building, and exited the building eastward toward the stack approximately 5-feet below grade. A new stack drain system needed to be installed prior to building demolition. The new system consists of a 500-gallon underground storage tank located at the base of the stack (Figure 3-2).



Photograph 2 – Temporary Stack Drain Sump and Old Stack Drain Line in the Basement of Building 704

1.2.2 Building 802

Building 802 was a one-story, above-grade structure approximately 45-feet long by 26-feet wide. The small brick structure, which was divided into two sections, was located at the base of the Stack. The western section of the building housed the fans and equipment that provided the building exhaust flow for Buildings 801, 815, and 830. The eastern section of the building housed the equipment for evaporation of low-level tritiated water. Operations began in approximately 1992 and the evaporation of tritiated water ceased in approximately 2002, when the 5,000-gallon tritiated waste tank was emptied. A 275-gallon diesel fuel tank was staged just outside of Building 802, adjacent to the west wall. In addition, a 42" steel air duct and 18" stainless steel acid off-gas duct, originating from Building 801, existed beneath Building 802 before transitioning to two above ground plenums that led to the Stack.



Photograph 3 – View of Building 802

1.3 Regulatory and Enforcement History

In 1980, the BNL site was placed on New York State's Department of Environmental Conservation (NYSDEC) list of Inactive Hazardous Waste Sites. On December 21, 1989, the BNL site was included on the U.S. Environmental Protection Agency (EPA) National Priorities List because of soil and groundwater contamination that resulted from BNL's past operations. Subsequently, EPA, NYSDEC, and DOE entered into a Federal Facilities Agreement (herein referred to as the Interagency Agreement; [IAG]) that became effective in May 1992 (Administrative Docket Number: II-CERCLA-FFA-00201) to coordinate the cleanup.

The IAG identified Areas of Concern (AOCs) that were grouped into Operable Units (OUs) to be evaluated for response actions. The IAG required a remedial investigation (RI)/feasibility study (FS) for OU I, pursuant to 42 United States Code (USC) 9601 et seq., to meet Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requirements. OU I consists of areas of soil contamination at the BNL site where waste was historically managed or disposed. The OUs and AOCs identified by the IAG are discussed further in Sections 1.6 and 2.0.

Upon completion and review of the results of the RI/FS for OU I, the *Record of Decision – Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6, 8, 10, 16, 17, and 18)* (OU I ROD), was signed in August 1999. The OU I ROD specified the excavation and off-site disposal of radiologically and chemically contaminated soils.

In April 2009, the HFBR ROD (AOC 31) was finalized. The HFBR ROD specified the removal of ancillary buildings and underground utilities, including the Fan Houses, as

well as the removal of contaminated soil within the HFBR complex utilizing the dose-based cleanup goal and methodology specified in the OU I ROD.

1.4 Site Investigation

Comprehensive sampling and analyses were performed to characterize the HFBR complex between 2000 and 2005. These activities included both radiological and non-radiological characterization of surface and subsurface soils, various underground duct and piping systems and HFBR ancillary buildings. Radiological characterization of the ducts associated with Building 704 and Building 802 indicated that they were contaminated above the free release criteria specified in Table 2-2 of the BNL Radiological Controls Manual, with an isotopic content of cobalt (Co)-60, Nickel (Ni)-63, and cesium (Cs)-137. In addition, characterization of soil in the Building 704 basement identified small areas where concentrations of Cs-137 and strontium (Sr)-90 exceeded site cleanup criteria specified in the OU I ROD.

A cable trench with an unknown discharge point was identified inside of Building 704. The cables within the trench were suspected to be lead sheathed and filled with oil that may contain polychlorinated biphenyls (PCBs). In addition, the cable tray material was noted to be asbestos. PCBs were also identified in soils in the vicinity of the transformers on the south side of Building 704.

Characterization of the HFBR soils, structures and underground duct and piping systems is discussed further in the following reports:

- *Preliminary Characterization for Brookhaven National Laboratory High Flux Beam Reactor*, WMG Report 9622 Rev.1 (WMG, September 2000);
- *Brookhaven National Laboratory High Flux Beam Reactor Final Characterization Report* (BNL, September 2001);
- *High Flux Beam Reactor & Balance of Plant Supplemental Characterization Summary* (PWGC, June 2005);
- *Brookhaven National Laboratory High Flux Beam Reactor Characterization Summary Report*, Rev. 0, (Cabrera, March 2005);
- *High Flux Beam Reactor and Balance of Plant Structures Preliminary Assessment/Site Inspection Report* (PWGC, January 2005);
- *Brookhaven National Laboratory Building 705 Stack Resolution of End-State* (PWGC, February 2005)
- *High Flux Beam Reactor: Building 751, Portable Structure 549, Interconnecting Ducts, Selected Components, & Soils Sampling and Analysis* (DAQ, December 2005);
- *Feasibility Study, Brookhaven High Flux Beam Reactor, Decommissioning Project* (BNL, 2006);

- *Proposed Remedial Action Plan for the High Flux Beam Reactor at Brookhaven National Laboratory* (BNL, January 2008); and
- *Final Record of Decision for Area of Concern 31, High Flux Beam Reactor* (BNL, February 2009).

1.5 Previous Remedial Activities

Most of the equipment associated with the BGRR, such as the exhaust fans, motors, and above-grade air ducting, was removed from Building 704 as part of the BGRR decommissioning project. In addition, the above ground ducts that penetrated the Building 704 roof were removed. Some of the equipment associated with the evaporation of low-level tritiated water was removed from Building 802 and the tritiated waste tank was emptied.

Related remedial activities that have been recently completed include the stabilization of Building 750, the removal of the HFBR Underground Utilities and the removal of the Building 801-811 Waste Transfer Lines. These activities are documented by separate closeout reports.

1.6 BNL Operable Units

As part of remedial efforts at BNL, thirty AOCs were identified and grouped into seven OUs. The seven OUs were subsequently reduced to six OUs as a result of combining OU II and OU VII. In February 2009, AOC 31, comprising the HFBR, was established.

This report documents completion of remedial actions associated with the HFBR, which is designated as AOC 31. As described in Section 2.1, the cleanup goals established in the OU I ROD were used for the HFBR Fan Houses Project.

2.0 OPERABLE UNIT BACKGROUND

2.1 Site Cleanup Criteria

The primary radiological contaminants of concern for the soil within HFBR complex were specified in the HFBR ROD and are the same as those for OU I radiologically contaminated soils: Cs-137, radium (Ra)-226, and Sr-90. The cleanup goals for specific radionuclides were calculated using the Residual Radioactivity Computer Code (RESRAD), Version 6.5 (Argonne National Laboratory (ANL), 2001), considering a residential scenario. The dose limit used was 15 millirem per year (mrem/yr) above background (*OSWER Directive 9200.4-1*, EPA, 1997), residential land use after 50 years of institutional control by the DOE, and industrial land use with no decay time (0 years). In addition, the NYSDEC cleanup guideline of 10 mrem/yr, from TAGM 4003, was adopted as an ALARA goal. The primary radiological isotope present at the site was Cs-137; its cleanup goal, as established in the OU I ROD and specified in the HFBR ROD, is 23 picocuries per gram (pCi/g).

The potential for radiologically contaminated soil to impact groundwater was also considered. A soil cleanup goal of 15 pCi/g was calculated for Sr-90, based on its potential to impact the groundwater. The goal also protects both residential and industrial uses. A cleanup goal of 5 pCi/g was selected for Ra-226, based on DOE Order 5400.5, *Radiation Protection of the Environment and the Public* (DOE, 1993).

Additional radionuclides that were not addressed in the OU I ROD were also evaluated. As discussed in Section 1.4, previous site investigations indicated that underground ducts associated with Building 704 and Building 802 were contaminated with Co-60. This radionuclide, in addition to europium (Eu)-152, Eu-154, uranium (U)-235, U-238, plutonium (Pu)-238, Pu-239/240 and americium (Am)-241, were considered as additional radiological contaminants of concern and are listed with their respective cleanup goals in Table 2-1.

The primary chemical contaminants of concern for soil within the HFBR complex are the same as those for OU I chemically contaminated soils: mercury and lead. The cleanup goal established for mercury is 1.84 mg/kg, based on the EPA's soil screening level guidance (*OSWER Directive 9355.4-23*) for protecting groundwater and residential use. The choice of a cleanup goal of 400 mg/kg for lead also was based on the EPA's soil screening level guidance; this level is protective of residential use. The cleanup goals for these chemical contaminants were established in the OU I ROD and specified in the HFBR ROD.

As discussed in Section 1.4, PCBs were previously identified in soils in the vicinity of the transformers on the south side of building 704; therefore PCBs were considered as an additional chemical contaminant of concern. Concentrations of PCBs were compared to 6 New York Codes, Rules and Regulations (NYCRR) Part 375 Residential Use Soil

Cleanup Objectives (SCOs). Chemical contaminants of concern are listed with their respective cleanup goals in Table 2-1.

Table 2-1
Radionuclides and Chemical Contaminants of Concern
for the HFBR Stabilization Project

Radionuclides of Concern	Cleanup Value (pCi/g)	Source of Cleanup Goal Value
Cs-137	23	OU I ROD (BNL, 2009)
Sr-90	15	OU I ROD (BNL, 2009)
Ra-226	5	OU I ROD (BNL, 2009)
Tritium	424(2)	(1)
Co-60	1,260 (3)	(1)
Eu-152	51 (3)	(1)
Eu-154	180 (3)	(1)
U-235	4.6 (4)	(1)
U-238	4.7 (4)	(1)
Pu-238	57	(1)
Pu-239/Pu-240	35	(1)
Am-241	34	(1)
Chemical Contaminant	Soil Cleanup Level	Source of Cleanup Goal Value
Mercury	1.84 mg/kg	OUI ROD (BNL, 2009)
Lead	400 mg/kg	OUI ROD (BNL, 2009)
PCBs	1 mg/kg	6NYCRR Part 375 Restricted Use – Soil Cleanup Objectives, Residential

Notes:

1. For those nuclides “not referenced,” the estimated cleanup levels were not listed in either the OU I ROD or in other BNL remediation references. A RESRAD evaluation was used as described in the project FSP to develop the cleanup levels that will meet the 15 mrem/yr criteria.
2. The value is based on a RESRAD evaluation for a residential scenario with no decay.
3. The value is based on a RESRAD evaluation for a residential scenario with 50 years of decay.
4. Values listed for uranium are based on 4 mrem/yr from groundwater consumption.

2.2 Design Criteria

Technical procedures and design criteria for the HFBR Fan Houses Project were established in the HFBR ROD, the *Remedial Design/Remedial Action Work Plan for the Decontamination and Dismantlement (D&D) of Fan Houses (Building 704 and Building 802)* (BNL, April 2010), the *Field Sampling Plan for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, Update: July 2010) and the *Excavation Plan for*

Building 704 (Fan House) and Building 802 (Fan House/Tritiated Water Evaporator Facility), Rev 1 (BNL, March 2011). The remedial design included:

- Procedures for the D&D of Building 704 and Building 802;
- Procedures for the exposure and removal of underground plenum, EABFF and other ducts and piping associated with the Building 704 and Building 802;
- Procedures for the excavation and handling of any contaminated soil associated with the HFBR Fan Houses Project;
- A plan and process for ensuring the total exposure from all radioisotopes does not exceed 15 mrem/yr above background following the 50-year period for institutional control for the site;
- Methods to reduce waste volumes that require offsite disposal; and
- An approach for sampling to confirm that cleanup goals have been achieved for the HFBR Fan Houses Project.

2.3 Community Relations Activities

2.3.1 BNL Community Relations

The BNL Community Involvement Plan was published April 15, 1999. It is supplemented by project-specific plans. In the case of the HFBR, a Communications Plan for the Regulatory Decision-Making Process for Decommissioning the High Flux Beam Reactor was developed. In accordance with these two plans and CERCLA Sections 113 (k)(2)(B)(i-v) and 117, the Community Relations Program focuses on informing and involving the public in the decision-making process to ensure that the views of the internal and external stakeholder communities are considered. A variety of activities are used to provide information and to seek public participation, including distribution of materials to a stakeholders' mailing list; holding community meetings, information sessions, tours, and workshops; and preparing and distributing fact sheets. The Administrative Record, which documents the basis for removal and remedial actions, was established and is maintained at the libraries listed below:

Brookhaven National Laboratory
Research Library, Bldg. 477A
Upton, NY 11973
631-344-3483 or 631-344-3489

Stony Brook University
Melville Library
Special Collections and University Archives
Room E-2320
Stony Brook, NY 11794
631-632-7119

U.S. EPA - Region II
Records Room
290 Broadway, 18th Floor
New York, New York 10007
212-637-4308

2.3.2 Community Involvement

The community involvement activities conducted for the remedy selection process for the HFBR (including the D&D of Building 704 and Building 802) included a formal public review of the HFBR Proposed Remedial Action Plan (PRAP). The public comment period began January 10, 2008 and ended March 17, 2008. Two information sessions and a public meeting were held during the public comment period. Public comments received indicated that there was considerable community support for DOE's preferred remedial alternative identified in the PRAP (Alternative C, Phased Decontamination and Dismantlement with Near-Term Control Rod Blades Removal). DOE's responses to public comments and concerns are included in the HFBR ROD Responsiveness Summary.

The implementation of the HFBR Fan Houses Project using ARRA funds was discussed with the BNL Community Advisory Council on April 15, 2009, November 12, 2009 and November 4, 2010. Minutes from these meetings are available on the BNL Community Relations website, located at: <http://www.bnl.gov/community/cac/meetings.asp>.

3.0 CONSTRUCTION ACTIVITIES

The objective of the HFBR Fan Houses Project was to safely complete the D&D of Buildings 704 and 802, as well as to characterize and remove any associated contaminated soil in accordance with the HFBR ROD and project specific plans. Following the D&D of Buildings 704 and 802, the removal of associated ducts and underground structures and the removal of any associated contaminated soil, an FSS and a dose assessment were performed by BNL ERP. The FSS was independently verified by ORISE. This work is further discussed in Section 3.2. The FSS was completed using the *Multi-Agency Radiological Survey and Site Investigation Manual (MARSSIM)* guidelines.

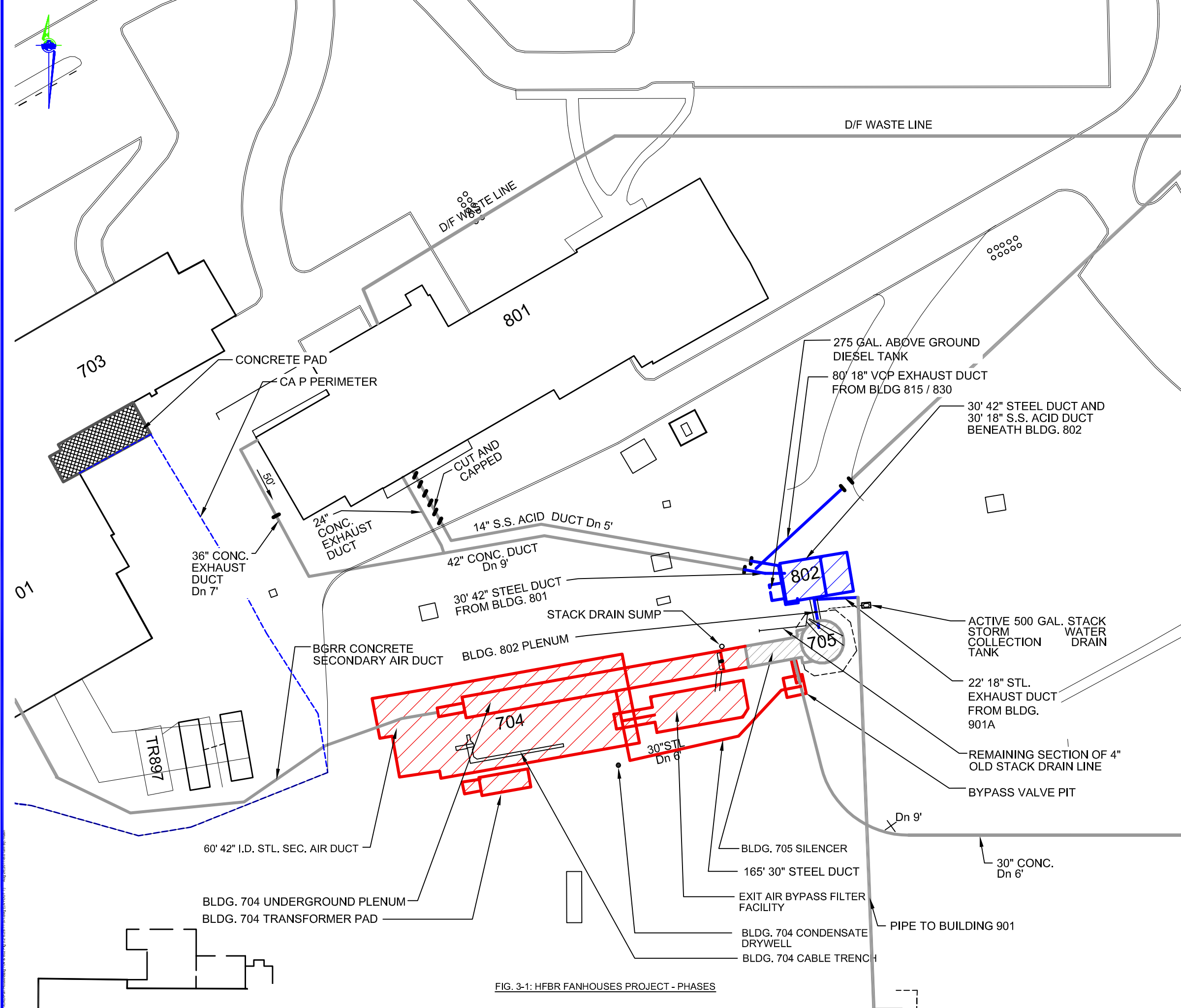
A Demolition Plan, Excavation Plan, Job Risk Assessments (JRAs), Radiological Work Permits (RWPs), and project-specific work procedures were developed to address hazards and work steps associated with the HFBR Fan Houses Project. The information presented in the project plans was reviewed by the site workers prior to initiating the project work activities. Copies of project plans were available onsite at all times for site workers to thoroughly review.

The *Field Sampling Plan for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, Update: July 2010) detailed the data quality objectives (DQOs) and quality assurance (QA) requirements for the FSS. The plan also presented the field screening value (21,500 counts per minute (cpm) with unshielded sodium iodide detector) to be used in guiding the excavation and in determining when the excavation was completed.

Completion of the HFBR Fan Houses Project was accomplished without any worker injuries categorized as lost time accidents.

3.1 Building D&D

The HFBR Fan Houses Project was divided into two work phases. The first phase took place between March 2010 and December 2010 and included the D&D of Building 704, as well as the removal of the associated ducts, underground structures and contaminated soil. The second phase took place between March 2011 and June 2011 and included the D&D of Building 802, as well as the removal of the associated piping, ducts, and contaminated soil. The separate phases of the project are illustrated in Figure 3-1.



CONSULTANTS

ABBREVIATIONS	
S.S.	STAINLESS STEEL
INV	INVERT ELEVATION
RCP	REINFORCED CONCRETE PIPE
ABAND.	ABANDONED
C.I.	CAST IRON PIPE
VCP	VITRIFIED CLAY PIPE
CONC	CONCRETE
A.G.	ACID GAS
STL	STEEL
Dn	DOWN
NIC	NOT IN CONTRACT

LEGEND	
	OFF GAS LINE
	ABANDONED OFF GAS LINE
	HEAD WALL
	STORM TRENCH
	CATCH BASIN
	MANHOLE
	DRY WELL
	CLEAN OUT
	STORM GRATES
	LEACHING POOL
	SEWAGE PUMPING STATION
	HORIZONTAL WELL

COLOR CODES	
	IN SCOPE OF WORK - PHASE 1
	IN SCOPE OF WORK - PHASE 2
	NOT PART OF WORK

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DRAWINGS PREPARED FOR

REVISIONS	DATE	INITIALS	COMMENTS
DRAWING INFORMATION			
PROJECT:	BNL0710	APPROVED BY:	BMM
DESIGNED BY:	MM/BMM	DATE:	9/25/09
DRAWN BY:	LLG	SCALE:	AS SHOWN

SHEET TITLE

BROOKHAVEN NATIONAL LAB
BLDG. 704 AND BLDG. 802 (FANHOUSE)
HFBR FANHOUSES PROJECT - PHASES

FIGURE NO
3-1

SHEET - OF -

FIG. 3-1: HFBR FANHOUSES PROJECT - PHASES

0 30 60
SCALE: 1" = 30'

FSS and IVS activities were performed upon completion of each of the two phases of remediation, as described further in Section 3.2. All pre-construction tasks for each work phase were completed prior to beginning D&D and characterization activities within the associated work area, including equipment mobilization, site inspections, securing the general work area, as well as marking out underground piping and ducts slated for removal and verifying their locations. Any remaining equipment, components and furnishings were removed from each building.

In addition, radiological and non-radiological hazards were either removed or stabilized prior to building demolition. This included the removal of contaminated concrete surfaces, application of fixative paints, and the abatement of asbestos-containing material (ACM) (i.e., pipe insulation, tiles and calking).

The D&D of Buildings 704 and 802, as well as removal of the associated ducts, piping underground structures and contaminated soil, were performed in accordance with the *Remedial Design/Remedial Action Work Plan for the Decontamination and Dismantlement (D&D) of Fan Houses (Building 704 and Building 802)* (BNL, April 2010). An excavator equipped with hydraulic shears was the primary tool used to dismantle Building 704 and a standard excavator with thumb attachment was utilized to demolish Building 802. As further discussed in Section 3.3, demolition debris, ducts and piping were size reduced in order to meet the disposal facility's waste acceptance criteria (WAC).

3.1.1 Building 704

The D&D of Building 704 and the removal of the associated ducts, piping and underground structures were completed between March 2010 and July 2010. Utilities were isolated prior to building demolition; and equipment and materials were removed prior to demolition as described below:

- ACM was removed, packaged and shipped offsite for disposal as described in Section 3.3.
- Lighting fixtures considered suspect PCB containing material were removed, packaged and shipped for disposal as described in Section 3.3.
- Fluorescent lighting was removed and turned over to BNL Facility and Operations (F&O) for onsite recycling.
- Electrical switch gears, transformers, breakers, switches, and associated cables were removed and turned over to BNL F&O for onsite recycling.
- Lead acid batteries used for backup power were removed, packaged and shipped for disposal as described in Section 3.3,
- A temporary 1,000-gallon stack drain tank (poly) and associated sump, pumps and piping were removed and turned over to the BNL Waste Management Program for reuse.

The southern half of Building 704 was surveyed and released in accordance with Simple Work Procedure (SWP)-603-21, *Fan House Radiological Release Survey*. Results of the release survey satisfied the requirements of the BNL Radiological Control Manual, specifically the requirements of FS-SOP-1005, *Radiological Surveys Required for Release of Materials from Areas Controlled for Radiological Purposes* (BNL, November 2007). The southern half of the building was demolished leaving the northern half of the building free standing. The foundation underlying the southern half of Building 704 was removed to a minimum depth of two feet below existing grade. As described further in Section 3.3, demolition debris from the southern half of Building 704 was either recycled at BNL or disposed of as Construction and Demolition (C&D) debris at an offsite disposal facility.

The remaining northern half of Building 704, which previously housed the five primary fans and a secondary fan, was subsequently demolished and the associated debris was direct-loaded into shipping containers for offsite disposal as low-level radioactive waste (LLRW), as further discussed in Section 3.3.

It should be noted that due to the open nature of the building during D&D activities, two or three pairs of barn swallows (*Hirundo rustica*) established nests within the Building 704 structure at about the time that the last walls and supports were to be demolished. Demolition was halted in order to consult with the U.S. Fish and Wildlife Service and the U.S. Department of Agriculture – Wildlife Services. The verbal consultation process resulted in the authorization to go forward with the building demolition due to worker and environmental safety issues (i.e. potential collapse of the structure and contamination). The remaining structure was removed without further incident.

Demolition of the aboveground portions of Building 704 exposed structures within the building footprint. These structures included the fan cell floor, basement walls, underground plenum, cable trench drain, 42-inch secondary air return duct and portions of the old stack drain line which was suspended from the building floor.

In addition, utilities and structures outside of the footprint of Building 704 were removed once the aboveground demolition of Building 704 was completed. This included the EABFF, bypass valve pit, transformer pad, 30-inch steel duct, old stack drain line, and stack drain standpipe. The Building 704 transformer pad was turned over to BNL F&O and recycled onsite. The soils underlying the pad were sampled for PCBs, as further discussed in Section 3.2.

Portions of the Building 704 footing (greater than 2 feet below existing grade) were left in place. The foundation walls, located under the north half of the building and surrounding the underground plenum, were left in place and included in the FSS. As described in Section 3.2, the results of the FSS and IVS indicated that the project cleanup criteria were met. The removal of underground plenum, ducts and piping are described further in Section 3.1.3.



Photograph 4 – Demolition of the southern half of Building 704

3.1.2 Building 802

The D&D of Building 802 and the removal of the associated ducts, piping and underground structures were completed between March 2011 and June 2011. Utilities were isolated prior to building demolition; and equipment and materials were removed prior to demolition as described below:

- ACM was removed, packaged and shipped offsite for disposal as described in Section 3.3,
- Lighting fixtures considered suspect PCB containing material were removed, packaged and shipped offsite for disposal as described in Section 3.3.
- Fluorescent lighting was removed and turned over to BNL F&O for onsite recycling.
- Transformers, breakers, switches, and associated cables were removed and turned over to BNL F&O for onsite recycling.
- A backup generator was removed and turned over to BNL F&O for reuse,

In addition, two SCDHS registered tanks (5,000-gallon tritiated waste tank and 275-gallon diesel fuel tank) were removed prior to building demolition. The empty tritiated waste tank was size reduced with a cutting torch and shipped for offsite disposal as LLRW. The diesel fuel tank was cleaned and transferred to BNL's Procurement and Property Management Division.



Photograph 5 – Cutting 5,000-gallon tritiated waste tank with torch



Photograph 6 – Cleaning out and removing 275-gallon diesel fuel tank

Building 802 was surveyed in accordance with Work Procedure (WP)-603-35, *Bldg 802 Radiological Release Survey*. Results of the release survey satisfied the requirements of the BNL Radiological Control Manual, specifically Table 2-2 and the requirements of FS-SOP-1005, *Radiological Surveys Required for Release of Materials from Areas Controlled for Radiological Purposes* (BNL, November 2007). The survey identified only a small area of floor slab above release criteria. A summary of the radiological release survey is provided in Appendix A. The building was demolished (except for the small section of floor slab which was not released) and the associated debris was

disposed of offsite as C&D debris waste. The small section of floor slab was later removed and disposed of as LLRW, as further discussed in Section 3.3.



Photograph 7 – Demolition of Building 802

The aboveground plenum between Building 802 and the Stack, along with the aboveground 14-inch and 36-inch acid off-gas lines were removed. The aboveground pipes were cut and capped at the exterior of the Stack. Several underground utilities in the vicinity of Building 802 were also addressed during this phase of the HFBR Fan Houses Project. Details on how each was addressed are provided in Section 3.1.3.

Localized soil contamination associated with a legacy fuel oil spill was identified during excavation activities associated with the demolition of Building 802. The soil contamination was located adjacent to and within the northwest corner of the Building 802 footprint. Due to the location of the soil contamination, the source of the spill is believed to have been historical operations associated with an above ground diesel fuel tank that pre-dated the 275-gallon diesel fuel tank that was discussed above. The removal of approximately 30 cubic yards of contaminated soil and collection of confirmatory endpoint samples were coordinated with the NYSDEC. The associated spill report is provided as Appendix B.

3.1.3 Underground Structures, Ducts and Piping

Underground structures, ducts and piping were exposed using standard excavation methods. Soil handling (e.g., transport, stockpiling and erosion control) and excavation activities were performed in accordance with the *Excavation Plan for Building 704 (Fan House) and Building 802 (Fan House/Tritiated Water Evaporator Facility)*, Rev 1 (BNL, March 2011).



Photograph 8 – Demolition of the Building 704 underground plenum

In an effort to minimize waste volumes several concrete structures were left in-place, this included the floor slab of the EABFF, foundation walls on the north side of Building 704, and concrete support footings for the underground plenum. A summary of how each underground structure, duct and pipe was addressed is provided in Table 3-1.



Photograph 9 – Interior of underground plenum

Table 3-1
Summary of Underground Structures, Ducts and Piping

Work Phase	Structure/Duct/Pipe	Description
1	Bldg 704 cable trench/cable trench drain	The cable trench was removed. The drain was identified beneath the northwest corner of Building 704 and was removed to a minimum of 2 feet below existing grade. Soil samples were collected to confirm the absence of PCB contamination as discussed in Section 3.2.
1	42-inch secondary air return duct	Ductwork was removed to a point where it transitioned to concrete immediately west of the Building 704 footprint. The duct was capped.
1	4-inch old stack drain line	The line was removed from the west end of the Building 704 footprint, where it was previously capped, to the approximate midpoint on the Stack silencer.
1	Stack Drain Standpipe	The stack drain standpipe, located immediately northwest of the Stack, was removed to 5 feet below existing grade and capped.
1	Building 704 underground plenum	The entire plenum was removed from beneath Building 704 footprint to the Stack silencer.
1	EABFF	The EABFF concrete floor was left in place. The remaining components were demolished and removed.
1	30-inch steel duct from Building 704 to the bypass filter facility and then to Stack	The 30-inch duct was removed between Building 704 and the bypass valve pit.
2	Bypass valve pit and internal and external ducts	The remaining ducts and valves inside of the pit were removed and the bypass valve pit walls were demolished and removed to a minimum depth of 2 feet below existing grade. The remaining structure was backfilled and left in place.
2	18-inch vitrified clay pipe (VCP)	Approximately 48 feet was removed. The remaining 32 feet, located beneath a high pressure steam line, was left in place. The remaining VCP towards Buildings 815/830 was excavated and confirmed to be capped.
2	18-inch steel duct from Building 901A	Approximately 22 feet of the duct was removed. The duct was capped southeast of the Building 802 footprint, where it transitioned to concrete below ground.
2	42-inch/14-inch acid off-gas lines	The off-gas lines were previously removed to immediately northwest of Building 802 during the HFBR Underground Utilities Project. The remaining lines beneath the Building 802 footprint were removed.

In addition to the underground structures, ducts and piping summarized in Table 3-1, a drywell was discovered adjacent to the southeast corner of Building 704 during excavation activities associated with the Building 704 D&D. Sediment from the structure was sampled and analyzed in accordance with SCDHS Standard Operating Procedure (SOP) No. 9-95, *Standard Operating Procedure for the Administration of Article 12 of the Suffolk County Sanitary Code, "Pumpout and Soil Cleanup Criteria."* The sediment analytical results, provided in Appendix A, were below SCDHS Action Levels and the drywell was backfilled as described in Section 3.4.



Photograph 10 – Drywell discovered adjacent to southeast corner of Building 704

The as-left conditions, including the locations of ducts, piping and structures that were left in place, are illustrated in Figure 3-2.

3.2 Final Status Survey and Sampling

After completion of the building demolition, debris removal, and contaminated soil removal, the Building 704 basement foundation walls remained in place, as did the subsurface concrete footings for the underground plenum and the floor slab for the EABFF. In addition, subsurface some structures and piping associated with Building 802 remained in place, as previously described in Table 3-1. An FSS was performed to confirm that the as-left conditions met the project cleanup criteria.

As discussed in Section 2.1, the primary radionuclides of concern, based on exposure potential, were Sr-90, Cs-137, and Ra-226. Although less likely to be present, certain other radionuclides were monitored and include tritium, gamma emitters (e.g., Co-60, Eu-152), and alpha emitters such as isotopes of uranium, americium, and plutonium. The chemical contaminants of concern were mercury and lead. PCBs were also a chemical contaminant of concern.



Photograph 11 – Collection of FSS Soil Samples from SU-5.

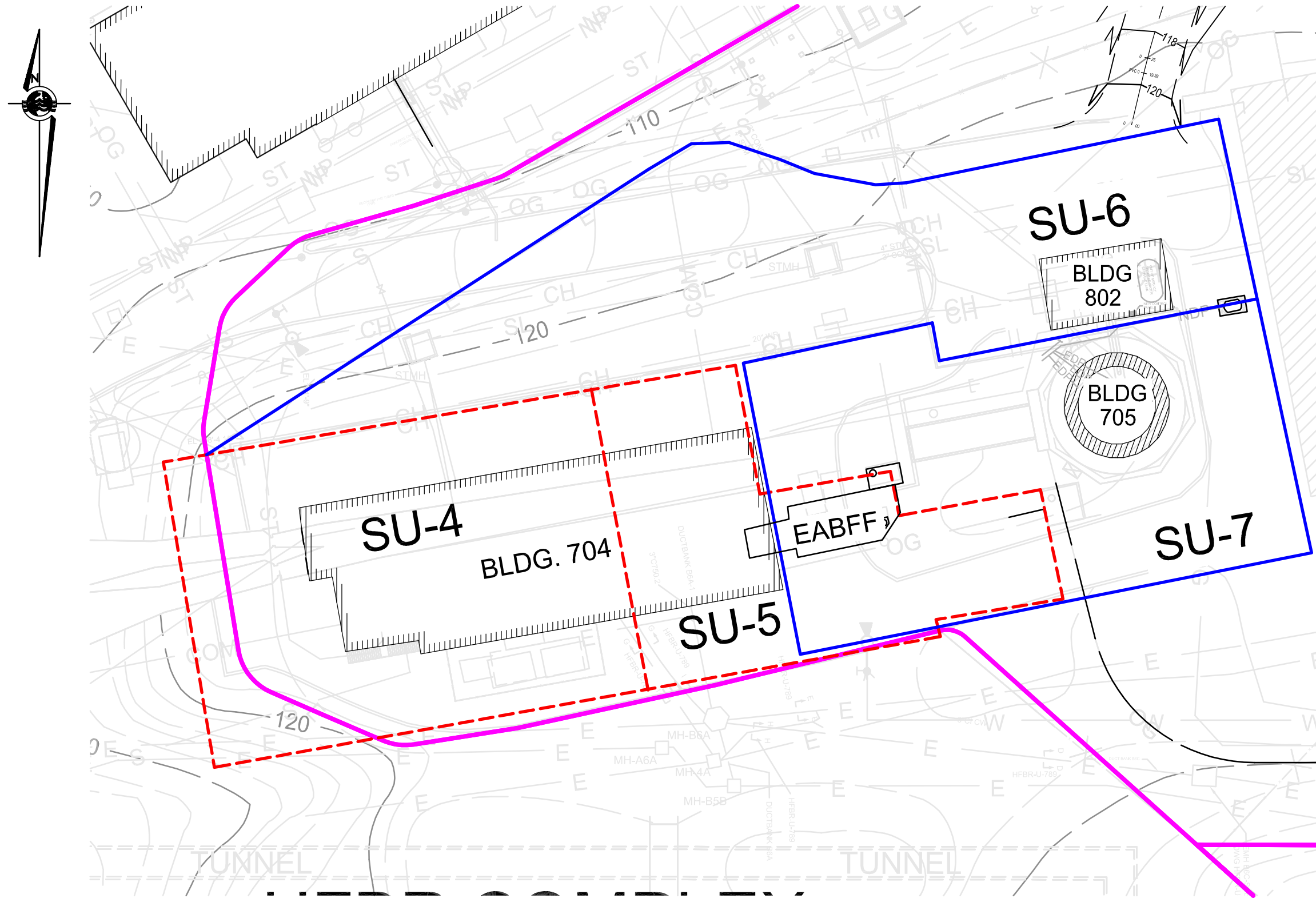
3.2.1 Final Status Survey Design

The FSS was divided into three SUs (SU-4, SU-5 and SU-6). SU-4 (19,200 ft²) and SU-5 (12,000 ft²) include the land area remaining post demolition, and also the remaining concrete associated with the subsurface walls of Building 704, underground plenum footings, and the EABFF floor slab. SU-5 also includes an extension to address the underground piping that was removed. SU-6 was expanded from its initial description in the *Field Sampling Plan for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, Update July 2010) to include a larger area as described in the *Field Sampling Plan for Building 705 (Stack) and Remaining HFBR Outside Areas* (December 2010). This larger area is not part of the HFBR Fan Houses Closeout Report. In terms of SU-6, this report addresses the excavation of Building 802 and associated underground ducts and piping specified in Table 3-1. SU-4, SU-5 and the initial configuration of SU-6 are shown in Figure 3-3. SU-7, while shown on the drawing, is related to the stack and will be addressed at a future time.

For SU-4 and SU-5, a three-step approach to cleanup confirmation for radiological soil contamination was followed using the MARSSIM approach. The first step consisted of a global positioning system (GPS)-based gamma scintillation walkover survey using a 2-inch by 2-inch sodium iodide (NaI) detector in conjunction with a Ludlum Model 2221 scaler/ratemeters and a PRO XR Satellite Receiver Trimble model TSCe Data Logger (Trimble Unit). The second step involved the collection of soil samples, in accordance with BNL Environmental Management (EM) SOPs for offsite analysis to verify that residual radiological contamination levels were sufficiently low to meet the cleanup goals established for the site. The third step involved surveys and samples of subsurface concrete remaining in place associated with Building 704 footing and the EABFF.

Core samples were taken from SU-4 and SU-5 to determine if there was residual contamination at depth, samples were analyzed by gamma spectroscopy, and for Sr-90 and tritium. Composites of the surface samples were analyzed for gamma emitters, chemical contaminants, alpha emitters, Sr-90, and tritium. For the excavations in the areas associated with Building 802 and the underground utilities within the boundary of SU-6, soil samples were taken at the bottom of each excavation and analyzed for gamma emitters. Composites of the excavation samples were analyzed for gamma emitters, chemical contaminants, alpha emitters, Sr-90, and tritium. Gamma surveys were taken in each excavation and surrounding areas.

The approximate sample locations for SU-4 and SU-5 are shown in Figure 3-4, and the locations of samples associated with excavation within the boundary of SU-6 are shown in Figure 3-5.



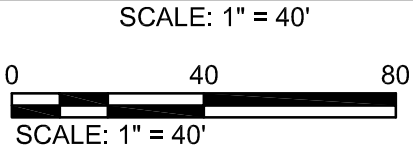
LEGEND

SU-4 AREA REQUIRES FINAL STATUS SURVEY

FIRGURE 3-3 - HFBR FAN HOUSE PROJECT SURVEY UNITS

REFERENCE:

OVERALL SITE PLAN BASED ON SURVEY PREPARED FOR BROOKHAVEN NATIONAL LAB DATED APRIL 2009.



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JOB NO.	SHEET NO.	REVISION	DATE	DWN.	APP'D.
 UNDER CONTRACT WITH UNITED STATES DEPARTMENT OF ENERGY PLANT ENGINEERING DIVISION UPTON, NEW YORK 11973					
JOB TITLE ENVIRONMENTAL RESTORATION PROJECTS		DWG. TITLE HFBR FAN HOUSE PROJECT SURVEY UNITS		SHEET OF 1 1	
SCALE AS SHOWN	DATE 10/28/11	DWN. BY RN	ACCT. NO.	JOB NO.	DWG. NO.
PROJ. QA	APP'D. BY MM	BLDG. NO. 704	3-3		
PATH:					

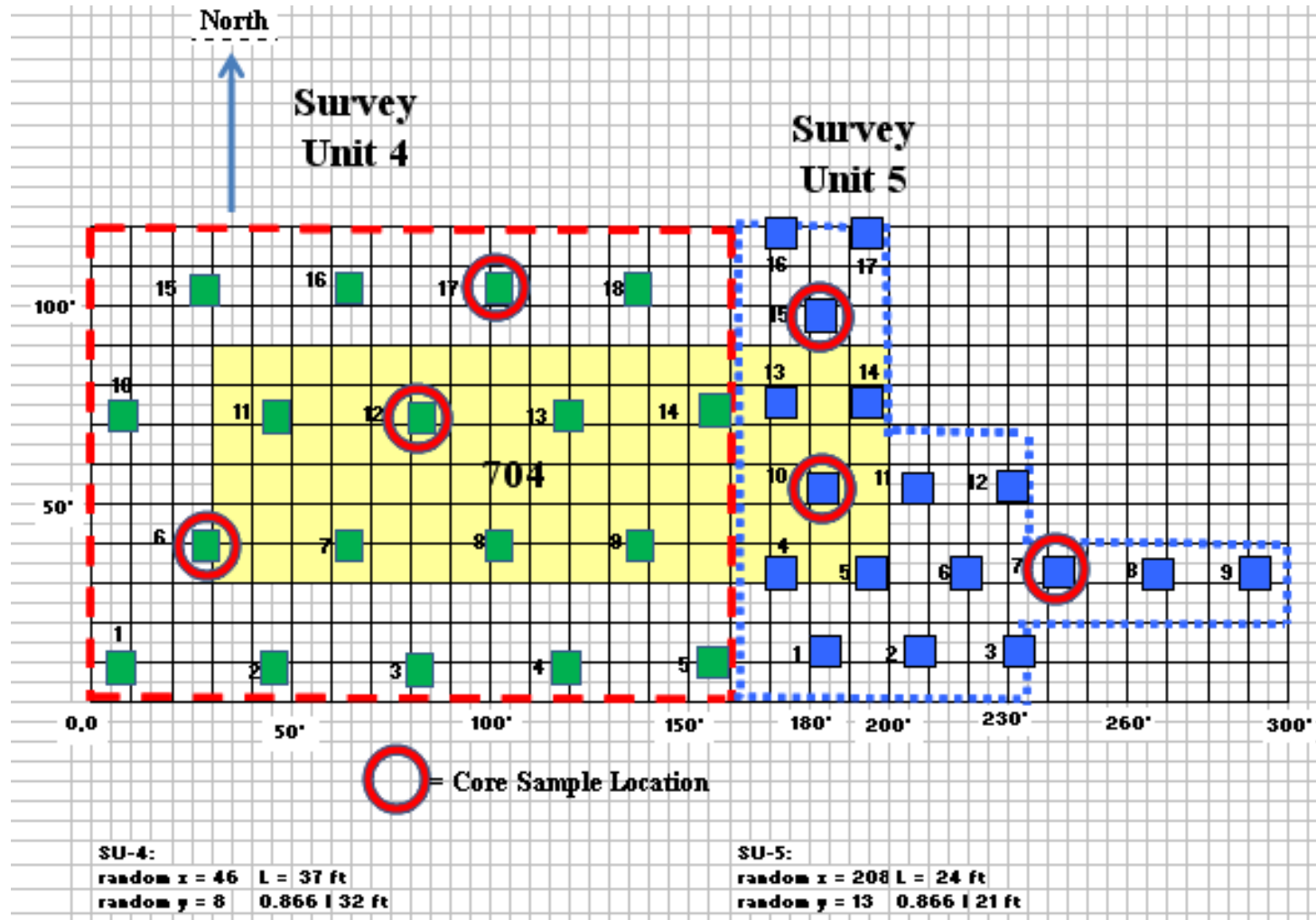


Figure 3-4 – Soil and Core Sample Locations – SU-4 & SU-5

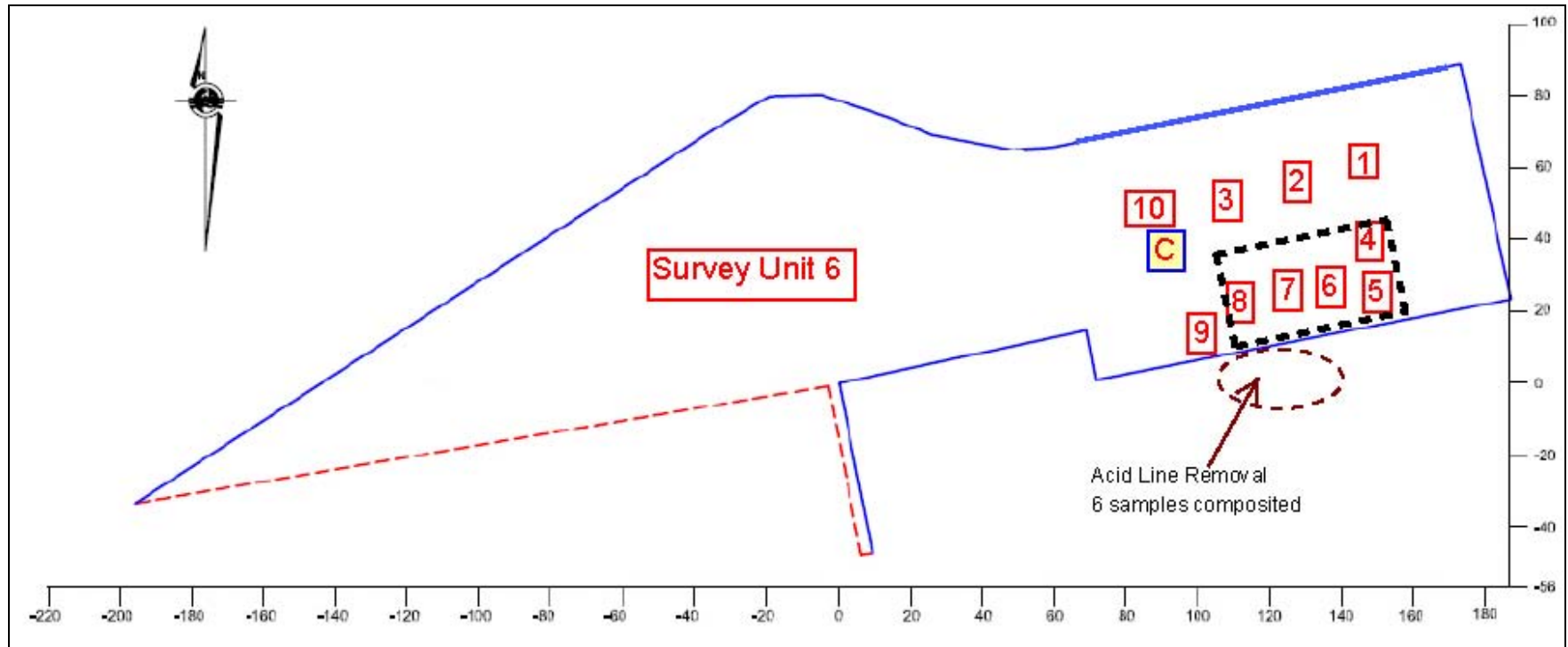


Figure 3-4 – Soil and Core Sample Locations - Excavations for Bldg 802 and Underground Utilities within SU 6

Note: SU 6 description has changed from that shown in Figure 3-2 based on the Field Sampling Plan for the Stack and Underground Utilities, December 2010. The samples related to the excavation of Building 802 and nearby underground utilities is shown above and is addressed in this Closeout Report.

3.2.2 Final Status Survey and Sampling Results

The results of the FSS are separated by SU and type of evaluation:

1. SU-4 and SU-5 Gamma Scans

Results of the final status radiological walkover survey for SU-4 and SU-5 exhibit count rates below 7,200 cpm using the collimated probe for all areas, as shown in Figure 3-6. As specified in Appendix B of the *Field Sampling Plan Addendum for the HFBR Underground Utilities, Building 704 and Building 802* (July, 2010), the value of 7,200 cpm count rate was determined to approximate a Cs-137 concentration of 15 pCi/g in soil, or two-thirds of the cleanup goal for Cs-137 in soil when using the collimated NaI gamma scintillation detector. The collimated probe was necessary in order to shield the high background from the area of the silencers and the Stack. In addition, individual 1-minute fixed-point measurements were taken with the NaI probe at each of the fixed sample points. The results ranged from 1,432 to 3,316 cpm, and all values were less than 7,200 cpm. Radiological survey forms for the gamma fixed-point readings are provided in Appendix A.

2. SU-4 and SU-5 Surface Soil Samples

Surface soil samples were collected at 35 locations. All sample results were below the site cleanup goals for Cs-137, Sr-90 and Ra-226. A summary of the soil sample results is provided in Table 3-2, and the individual sample results are shown in Table 3-3. Composite samples indicated no detection of tritium, Sr-90, or alpha emitters. The required detection limit is approximately as follows: Tritium: 230 pCi/g; Sr-90: 0.3 pCi/g; alpha emitters: 0.2 - 0.4 pCi/g.

Table 3-2 Summary of SU-4 & SU-5 Soil Sample Results for Radionuclides

	Cs-137 (pCi/g)	Sr-90 (pCi/g)	Ra-226 (pCi/g)	U-238 (pCi/g)
Cleanup Goal	23	15	5	N/A*
Average	1.43 (average of detectable values)	No samples indicated detectable values	0.33	0.37 (average of detectable values)**
Maximum	14.9	No samples indicated detectable values	0.80	0.37**

* U-238 is not listed in the ROD; however, a RESRAD evaluation shows a derived value of 14 pCi/g

** The composite sample for SU-5 indicated U-238 at an "estimated" value (J Qualifier) of 0.37pCi/g

Chemical results for soil samples analyzed for mercury, lead, and PCBs also indicated that residual soil concentrations for these contaminants are within their respective cleanup goals, i.e., 400 mg/kg for lead, 1.84 mg/kg for mercury, 1 mg/kg for PCBs. Maximum chemical concentrations were 19.2 mg/kg for lead, 0.02 mg/kg for mercury, and 0.22 mg/kg for PCBs.

Radiological and chemical results for offsite soil sample analyses are provided in Appendix A.

3. SU-4 and SU-5 Core Sample Results

Core samples from surface to 8 ft below existing grade indicated no detection of Cs-137 (detection limit of 0.04 pCi/g), up to 0.56 pCi/g of Ra-226, and no detection of Sr-90 (detection limit of 0.3 pCi/g). Metals were analyzed in the 0-2 feet interval, and indicated a maximum of 0.02 mg/kg for mercury, and 19.2 mg/kg for lead.

4. SU-4 and SU-5 Fan House Subsurface Concrete Radiation Scans

Scans of the Building 704 subsurface concrete walls remaining in place were less than the screening value, with a range of 9,000 cpm to 16,800 cpm using the unshielded sodium iodide detector. The beta scan of the footing/pedestal sections were close to background and were less than 100 cpm. Gamma and beta scans of the subsurface concrete surfaces are provided in Appendix A.

5. SU-4 and SU-5 Fan House Subsurface Concrete Samples

For the subsurface concrete foundation walls, 20 concrete surface samples were collected and analyzed for gamma radionuclides, and Cs-137 was detected at a small fraction of the 23 pCi/g cleanup goal. Nine of twenty samples indicated detectable Cs-137, with a maximum concentration of 1.7 pCi/g and an average concentration of 0.4 pCi/g. All other radionuclides were detected at background levels. Appendix B contains the surface concrete sample results.

6. EABFF Concrete Radiation Scans

Scans of the EABFF concrete floor slab remaining in place were less than the screening value, with a range of 2,600 cpm to 3,200 cpm using the collimated sodium iodide detector. The beta scan of the slab showed background levels of about 80 cpm. Gamma and beta scans of the subsurface concrete surfaces are provided in Appendix A.

7. EABFF Subsurface Concrete Samples

For the EABFF, 17 concrete floor surface samples were collected and analyzed for gamma radionuclides; the only BNL-related nuclide detected was Cs-137. Two of 17 samples indicated detectable Cs-137, with a maximum concentration of 0.22 pCi/g and average of 0.16 pCi/g. Two core samples with a depth to 4 feet below the concrete EABFF floor slab were collected, and results indicated background radioactivity concentrations. Appendix A contains the surface concrete sample and soil core sample results.

8. Building 802 Excavation and Associated Piping Excavation Gamma Scans

Scans of the excavation area after removal of Building 802 and the associated piping were less than the screening value, with all results less than the screening value of 21,500 cpm. In the acid waste line excavation area, the maximum reading was 10,000 cpm, with a background of 7,600 cpm to 9,300 cpm. Gamma scans of the excavated area associated with Building 802 are shown in Figure 3-7.

9. Building 802 and Associated Piping Excavation Sample Results

For the excavations in the areas associated with Building 802 and associated piping within the boundary of SU-6, soil samples were collected at the bottom of each

excavation. 10 soil samples and one core sample were collected following removal of Building 802, including associated piping:

- 18-inch VCP
- 18-inch steel duct from Building 901A
- 42-inch/14-inch acid off-gas lines

Samples 1 through 3 were associated with the area where the 18-inch VCP was removed. Samples 4 through 9 were associated with Building 802 excavation, which includes the removal of the 42-inch/14-inch acid off-gas lines. Sample 10 was located near the 32-foot segment of 18-inch VCP that was left in place, and the core sample was taken near the intersection of several removed pipes. The samples were evaluated by onsite gamma spectroscopy, and surface sample no. 1 contained Cs-137 at a concentration of 0.13 pCi/g. All other surface and core samples indicated background levels of radioactivity. Onsite gamma spectroscopy results are provided in Appendix A.

Five of the samples, one composite, and the core sample were sent to an offsite laboratory for analysis. The results indicated that one of the 5 samples contained Cs-137 at a concentration of 0.22 pCi/g (estimated). The composite sample indicated an estimated Cs-137 concentration of 0.06 pCi/g, and an estimated U-238 concentration of 0.45 pCi/g. The composite indicated lead at a concentration of 7.6 mg/kg. Tritium, Sr-90, and mercury were also analyzed but were not detected. Offsite laboratory results are provided in Appendix A.

3.2.3 Sign Test and Elevated Measurement Comparison

Since no samples exceeded the cleanup criteria, the SUs do not require testing with the sign test or the elevated measurement comparison.



Figure 3-6– SU-4 and SU-5 Gamma Walkover Survey Results (Collimated Probe)

Table 3-3 Soil Sample Results – Survey Units 4, 5 and 802 Excavations Combined

Survey Units 4, 5 & 802 Excavation							
Location No	Cs-137 (pCi/g)	Fraction of Limit for Cs-137	Ra-226 (pCi/g)	Fraction of Limit for Ra-226	U-238	Fraction of Limit for U-238*	Sum of Fractions
4-1	0.34	0.01	0.80	0.16	N/A	0.03	0.20
4-2		0.00	0.29	0.06	N/A	0.03	0.08
4-3		0.00	0.27	0.05	N/A	0.03	0.08
4-4		0.00	0.37	0.07	N/A	0.03	0.10
4-5	0.07	0.00	0.38	0.08	N/A	0.03	0.10
4-6		0.00	0.34	0.07	N/A	0.03	0.10
4-7	2.07	0.09	0.44	0.09	N/A	0.03	0.20
4-8		0.00	0.37	0.07	N/A	0.03	0.10
4-9		0.00	0.28	0.06	N/A	0.03	0.08
4-10	0.57	0.02	0.65	0.13	N/A	0.03	0.18
4-11		0.00	0.30	0.06	N/A	0.03	0.09
4-12	0.09	0.00	0.30	0.06	N/A	0.03	0.09
4-13	0.07	0.00	0.38	0.08	N/A	0.03	0.11
4-14	0.26	0.01	0.33	0.07	N/A	0.03	0.10
4-15	0.16	0.01	0.55	0.11	N/A	0.03	0.14
4-16	0.22	0.01	0.44	0.09	N/A	0.03	0.12
4-17	0.09	0.00	0.32	0.06	N/A	0.03	0.10
4-18		0.00	0.25	0.05	N/A	0.03	0.08
5-1		0.00	0.27	0.05	N/A	0.03	0.08
5-2	0.07	0.00	0.26	0.05	N/A	0.03	0.08
5-3		0.00	0.26	0.05	N/A	0.03	0.08
5-4		0.00	0.22	0.04	N/A	0.03	0.07
5-5		0.00	0.34	0.07	N/A	0.03	0.10
5-6		0.00	0.21	0.04	N/A	0.03	0.07
5-7		0.00	0.19	0.04	N/A	0.03	0.06
5-8		0.00	0.33	0.07	N/A	0.03	0.09
5-9		0.00	0.29	0.06	N/A	0.03	0.08
5-10	0.43	0.02	0.39	0.08	N/A	0.03	0.12
5-11	2.53	0.11	0.29	0.06	N/A	0.03	0.19
5-12	0.10	0.00	0.37	0.07	N/A	0.03	0.10
5-13	0.60	0.03	0.14	0.03	N/A	0.03	0.08
5-14	14.9	0.65	0.33	0.07	N/A	0.03	0.74
5-15		0.00	0.23	0.05	N/A	0.03	0.07
5-16		0.00	0.23	0.05	N/A	0.03	0.07
5-17	0.12	0.01	0.35	0.07	N/A	0.03	0.10
Comp. SU4	0.50	0.02	0.31	0.06		0.00	0.08
Comp. SU5	0.93	0.04	0.27	0.05	0.37	0.03	0.12
802-1	0.13	0.01		0.00		0.00	0.01
802 comp.	0.06	0.00		0.00	0.45	0.03	0.03
Average	1.16	0.03	0.33	0.05	0.41	0.03	0.12
Maximum	14.9	0.65	0.80	0.16	0.45	0.03	0.74
All samples < cleanup goals; sign test and the elevated measurement comparison check are not necessary.							
* Alpha emitters were evaluated in the composite samples. The composite for SU-4 showed no alpha emitters above the detection limit. SU-5 indicated 0.37 pCi/g U-238 (estimated) and 802 excavation showed 0.453 (est.). The avg of these values was applied to all samples in both survey units for calculation of the sum of the fractions.							
Sr-90 was not detected above the detection limit in any sample, and is not included in this table.							
A blank cell with gray shading indicates that the radionuclide was not detected in that sample. Although 10 samples were taken for 802 excavation, only one sample and the composite are shown here, as others indicated no detected radionuclides.							

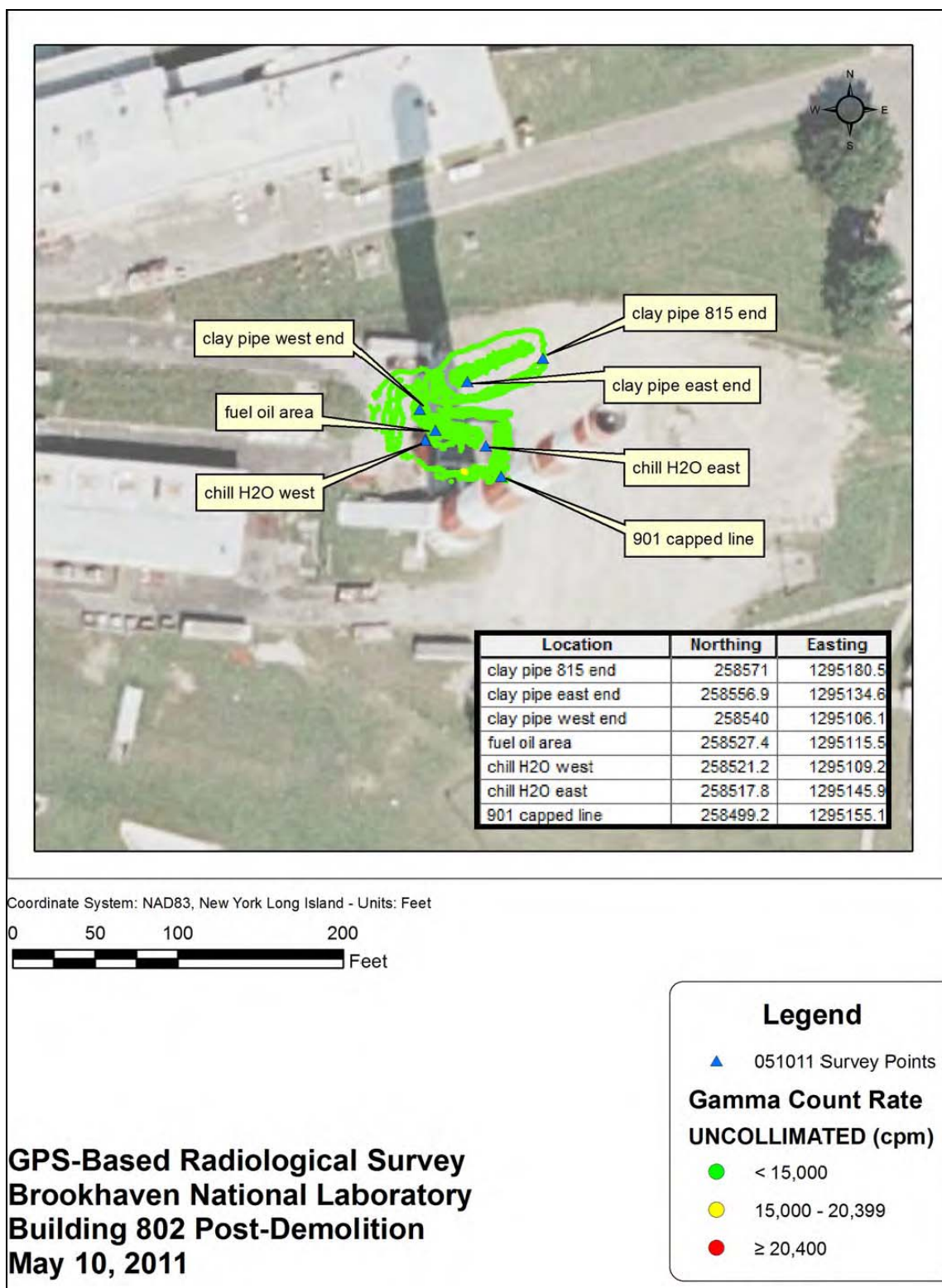


Figure 3-7– Post-Excavation Radiological Survey for Building 802 and Underground Utilities

3.2.4 Post Remediation Dose Assessment

A dose assessment was conducted to evaluate radiological dose impacts from residual radioactive materials remaining following the completion of the HFBR Fan Houses Project. The dose assessment was conducted using RESRAD, Version 6.5 (Argonne National Laboratory (ANL), 2001). The average concentration for each radionuclide from SU-4, SU-5 and the 10 samples associated with Building 802 excavation was used as input to the model in order to determine the projected dose. The average concentrations (see Table 3-3) are as follows:

- Cs-137: 1.16 pCi/g
- Ra-226: 0.33 pCi/g
- Sr-90: not detected
- U-238: 0.41 pCi/g

Note that Ra-226 background on the BNL property had previously been established at approximately 0.56 pCi/g (CDM, 1996). Therefore, the average Ra-226 value of 0.33 pCi/g from the Fan Houses area is below established background. For determination of acceptable levels of cleanup, the value of 0.33 pCi/g was used as a conservative measure, with no subtraction of background Ra-226 in the soil. However, when performing the post-remediation dose assessment using RESRAD, background is subtracted to obtain a more accurate result of the dose above background.

Two potential radiological dose scenarios were evaluated following remediation. The first assessment considered the radiation dose to a hypothetical future resident (non-farmer) assuming 50 years of institutional control. The second assessment considered the radiation dose to a current industrial worker (no decay). The parameters and pathways used in this dose assessment for the SU-4, SU-5 and Building 802 excavation are shown in the RESRAD summary reports, provided in Appendix C.

The results of the dose assessment are shown in Table 3-4 below. The maximum projected dose to a resident in Year 50 (1.2 mrem/year) at the Fan Houses area would be below the dose objective (non-farmer) of 15 mrem/year. For a resident with no decay time (Year 0), the maximum projected annual dose (2.6 mrem/year) is also less than 15 mrem/year. In addition, the maximum projected dose to an industrial worker at Year 0 (0.7 mrem/year) is less than 15 mrem/year. The results also indicate that the NYSDEC TAGM 4003 guideline of 10 mrem/yr would be met under each of the three scenarios described above. If background was not subtracted for Ra-226 (use 0.33 pCi/g without background subtracted), then the residential and industrial dose would be 6.6 mrem/yr at Year 50 and 6.4 mrem/yr at Year 0. For the industrial scenario at Year 0, the non-background subtract value would be 1.4 mrem/yr.

Table 3-4 Summary of Post-Remediation Dose Assessment Results

	Resident at 50 years	Resident at 0 years	Industrial Worker at 0 years
Dose (mrem/yr)	1.2	2.6	0.7

3.2.5 Final Status Survey Conclusions

The results of the FSS and sampling following the completion of the demolition of Building 704 and Building 802, and removal of the associated subsurface structures, ducts and piping demonstrate conformance to the site cleanup goals established for the project.

3.2.6 Final Status Survey Independent Verification

The IVS for the HFBR Fan Houses Project was performed by ORISE. The ORISE survey team conducted surveying and sampling during two separate visits. The IVS of Building 704, SU-4 and SU-5 took place during August 17 - 23, 2010. In addition, on May 9, 2011, ORISE performed visual inspections and independent measurements and sampling of remaining soils and the VCP associated with the Building 802.

For Building 704, ORISE performed surveys and sampled as described below:

- Alpha plus beta scans of the remaining foundation lower walls;
- Smears for removable gross alpha and beta activity and tritium;
- Concrete pad, scans for alpha plus beta;
- Samples of the concrete pad, analyzed for tritium, Cs-137, Ra-226 and Sr-90;
- Soil samples in SU-4 and SU-5, analyzed for Cs-137, Ra-226 and Sr-90;
- Gamma scans in accessible areas for SU-4 and SU-5; and
- Gamma scans of foundation lower walls, floor, and concrete pad.

For most of the above surveys, results indicated that cleanup criteria were met. There were two locations identified during gamma scans of the soil near the base of the Building 704 foundation lower walls that indicated elevated readings. ORISE notified ERP and both locations were remediated.

Gamma spectroscopy results for the concrete pad samples were below the applicable site cleanup objectives. Specifically, Cs-137 results ranged from 0.02 to 0.11 pCi/g; Ra-226 results ranged from 0.19 to 0.22 pCi/g; Sr-90 results ranged from -0.09 to 3.02 pCi/g; and tritium results ranged from 75.0 to 299.7 pCi/g.

Twelve random systematic soil samples were obtained within SU-4 and SU-5, and two judgmental soil samples were collected from remediated hot spot locations within SU-5. The range of results and a comparison to BNL ERP's results are provided in Table 3-5.

The conclusion of independent verification activities for SU-4 and SU-5 is that the SUs meet the applicable site cleanup objectives established for as-left radiological conditions

Table 3-5 Summary of FSS and ORISE IVS Results - Survey Units 4 and 5

Radionuclide	ORISE Range of Results (pCi/g)		BNL ERP Range* for SU- 4 & SU-5 (pCi/g)
	12 random systematic soil samples	2 judgmental soil samples	
Cs-137	0.01 - 0.17	0.16 - 0.37	0.06 - 14.9
Ra-226	0.21 - 0.58	0.22 - 0.24	0.14 - 0.80
Sr-90	0.03 - 0.55	-0.02 – 0.57	Not detected (<0.3 pCi/g)

* Range of those samples where Cs-137 was detected

For the Building 802 excavation, ORISE performed surveys and sampled the following:

- Surface gamma scans of the 802 Building excavation;
- Alpha and beta scans of the VCP left in the ground;
- Surface measurements, direct gamma readings at each soil collection point;
- Soil samples at the deepest point of excavation, analyzed for Cs-137, Ra-226, and Sr-90; and
- Smears for gross alpha/beta and for tritium for locations inside the VCP

For the above surveys, results indicated that cleanup criteria were met. The average results for soil samples collected in the Building 802 excavation and a comparison to BNL ERP's results are provided in Table 3-6. The conclusion of the above independent verification activities at the Building 802 is that the FSS unit meets the applicable site cleanup objectives established for as-left radiological conditions.

Table 3-6 Summary of FSS and ORISE IVS Results - Building 802 Excavation

Radionuclide	ORISE Soil Sample Results		BNL ERP Soil Sample Results* Average (pCi/g)
	Range of ORISE Results (pCi/g)	Average ORISE Results (pCi/g)	
Cs-137	-0.01 - 0.07	0.02	0.10
Ra-226	0.25 - 0.32	0.27	0.33
Sr-90	-0.31 - 0.05	-0.10	Not detected (<0.3 pCi/g)

* Average of those samples where Cs-137 was detected

The results of the IVS for the HFBR Fan Houses Project are documented in the *Final Report - Independent Verification Survey of the High Flux Beam Reactor, Fan Houses Buildings 704 and 802, Brookhaven National Laboratory, Upton, New York* (ORISE, July 2011), provided in Appendix D.

3.3 Waste Management

3.3.1 Waste Characterization, Handling and Disposal

The waste management strategy, waste characterization, packaging, handling, and storage were performed in accordance with the *Waste Management Plan for the D&D of the HFBR Buildings 802 & 704 Fanhouses* (BNL, December 2009) and BNL Standards Based Management System (SBMS) waste management procedures. Waste generated during the HFBR Fan Houses Project was characterized as LLRW, C&D waste or hazardous industrial waste; and included concrete, brick, steel, lead acid batteries, lighting fixtures that were considered suspect PCB containing material, and ACM. Oversized waste was size-reduced to meet the disposal facility's WAC prior to being packaged for disposal. Debris and soil characterization data collected during remedial activities were used to characterize project waste. The waste shipped met the WAC of the disposal facilities specified below. Waste verification results were submitted to BNL's Waste Management Program. All LLRW was shipped via rail to Energy Solutions of Utah. C&D waste that wasn't recycled onsite was shipped via truck to a Veolia ES Greentree Landfill of Kersey, Pennsylvania. ACM was shipped via truck to a Minerva Enterprises of Waynesburgh, Ohio. Lighting fixtures that were considered suspect PCB containing material and lead acid batteries were shipped via truck to Veolia ES Greentree Landfill of Kersey, Pennsylvania.

Waste loading and shipping was initiated in March 2010 and was completed in August/September 2011. MHF Services provided shipping containers and railcars for transportation of project waste. Envioron Transport Group, Inc. and ATC provided waste shipment services for C&D waste and ACM, respectively. A project waste summary is provided below in Table 3-7.



Photograph 12 – Shipping project waste via rail.

Table 3-7
Project Waste Summary

Waste Type	Manifested Volume	Containers	Disposal Facility	Number/Conveyances
Clean Demolition Debris	680 yd ³ (C&D)	3-20 yard Roll-offs 10-30 yard Roll-offs	Veolia ES Greentree Landfill	43 Trucks
Hazardous Industrial Waste - ACM	20 yd ³	1-20 yard Roll-off	Minerva Enterprises	1 Truck
Radiologically Contaminated Demolition Debris	2,520 yd ³ (LLRW)	129.5 Intermodals 4-20 foot Sea-Lands	Energy Solutions	32 ABC Railcars
Lead Acid Batteries	2 yd ³	4-shrink wrapped pallets	Veolia ES Greentree Landfill	1 Truck
Lighting Fixtures – Suspect PCB Containing Material	2 ft ³	2-5 gallon pails	Veolia ES Greentree Landfill	1 Truck

3.3.2 Pollution Prevention and Waste Minimization Opportunities

Waste minimization and pollution prevention methods employed during the HFBR Fan Houses Project included the judicious use of consumables (Personal Protection Equipment) as well the survey, free release and onsite recycling of approximately 1,540 cubic yards of concrete debris; and the recycling/reuse of fluorescent lighting, electrical equipment, the 1,000-gallon stack drain tank and the backup generator, as discussed in Sections 3.1 and 3.2. In addition, overburden soil was segregated and characterized for reuse as backfill during site restoration activities. Characterization data is included in Appendix E.

3.4 Site Restoration

Site restoration, including trench backfilling and compaction, was performed in accordance with the *Excavation Plan for Building 704 (Fan House) and Building 802 (Fan House/Tritiated Water Evaporator Facility), Rev 1* (BNL, March 2011). Disturbed groundwater monitoring wells, sidewalks, curbs and asphalt areas were repaired as necessary. Disturbed grassed areas were seeded using hydroseeding methods in accordance with project plans.

Site restoration activities were completed in July 2011. Future site controls are discussed in Section 7.0.



Photograph 13 – Placing clean fill at previous location of Building 704.

4.0 CHRONOLOGY OF EVENTS

Table 4-1 lists a chronology of the main remedial events associated with the HFBR Fan Houses:

Table 4-1 Chronology of Remedial Events for the HFBR Fan Houses

Date	Remedial Event
April 2009	HFBR ROD finalized
April 2010	Remedial Design/Remedial Action Work Plan for the D&D of the Fan Houses finalized.
March 2010 – December 2010	D&D of Building 704, as well as the removal of the Building 704 duct, EABFF and associated contaminated soil completed. The associated FSS and IVS were performed.
March 2011 – June 2011	D&D of Building 802 and aboveground plenum, as well as the removal of associated ducts, piping and contaminated soil completed. The associated FSS and IVS were performed.

5.0 PERFORMANCE STANDARDS & QUALITY CONTROL

As discussed in Section 3.2.2, the average concentrations for Cs-137, Sr-90, and Ra-226 in soil were below the cleanup goals of 23 pCi/g, 15 pCi/g, and 5 pCi/g, respectively. The calculated radiological doses from all radioisotopes were also below the levels stipulated in the HFBR ROD. In addition, concentrations of mercury and lead in soil were below the cleanup goals of 1.84 mg/kg and 400 mg/kg, respectively. Concentrations of PCBs were below NYSDEC standards.

Physical and radiological inspections were conducted on both incoming and outgoing intermodal containers. Inspections were also conducted on excavations, trench boxes and storm water control measures during excavation operations. Field sampling procedures were reviewed periodically.

QA/quality control (QC) samples were collected in accordance with the *Field Sampling Plan for the HFBR Underground Utilities, Building 704 and Building 802* (BNL, June 2010). Field duplicates were collected at a frequency of one per twenty soil samples and analyzed for the radiological and chemical contaminants of concern. QA/QC results are summarized with the FSS results provided in Appendix A.

6.0 FINAL INSPECTION AND CERTIFICATIONS

As described in Section 3.3.6, IVS was performed by ORISE upon the completion of each FSS performed by ERP. Based on the results of each FSS, an evaluation of the dose from the remaining activity in the vicinity of the HFBR Fan Houses was performed using RESRAD; results were within the design criteria described in Section 2.2.

There was strict adherence to industrial safety and radiological safety precautions during the HFBR Fan Houses Project. Work was performed under written and approved procedures, and any potentially hazardous steps were highlighted in the procedure to ensure understanding and compliance. JRAs were developed and approved for the stabilization work. Radiological safety and oversight was provided by Radiological Control Technicians (RCTs), and all work was performed under a RWP. Completion of the HFBR Fan Houses Project was accomplished without any worker injuries categorized as lost time accidents.

6.1 Industrial Hygiene Oversight & Monitoring

Industrial hygiene (IH) oversight and monitoring was conducted by ERP personnel in accordance with ERP procedures. JRAs identified hazards associated with each of the tasks identified and specified the required controls for each hazard. A designated Site Health and Safety Officer was onsite during cleanup activities to ensure controls were in place as specified in JRAs, including the use of safety equipment, safe work practices, excavation safety and asbestos controls. IH monitoring included confined space monitoring and mercury vapor monitoring.

6.2 Radiological Oversight & Monitoring

Radiological oversight and monitoring for the HFBR Fan Houses Project was conducted by BNL RCTs in accordance with project RWPs (2010-ERP-010 & 2011-ERP-010). Thermoluminescent dosimeters (TLDs) were worn by each individual entering the posted Controlled Area, Soil Contamination Areas and Contamination Areas. The radiation exposure estimate and actual radiation exposures for the project is less than 10 mrem, far less than the administrative control level dose value of 100 mrem. In addition, radiological monitoring included air sampling as specified by the RWPs and the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) Assessment. All general area air sample results were below 0.5 derived air concentrations (DAC). Workers entering the posted contamination areas were also required to have a whole body count prior to and upon completion of work on the HFBR Fan Houses Project.

Portions of both Building 704 and Building 802 were radiologically surveyed and free released. Results of the release survey satisfied the requirements of the BNL Radiological Control Manual, specifically Table 2-2 and the requirements of FS-SOP-1005,

Radiological Surveys Required For Release of Materials from Areas Controlled For Radiological Purposes (BNL, November 2007).

Equipment used during the HFBR Fan Houses Project was also monitored for radiological contamination. All equipment that was released from the work zone was surveyed in accordance with the requirements of FS-SOP-1005, *Radiological Surveys Required For Release of Materials from Areas Controlled For Radiological Purposes* (BNL, November 2007).

7.0 OPERATION AND MAINTENANCE ACTIVITIES

The BNL Land Use Controls Management Plan will be revised to include the HFBR Fan Houses, and the BNL site utility drawings will be updated.

The *HFBR Long Term Surveillance and Maintenance Manual* will be prepared to include the post remediation surveillance and maintenance activities for the HFBR Fan Houses area. These activities will include institutional controls (land use controls, notifications and restrictions, work planning controls such as digging permits, and government ownership). The topsoil cover, placed during site restoration, will also be inspected for signs of erosion.

Brookhaven Science Associates (BSA) will perform surveillance and maintenance activities. In addition to maintaining institutional controls for the HFBR Fan Houses area, BSA will ensure that that routine monitoring/inspections are performed. DOE will ensure enforcement of all institutional controls.

8.0 SUMMARY OF PROJECT COSTS

The HFBR Fan Houses Project was performed with ARRA funding. The project cost approximately \$8,200,000 to complete. The original estimate cost for the HFBR Fan Houses Project was \$7,800,000. The additional cost was associated with the re-sequencing of demolition activities, specifically the demolition of Building 802 prior to the demolition of the Stack. This re-sequencing necessitated the installation of alternative power supplies for the Stack lighting.

The costs for the HFBR Fan Houses Project included the following details:

Engineering and planning	\$ 590,000
D&D/Remediation & Site Restoration	\$ 5,283,000
Independent Verification (ORISE)	\$ 60,000
Waste Transportation and Disposal	\$ 2,243,000
Project Closeout	\$ 10,000
Total Cost	\$ 8,200,000

9.0 OBSERVATIONS AND LESSONS LEARNED

The following is a summary of the lessons learned from this project and the corrective actions for future projects:

- Heavy equipment was used to load concrete rubble, rebar and steel debris directly into intermodal shipping containers. Limited attempts were made to size reduce the materials prior to loading. Instead, debris was sometimes compacted with a loader bucket after it was loaded into the shipping containers. Subsequent to the loading process, small holes were identified on the bottoms of several intermodal shipping containers. This was first identified when a hole was found upon arrival of a breached container. This triggered additional inspections of shipping containers that were loaded and staged at BNL. Holes were identified in the bottom of three additional shipping containers. It could not be positively determined whether the damage was caused by loading activities or by movement of the debris during transportation. All of the damaged 25-cubic yard shipping containers, which were leased from a vendor, were designed with 9-gauge steel floors. The smaller 20-cubic yard shipping containers, which ERP previously purchased, were designed with heavier 7-gauge steel floors. Although the same loading techniques and material were used, no damage was identified on the 20-cubic yard shipping containers. All railroad shipments of intermodal shipping containers were suspended pending repairs to the damaged containers, a causal analysis and the completion of an approved corrective action plan. The corrective action plan included the following instructions:
 - Size-reduce debris prior to loading (e.g., cutting rebar from concrete blocks).
 - Protect containers from damage by adding a layer of soil or plywood to the bottom prior to waste loading.
 - Do not allow loaded items to make contact with the shipping container lid.
 - Ensure an independent waste verifier is available during waste loading.
 - Perform container integrity inspections immediately following container lid closure and prior to loading onto offsite conveyance.
- Size reducing debris is an integral step in the building demolition process and can be completed after the building has been demolished or during building demolition. Size reducing debris during the demolition process, using a slow and deliberate approach, was determined to be the most efficient method during the HFBR Fan Houses Project.
- A Daily Excavation Inspection Checklist was not available at the work site during one day of the HFBR Fan Houses Project. In that instance, workers decided to document the inspection with a written statement in the Daily Field

Report in lieu of the checklist. The absence of the Daily Excavation Inspection Checklist resulted in workers moving from a rule based work mode to a knowledge based work mode. Ensuring that field work package folders contain a sufficient number of pre-printed inspection forms both saves time and reduces the chance for human error.

10.0 PROTECTIVENESS

D&D of the HFBR Fan Houses, as well as the removal of associated piping, ducts and contaminated soil is protective of human health and the environment. These actions have also minimized the potential for the migration of contaminants into the underlying groundwater.

10.1 Facility Review Disposition Project Issues

The Facility Review Disposition Project (FRDP) was initiated in 1998 to resolve the issues identified during the preceding BNL Facility Review Project. The completion of the HFBR Fan Houses Project satisfies the closure requirements associated with the FRDP issues summarized in Table 10-1.

Table 10-1 HFBR Fan Houses Project FRDP Issues Summary

BNL I.D. #	SCDHS I.D. #	Building	BNL Issue Description	Resolution
402	1487	704	Lead acid batteries stored in Building 704.	The batteries were removed and disposed.
558	N/A	802	Storage tank for tritiated water.	The tank was removed and disposed.
562	N/A	802	There are four underground piping systems that are associated with Bldg 802 – Includes the Acid and Non-Acid Ventilation Systems, the sample port systems for the Vent Systems and water lines that ran to 704 and 701.	The majority of piping systems/ducts were removed under the HFBR Underground Utilities Project. The balance was removed under the HFBR Fan Houses Project.
849	N/A	750/704	Soil Contamination	Isolated areas of soil contamination in the vicinity of Building 750, referred to as the "HFBR Outside Areas," were removed as part of the HFBR Stabilization Project. The balance of isolated areas of soil contamination, located in the vicinity of Building 704, were removed under the HFBR Fan Houses Project.
2866	0993	802	The wall between the evaporator room and fan room has penetrations where tritium steam could enter.	D&D of Building 802 was completed and all contaminated material shipped to an appropriate waste disposal site.

11.0 FIVE YEAR REVIEW

Five-year reviews will be conducted to determine whether the remedy implemented continues to be protective of human health and the environment. These reviews will be performed in accordance with the *Comprehensive Five-Year Review Guidance*, OSWER No. 9355.7-03B-P (EPA, June 2001). Remedy implementation at the HFBR, including D&D of the HFBR Fan Houses, was discussed in the *Five Year Review Report for Brookhaven National Laboratory Superfund Site* (BNL, March 2011). The HFBR complex will be included in the next sitewide five year review in 2016.

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APPENDIX A

HFBR Fan Houses Final Status Survey Results

- 1) FSS GEL Data
- 2) FSS RCT Survey Forms and Onsite ISOCS Data

HFBR Fan Houses Project
Building 704 (SU-4)
Soil Sample Locations

	DCGL	30064-001	30064-002	30064-003	30064-004	30064-005	30064-006	30064-007	30064-008	30064-009	30064-010	30064-011	30064-012	30064-013	30064-014	30064-015	30064-016	30064-017	30064-018																		
Parameter	or ECV	1 (pCi/g)	2 (pCi/g)	3 (pCi/g)	4 (pCi/g)	5 (pCi/g)	6 (pCi/g)	7 (pCi/g)	8 (pCi/g)	9 (pCi/g)	10 (pCi/g)	11 (pCi/g)	12 (pCi/g)	13 (pCi/g)	14 (pCi/g)	15 (pCi/g)	16 (pCi/g)	17 (pCi/g)	18 (pCi/g)																		
Rad Gamma Spec Analysis																																					
Americium-241	34	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT																		
Beryllium-7	NA	-0.0825	DL	0.152	DL	0.342	DL	0.228	DL	0.14	DL	-0.223	DL	0.0493	DL	0.26	DL	0.0723	DL	0.00313	DL	-0.174	DL	0.0691	DL	-0.0369	DL	-0.277	DL	0.192	DL	-0.18	DL	-0.102	DL	-0.0277	DL
Cesium-134	NA		NT	NT	NT	NT		NT	NT	NT		NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		
Cesium-137	23	0.338	DI	0.00828	DI	0.0257	DL	0.0428	DL	0.065		0.0107	DL	2.07		0.0208	DL	0.0243	DL	0.573		0.037	UI	0.0889		0.071	DL	0.261		0.162		0.215		0.0937		0.00421	DL
Cobalt-57	NA	-0.000485	DL	-0.00819	DL	-0.0114	DL	-0.00694	DL	0.0165	DL	0.0084	DL	0.00414	DL	-0.000297	DL	0.0056	DL	0.00103	DL	0.0024	DL	-0.00643	DL	-0.00874	DL	0.0189	DL	-0.00366	DL	-0.00269	DL	0.0078	DL	-0.00224	DL
Cobalt-60	1260	0.0121	DL	-0.00961	DL	0.00522	DL	-0.013	DL	-0.00173	DL	0.0161	DL	0.0163	DL	0.0162	DL	-0.00104	DL	-0.00377	DL	-0.0029	DL	-0.00449	DL	0.0092	DL	-0.00325	DL	-0.0165	DL	-0.0268	DL	0.00904	DL	-0.00809	DL
Europium-152	51	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	
Europium-154	180	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	
Europium-155	NA	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	
Manganese-54	NA	0.0136	DL	0.0119	DL	0.00584	DL	-0.00651	DL	0.0162	DL	0.013	DL	0.00247	DL	-0.0258	DL	-0.0031	DL	0.0223	DL	-0.00731	DL	0.0173	DL	-0.011	DL	0.0637	UI	0.013	DL	-0.0235	DL	-0.00646	DL	0.0154	DL
Potassium-40	NA	7.55		4.77		4		4.74		3.96		4.09		5.63		4.59		3.99		6.59		5.55		4.47		4.7		5.73		5.26		3.91		4.1		3.42	
Radium-226	5	0.804		0.29		0.267		0.373		0.375		0.344	UI	0.367		0.277		0.646		0.3		0.303		0.384		0.328		0.547		0.439	UI	0.323		0.247	UI		
Sodium-22	NA	-0.0111	DL	-0.0015	DL	0.00804	DL	-0.0185	DL	-0.0143	DL	0.00309	DL	-0.0315	DL	0.0108	DL	0.00421	DL	-0.012	DL	-0.00555	DL	-0.00216	DL	0.00822	DL	0.0172	DL	0.00149	DL	-0.0153	DL	-0.0186	DL	0.00447	DL
Thorium-228	NA	0.798		0.291		0.423		0.501		0.474		0.338		0.453		0.411		0.299		0.792		0.465		0.36		0.499		0.533		0.57		0.456		0.449		0.348	
Zinc-65	NA	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Nuilding 704 and Building 802 June2010

All samples taken from 0.0-0.5' below grade

DL - Below the detection limit

ND - Not detected

J - Indicates an estimated concentration

U - Indicates that the compound was analyzed for, but was not detected

UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Levels.

All units are pCi/g

Gamma Spec results only reported for those parameters that were recorded during the analysis

**HFBR Fan Houses Project
Building 704 (SU-4)
Soil Composite and Core Samples**

Parameter	DCGL	30064-019		30064-022		30064-023		30064-024		30064-025		30064-026		30064-027		30064-028		30064-029		30064-030		30064-031		30064-032		30064-033			
	or ECV	SU4 Comp 1-18		SU4 -6 Core 0-2'		SU4 -6 Core 2-4'		SU4 -6 Core 4-6'		SU4 -6 Core 6-8'		SU4- 12 Core 0-2'		SU4- 12 Core 2-4'		SU4- 12 Core 4-6'		SU4- 12 Core 6-8'		SU4-17 Core 0-2'		SU4-17 Core 2-4'		SU4-17 Core 4-6'		SU4-17 Core 6-8'			
Rad Gamma Spec Analysis																													
Americium-241	34	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Beryllium-7	NA	-0.176	DL	0.0125	DL	0.0251	DL	0.00607	DL	-0.267	DL	0.0219	DL	-0.0351	DL	0.00958	DL	0.0953	DL	0.191	DL	0.0718	DL	0.0709	DL	-0.0865	DL		
Cesium-134	NA			NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Cesium-137	23	0.503		0.01	DL	0.0107	DL	-0.0503	DL	0.00939	DL	-0.0219	DL	-0.015	DL	0.0043	DL	-0.00158	DL	0.00224	DL	-0.00834	DL	0.0146	DL	-0.00657	DL		
Cobalt-57	NA	-0.00319	DL	-0.015	DL	-0.0195	DL	0.0107	DL	-0.00718	DL	-0.00133	DL	-0.00603	DL	0.00815	DL	0.00636	DL	0.000973	DL	0.00827	DL	-0.00354	DL	-0.00131	DL		
Cobalt-60	1,260	-0.0129	DL	0.00175	DL	-0.0112	DL	0.0175	DL	0.00389	DL	-0.00146	DL	-0.00404	DL	0.00199	DL	-0.00347	DL	-0.0194	DL	0.00798	DL	-0.0012	DL	-0.00263	DL		
Europium-152	51	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Europium-154	180	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Europium-155	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Manganese-54	NA	-0.0253	DL	-0.0156	DL	-0.0104	DL	0.0149	DL	-0.00301	DL	0.000889	DL	0.0199	DL	-0.0188	DL	-0.00798	DL	0.0113	DL	-0.0105	DL	-0.00708	DL	-0.015	DL		
Potassium-40	NA	4.23		5.72		5.87		7.81		6.06		4.85		3.22		1.49		3.59		3.31		2.79		4.02		3.78			
Radium-226	5	0.312		0.441		0.466		0.556		0.291		0.168		0.216		0.219		0.166		0.245	UI	0.154	UI	0.315	UI	0.206	UI		
Sodium-22	NA	0.0119	DL	0.00139	DL	-0.0192	DL	0.00766	DL	-0.000769	DL	0.00883	DL	0.0107	DL	-0.00693	DL	-0.000474	DL	0.00134	DL	0.013	DL	0.0132	DL	-0.0255	DL		
Thorium-228	NA	0.399		0.682		0.609		0.858		0.353		0.155		0.271		0.498		0.271		0.42		0.18		0.41		0.267			
Zinc-65	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Rad Alpha Spec Analysis																													
Curium-234/244	NA	-0.00473	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Plutonium-238	57	0.0212	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Plutonium-239/240	35	0.0204	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Uranium-235/236	4.6	-0.0383	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Uranium-238	4.7	0.114	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Plutonium-241	NA	-2.88	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Rad Liquid Scintillation Analysis																													
Tritium	NA	36.2	U	51.6	U	73	U	171	U	33.3	U	75.3	U	33.4	U	27.9	U	72.5	U	36.1	U	100	U	-19.5	U	51	U		
Rad Gas Flow Proportional Counting																													
Strontium	15	0.206	U	-0.254	U	0.476	U	0.107	U	0.188	U	-0.212	U	-0.0138	U	0.219	U	-0.075	U	0.165	U	-0.262	U	0.0658	U	0.217	U		
Metals																													
Mercury (mg/kg)	1.84	0.162		0.0196		NT		NT		NT		0.00403		NT		NT		NT		0.00901		NT		NT		NT		NT	
Lead (mg/kg)	400	14.4		2.55		NT		NT		NT		0.743		NT		NT		NT		5.83		NT		NT		NT		NT	

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Nuilding 704 and Building 802 June2010

DL - Below the detection limit

ND - Not detected

NT-Analyte not tested for

J - Indicates an estimated concentration

U - Indicates that the compound was analyzed for, but was not detected

UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Level:

All units are pCi/g except for Metals which are shown in mg/kg

Gamma Spec results only reported for those parameters that were recorded during the analysis

**HDBR Fan Houses Project
Building 704 (SU-4)
PCB Results**

Compound	NYSDEC RSCO ⁽¹⁾	30064-001		30064-002		30064-003		30064-004		30064-005		30064-006		30064-007		30064-008		30064-009		30064-010		30064-011		30064-012		30064-013		30064-014	
		1		2		3		4		5		6		7		8		9		10		11		12		13		14	
		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'		0-0.5'	
Polychlorinated Biphenyls																													
Aroclor 1016	10000	19	U	33.3	U	34	U	33.9	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1221	10000	19	U	33.3	U	34	U	33.9	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1232	10000	19	U	33.3	U	34	U	33.9	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1242	10000	19	U	33.3	U	34	U	33.9	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	9.1	J	16.6	U	16.6	U
Aroclor 1248	10000	19	U	23.1	J	34	U	33.9	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1254	10000	19	U	33.3	U	34	U	33.9	U	33.7	U	52.3		34.3	U	17.4	U	17.1	U	173		3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1260	10000	19	U	33.3	U	34	U	33.9	U	33.7	U	23.3	J	34.3	U	17.4	U	17.1	U	46.3	P	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor Total	NS	19	U	23.1	J	34	U	33.9	U	33.7	U	75.6		34.3	U	17.4	U	17.1	U	219		3.32	U	9.1	J	16.6	U	16.6	U

Compound	NYSDEC RSCO ⁽¹⁾	30064-015 15 0-0.5'	30064-016 16 0-0.5'	30064-017 17 0-0.5'	30064-018 18 0-0.5'	30064-019 Composite of 1-18 0-0.5'	30064-020 Field Dup. of 12 0-0.5'	30064-021 Field Blank 0-0.5'	30064-022 6 Core 0-2'	30064-023 6 Core 2-4'	30064-024 6 Core 4-6'	30064-025 6 Core 6-8'	30064-026 12 Core 0-2'	30064-027 12 Core 2-4'	30064-028 12 Core 4-6'														
Polychlorinated Biphenyls																													
Aroclor 1016	10000	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1221	10000	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1232	10000	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1242	10000	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	9.1	J	16.6	U	16.6	U
Aroclor 1248	10000	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	33.8	U	34.3	U	17.4	U	17.1	U	34.9	U	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1254	10000	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	52.3		34.3	U	17.4	U	17.1	U	173		3.32	U	16.6	U	16.6	U	16.6	U
Aroclor 1260	10000	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	23.3	J	34.3	U	17.4	U	17.1	U	46.3	P	3.32	U	16.6	U	16.6	U	16.6	U
Aroclor Total	NS	34.9	U	33.4	U	33.4	U	33.8	U	33.7	U	75.6		34.3	U	17.4	U	17.1	U	219		3.32	U	9.1	J	16.6	U	16.6	U

Compound	NYSDEC RSCO ⁽¹⁾	30064-029 12 Core 6-8'	30064-030 17 Core 0-2'	30064-031 17 Core 2-4'	30064-032 17 Core 4-6'	30064-033 17 Core 6-8'			
Polychlorinated Biphenyls									
Aroclor 1016	10000	34.9	U	33.4	U	33.8	U	33.7	U
Aroclor 1221	10000	34.9	U	33.4	U	33.4	U	33.8	U
Aroclor 1232	10000	34.9	U	33.4	U	33.4	U	33.8	U
Aroclor 1242	10000	34.9	U	33.4	U	33.4	U	33.8	U
Aroclor 1248	10000	34.9	U	33.4	U	33.4	U	33.8	U
Aroclor 1254	10000	34.9	U	33.4	U	33.4	U	33.8	U
Aroclor 1260	10000	34.9	U	33.4	U	33.4	U	33.8	U
Aroclor Total	NS	34.9	U	33.4	U	33.4	U	33.8	U

Notes:
 All units are µg/Kg (ppb).
⁽¹⁾ NYSDEC Recommended Soil Cleanup Objectives (RSCO), Technical and Administrative Guidance Memorandum #404Determination of Soil Cleanup Objectives and Cleanup Levels , 12/00
 NS - No RSCO established
 DL - Below the detection limit
 ND - Not detected
 J - Indicates an estimated concentration
 U - Indicates that the compound was analyzed for, but was not detected
Bold/Shaded text denotes concentrations exceeding RSCO Action Level.

HFBR Fan Houses Project
Building 704 (SU-5)
Soil Sample Locations

Parameter	DCGL or ECV	30067-001 1 (pCi/g)	30067-002 2 (pCi/g)	30067-003 3 (pCi/g)	30067-004 4 (pCi/g)	30067-005 5 (pCi/g)	30067-006 6 (pCi/g)	30067-007 7 (pCi/g)	30067-008 8 (pCi/g)	30067-009 9 (pCi/g)	30067-010 10 (pCi/g)	30067-011 11 (pCi/g)	30067-012 12 (pCi/g)	30067-013 13 (pCi/g)	30067-014 14 (pCi/g)	30067-015 15 (pCi/g)	30067-016 16 (pCi/g)	30067-017 17 (pCi/g)																	
Rad Gamma Spec Analysis																																			
Americium-241	34	NT		NT		NT		NT		NT		NT		NT		NT		NT																	
Beryllium-7	NA	-0.0553	DL	0.181	DL	-0.0345	DL	0.15	DL	0.206	DL	-0.114	DL	0.149	DL	0.158	DL	0.131	DL	0.116	DL	0.195	DL	0.224	DL	-0.139	DL	0.403	DL	-0.0602	DL	0.273	DL	-0.122	DL
Cesium-134	NA	NT		NT				NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Cesium-137	23	0.00595	DI	0.0731	DI	0.0267	DL	0.0244	DL	-0.015	-0.00299	DL	0.00604	DL	0.0385	DL	0.43	2.53	0.104	0.604	DL	14.9	0.0422	DL	0.0422	DL	0.0391	DL	0.122	DL					
Cobalt-57	NA	0.0114	DL	-0.00641	DL	0.011	DL	0.0101	DL	0.0117	DL	-0.0129	DL	-0.00593	DL	0.00911	DL	-0.00527	DL	-9.33E-05	DL	-0.00497	DL	0.00529	DL	-0.00467	DL	0.0051	DL	-0.00833	DL	-0.0131	DL	0.00836	DL
Cobalt-60	1260	-0.00661	DL	0.00601	DL	0.00398	DL	-0.0113	DL	0.000307	DL	-0.0161	DL	-0.023	DL	0.00893	DL	0.00846	DL	0.00495	DL	-0.0051	DL	-0.00458	DL	0.0103	DL	-0.00857	DL	0.00189	DL	-0.00367	DL	-0.016	DL
Europium-152	51	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Europium-154	180	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Europium-155	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Manganese-54	NA	0.0116	DL	0.0152	DL	0.00258	DL	0.00792	DL	-0.00962	DL	0.0185	DL	0.00148	DL	0.0282	DL	0.00252	DL	0.00119	DL	0.0248	DL	0.0262	DL	-0.00152	DL	0.00531	UI	-0.006	DL	-0.00609	DL	-0.000388	DL
Potassium-40	NA	4.28		4.16		4.34		3.3		3.93		2.56		1.87		5.36		4.55		4.86		4.13		3.5		3.4		3.85		3.73		3.91		5.14	
Radium-226	5	0.272		0.262	UI	0.263		0.223		0.343		0.214		0.189		0.327		0.291		0.391		0.288		0.37		0.144		0.333		0.228	UI	0.233	UI	0.35	
Sodium-22	NA	-0.0141	DL	0.000331	DL	0.0138	DL	-0.102	DL	0.016	DL	-0.0104	DL	-0.00709	DL	0.00828	DL	-0.00692	DL	-0.0171	DL	-0.00951	DL	-6.86E-05	DL	0.014	DL	-0.0108	DL	-0.00649	DL	-0.00919	DL	-0.0056	DL
Thorium-228	NA	0.452		0.395		0.424		0.399		0.526		0.532		0.394		0.412		0.445	UI	0.572		0.469		0.44		0.337		0.446		0.405		0.424		0.648	
Zinc-65	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	

Notes:
DCGL-Derived Concentration Guidance Limits from the OU I ROD
ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Nulding 704 and Building 802 June2010
All samples taken from 0.0-0.5' below grade
DL - Below the detection limit
ND - Not detected
NT - Analyte not tested for
J - Indicates an estimated concentration
UI - Indicates that the compound was analyzed for, but was not detected
UI -Uncertain identification for gamma spectroscopy
Bold/Shaded text denotes concentrations exceeding OU1 Action Levels.
All units are pCi/g
Gamma Spec results only reported for those parameters that were recorded during the analysis

**HFBR Fan Houses Project
Building 704 (SU-5)
SoilComposite and Core Samples**

Parameter	DCGL or ECV	30067-018 SU5 Comp 1-17	30067-021 SU5 -7 Core 0-2'	30067-022 SU5 -7 Core 2-4'	30067-023 SU5 -7 Core 4-6'	30067-024 SU5 -7 Core 6-8'	30067-025 SU5- 10 Core 0-2'	30067-026 SU5- 10 Core 2-4'	30067-027 SU5- 10 Core 4-6'	30067-028 SU5- 10 Core 6-8'	30067-029 SU5-15 Core 0-2'	30067-030 SU5-15 Core 2-4'	30067-031 SU5-15 Core 4-6'	30067-032 SU5-15 Core 6-8'													
Rad Gamma Spec Analysis																											
Americium-241	34	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT													
Beryllium-7	NA	0.00523	DL	-0.127	DL	0.0288	DL	0.128	DL	0.0415	DL	-0.0443	DL	0.0903	DL	0.0641	DL	0.0432	DL	0.0275	DL	0.0521	DL	-0.048	DL	0.0433	DL
Cesium-134	NA	NT			NT	NT	NT			NT				NT				NT				NT				NT	
Cesium-137	23	0.932		-0.0207	DL	0.00507	DL	-0.00661	DL	-0.0116	DL	0.0132	DL	-0.00863	DL	0.0408	UI	0.0141	DL	-0.00793	DL	-0.00212	DL	-0.00556	DL	0.0119	DL
Cobalt-57	NA	-0.00825	DL	0.0118	DL	0.00387	DL	-0.000662	DL	-0.0042	DL	-0.00335	DL	1.72E-05	DL	0.00203	DL	0.00723	DL	0.00276	DL	0.00437	DL	0.0011	DL	-0.00373	DL
Cobalt-60	1,260	0.00434	DL	0.00678	DL	-0.00145	DL	0.00146	DL	-0.00103	DL	0.000384	DL	-0.00468	DL	-0.000166	DL	0.012	DL	0.000553	DL	0.00523	DL	0.00273	DL	0.00358	DL
Europium-152	51	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Europium-154	180	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Europium-155	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Manganese-54	NA	-0.00434	DL	-0.0116	DL	0.0146	DL	0.0359	DL	-0.002	DL	0.00963	DL	0.0103	DL	0.0276	DL	0.0284	DL	-0.0106	DL	-0.00118	DL	0.0069	DL	-0.0157	DL
Potassium-40	NA	4.69		2.6		2.57		1.3		1.47		4.21		1.95		2.04		0.98		3.3		3.39		3.26		4.72	
Radium-226	5	0.267		0.395		0.206		0.277		0.149	UI	0.348		0.484		0.168		0.386		0.335	UI	0.241	UI	0.323	UI	0.116	DL
Sodium-22	NA	-0.00426	DL	-0.0177	DL	0.00489	DL	-0.013	DL	0.00135	DL	-0.0179	DL	-0.0305	DL	-0.00402	DL	-0.00469	DL	-0.00897	DL	-0.0109	DL	0.00687	DL	-0.0118	DL
Thorium-228	NA	0.552		1.04		0.374		0.505		0.334		0.509		1.07		0.421		0.597		0.461		0.414		0.265		0.186	
Zinc-65	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Rad Alpha Spec Analysis																											
Curium-234/244	NA	-0.00994	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Plutonium-238	57	-0.0226	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Plutonium-239/240	35	-0.00672	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Uranium-235/236	4.6	-0.0217	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Uranium-238	4.7	0.365	J	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Plutonium-241	NA	-0.915	U	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Rad Liquid Scintillation Analysis																											
Tritium	NA	-28.2	U	-40.5	U	-154	U	-72.1	U	-65.6	U	14.9	U	6.31	U	-26.1	U	-23.6	U	-19.6	U	-51.7	U	-60	U	-84.7	U
Rad Gas Flow Proportional Counting																											
Strontium	15	0.192	U	-0.0902	U	0.201	U	0.28	U	0.311	U	0.616	U	-0.0641	U	0.0508	U	0.596	U	-0.0696	U	-0.0251	U	-0.0212	U	-0.237	U
Metals																											
Mercury (mg/kg)	1.84	0.0232		0.00396	U	NT		NT		NT		0.00404	U	NT		NT		NT		0.00766		NT		NT		NT	
Lead (mg/kg)	400	7.81		0.769	NT	NT		NT		NT		2.8	NT	NT		NT		NT		19.2		NT		NT		NT	

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Building 704 and Building 802 June2010

DL - Below the detection limit

ND - Not detected

NT-Analyte not tested for

J - Indicates an estimated concentration

U - Indicates that the compound was analyzed for, but was not detected

UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Level:

All units are pCi/g except for Metals which are shown in mg/kg

Gamma Spec results only reported for those parameters that were recorded during the analysis

**HFBR Fan Houses Project
Building 704 Walls and Footing (SU-4)
Concrete Composite and Samples**

Parameter	DCGL or ECV	30066-006 704 North Wall Composite	30066-007 704 South Wall Composite	30066-008 704 Footing Composite
Rad Gamma Spec Analysis				
Americium-241	34	NT	NT	NT
Beryllium-7	NA	0.142	DL	0.152
Cesium-134	NA	NT	NT	NT
Cesium-137	23	0.800	0.103	2.45
Cobalt-57	NA	0.0133	DL	-0.0126
Cobalt-60	1,260	-0.0117	DL	0.00903
Europium-152	51	NT	NT	NT
Europium-154	180	NT	NT	NT
Europium-155	NA	NT	NT	NT
Manganese-54	NA	0.0132	DL	0.125
Potassium-40	NA	6.54	6.58	3.98
Radium-226	5	0.00	DLUI	0.351
Sodium-22	NA	-0.0101	DL	0.00303
Thorium-228	NA	0.314	0.344	0.382
Zinc-65	NA	NT	NT	NT
Rad Alpha Spec Analysis				
Curium-234/244	NA	NT	NT	NT
Plutonium-238	57	-0.00373	U	-0.012
Plutonium-239/240	35	0.0273	U	0.013
Uranium-235/236	4.6	0.121	U	-0.0326
Uranium-238	4.7	0.195	U	0.768
Plutonium-241	NA	0.687	U	0.261
Rad Liquid Scintillation Analysis				
Tritium	NA	9.07	U	-9.83
Rad Gas Flow Proportional Counting				
Strontium	15	0.539	U	0.159
Metals				
Mercury (mg/kg)	1.84	NT	NT	NT
Lead (mg/kg)	400	NT	NT	NT

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Building 704 and Building 80

DL - Below the detection limit

ND - Not detected

NT-Analyte not tested for

J - Indicates an estimated concentration

U - Indicates that the compound was analyzed for, but was not detected

UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Levels.

All units are pCi/g except for Metals which are shown in mg/kg

Gamma Spec results only reported for those parameters that were recorded during the analysis

HFBR Fan Houses Project
Exit Air Bypass Filter Facility (SU-5)
Concrete, Soil Composite and Core Samples

Parameter	DCGL or ECV	30065-001 EABFF-1 0-0.16'	30065-002 EABFF-3 0-0.16'	30065-003 EABFF-5 0-0.16'	30065-004 EABFF-7 0-0.16'	30065-005 EABFF-9 0-0.16'	30065-006 EABFF-11 0-0.16'	30065-007 EABFF-13 0-0.16'	30065-008 EABFF-15 0-0.16'	30065-009 EABFF-4 Core 6-8'	30065-010 EABFF Comp 1-8 0-2'	30065-011 EABFF Comp 9-17 2-4'	30065-012 EABFF-4 Core 0-4'	30065-013 EABFF-13 Core 0-2'	30065-014 EABFF-13 Core 0-4'														
Rad Gamma Spec Analysis																													
Americium-241	34	NT		NT		NT		NT		NT		NT		NT															
Beryllium-7	NA	-0.0247	DL	0.161	DL	0.217	DL	0.150	DL	-0.0679	DL	-0.129	DL	-0.121	DL	0.0876	DL	0.155	DL	0.161	DL	0.0495	DL	-0.0905	DL	0.123	DL	-0.0647	DL
Cesium-134	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Cesium-137	23	0.022	DL	-0.00672	DL	-0.0107	DL	-0.0061	DL	0.019	DL	0.0371	DL	0.0898		0.0433		0.0117	DL	0.00879	DL	0.113		-0.00392	DL	0.00874	DL	-0.0165	DL
Cobalt-57	NA	0.00257	DL	-0.0102	DL	-0.0131	DL	0.0056	DL	0.00438	DL	-0.00561	DL	-0.00239	DL	-0.0207	DL	-0.00405	DL	0.00865	DL	-0.00929	DL	0.00691	DL	0.000214	DL	0.00624	DL
Cobalt-60	1,260	-0.000194	DL	-0.0151	DL	0.0101	DL	-0.0156	DL	0.00135	DL	0.0082	DL	0.00488	DL	0.0307	DL	0.00435	DL	0.00199	DL	0.00489	DL	-0.0039	DL	0.0078	DL	-0.0148	DL
Europium-152	51	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Europium-154	180	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Europium-155	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Manganese-54	NA	-0.00525	DL	-0.00696	DL	-0.00565	DL	0.0195	DL	-0.0193	DL	-0.0167	DL	-0.00696	DL	-0.0107	DL	0.0122	DL	-0.00303	DL	0.0112	DL	0.00121	DL	0.028	DL	0.0043	DL
Potassium-40	NA	2.88		2.85		2.69		2.10		2.95		2.90		3.55		3.04		1.75		2.42		3.19		1.66		3.41		2.24	
Radium-226	5	0.251		0.219		0.375		0.220		0.00	DLUI	0.394		0.316		0.313		0.213		0.314		0.271		0.223		0.318		0.00	DLUI
Sodium-22	NA	0.00396	DL	0.00714	DL	-0.00713	DL	-0.0132	DL	0.0219	DL	0.0127	DL	-0.0107	DL	0.00209	DL	-0.00421	DL	0.00147	DL	-0.00707	DL	-0.0057	DL	0.00567	DL	-0.00151	DL
Thorium-228	NA	0.262		0.275		0.358		0.253		0.282		0.284		0.338		0.308		0.302		0.249		0.228		0.300		0.719		0.349	
Zinc-65	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Rad Alpha Spec Analysis																													
Curium-234/244	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Plutonium-238	57	NT		NT		NT		NT		NT		NT		NT		NT		0.243	U	-0.033	U	-0.0122	U	0.00	U	0.0175	U	0.00	
Plutonium-239/240	35	NT		NT		NT		NT		NT		NT		NT		NT		0.0203	U	0.0881	U	-0.0244	U	-0.0702	U	0.0326	U	0.00	
Uranium-235/236	4.6	NT		NT		NT		NT		NT		NT		NT		NT		0.00	U	0.0899	U	0.0977	U	0.00	U	-0.0434	U	0.167	U
Uranium-238	4.7	NT		NT		NT		NT		NT		NT		NT		NT		0.203	U	0.201	U	0.712	J	0.403	U	0.219		0.365	U
Plutonium-241	NA	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Rad Liquid Scintillation Analysis																													
Tritium	NA	325		220	U	280	J	456		128	U	546		219	U	13.6	U	40.1	U	367		331		80.6	U	35.4	U	-108	U
Rad Gas Flow Proportional Counting																													
Strontium	15	NT		NT		NT		NT		NT		NT		NT		NT		0.160	U	-0.0855	U	0.0878	U	0.0194	U	0.126	U	0.0906	U
Metals																													
Mercury (mg/kg)	1.84	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Lead (mg/kg)	400	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	

Notes:

DCGL-Derived Concentration Guidance Limits from the OU 1 ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Nuilding 704 and Building 802 June2010

DL - Below the dectection limit

ND - Not detected

NT-Analyte not tested for

J - Indicates an estimated concentration

U - Indicates that the compound was analyzed for, but was not detected

UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Level

All units are pCi/g except for Metals which are shown in mg/kg

Gamma Spec results only reported for those parameters that were recorded during the analysis

**HFBR Fan Houses Project
Building 802 (SU-6)
Soil Sample Points**

Parameter	DCGL or ECV	31310-006 1 0-0.5'	31310-007 3 0-0.5'	31310-008 5 0-0.5'	31310-009 7 0-0.5'	31310-010 9 0-0.5'					
Rad Gamma Spec Analysis											
Americium-241	34	0.019	U	0.0674	U	0.000447	U	0.0114	U	0.0242	U
Beryllium-7	NA	-0.0135	U	-0.0508	U	0.055	U	-0.0224	U	-0.0401	U
Cesium-134	NA	0.0268	DL	0.0438	UI	0.013	U	0.0259	J-UI	0.00429	U
Cesium-137	23	0.219	J	0.00424	U	0.0104	U	0.00171	U	0.000126	U
Cobalt-57	NA	0.000839	U	0.0214	U	-0.0104	U	-0.000169	U	-0.00154	U
Cobalt-60	1.260	0.0124	U	-0.0074	U	-0.00392	U	-0.00469	U	0.00151	U
Europium-152	51	-0.0221	U	0.00605	U	-0.0194	U	-0.023	U	-0.00687	U
Europium-154	180	0.000252	U	-0.00426	U	-0.0427	U	-0.0138	U	-0.0135	U
Europium-155	NA	0.0383	U	0.0277	U	0.00489	U	0.0227	U	0.0217	U
Manganese-54	NA	0.000457	U	0.00331	U	-0.00167	U	-0.00208	U	0.00842	U
Potassium-40	NA	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Radium-226	5	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Sodium-22	NA	0.00247	U	-0.00188	U	-0.0147	U	-0.00345	U	-0.00465	U
Thorium-228	NA	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Zinc-65	NA	0.0643	U	-0.00155	U	0.0255	U	0.00934	U	-0.00535	U
Rad Alpha Spec Analysis											
Curium-234/244	NA	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Plutonium-238	57	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Plutonium-239/240	35	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Uranium-235/236	4.6	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Uranium-238	4.7	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Plutonium-241	NA	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Rad Liquid Scintillation Analysis											
Tritium	NA	19.2	U	4.28	U	73.0	U	16.3	U	-22.6	U
Rad Gas Flow Proportional Counting											
Strontium	15	0.390	U	-0.151	U	-0.205	U	-0.314	U	-0.347	U
Metals											
Mercury (mg/kg)	1.84	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Lead (mg/kg)	400	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Building 704 and Building 802 June2010

DL - Below the detection limit

ND - Not detected

NT-Analyte not tested for

J - Indicates an estimated concentration

U - Indicates that the compound was analyzed for, but was not detected

UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Level:

All units are pCi/g except for Metals which are shown in mg/kg

Gamma Spec results only reported for those parameters that were recorded during the analysis

**HFBR Fan Houses Project
Building 802 (SU-6)
Soil Composite and Core Samples**

Parameter	DCGL or ECV	31310-005 SU6 Comp		31310-001 SU6 Core 0-2'		31310-002 SU6 Core 2-4'		31310-003 SU6 Core 4-6'		31310-004 SU6 Core 6-8'	
Rad Gamma Spec Analysis											
Americium-241	34	0.00193	U	0.0392	U	0.00972	U	-0.0568	U	0.0041	U
Beryllium-7	NA	-0.0973	U	0.00533	U	-0.00613	U	-0.0184	U	-0.0121	U
Cesium-134	NA	0.0105	U	0.0249	J-UI	0.0192	U	0.015	U	0.0107	U
Cesium-137	23	0.060	J	0.0138	U	0.00291	U	-0.0117	U	0.000734	U
Cobalt-57	NA	-0.00563	U	-0.00415	U	0.000145	U	0.0017	U	-0.00281	U
Cobalt-60	1.260	-5.03E-05	U	0.0109	U	-0.0065	U	0.000797	U	0.00507	U
Europium-152	51	-0.0184	U	-0.0321	U	0.00135	U	-0.015	U	0.000277	U
Europium-154	180	0.0274	U	-0.00641	U	-0.0238	U	-0.0182	U	-0.0168	U
Europium-155	NA	0.0348	U	0.0153	U	-0.00682	U	0.00255	U	0.0236	U
Manganese-54	NA	0.00567	U	-0.00204	U	-0.0183	U	0.00509	U	-0.0053	U
Potassium-40	NA	NT		NT		NT		NT		NT	
Radium-226	5	NT		NT		NT		NT		NT	
Sodium-22	NA	0.010	U	-0.00219	U	-0.00529	U	-0.00706	U	-0.00604	U
Thorium-228	NA	NT		NT		NT		NT		NT	
Zinc-65	NA	-0.0139	U	0.00727	U	-0.0001	U	0.00926	U	0.0174	U
Rad Alpha Spec Analysis											
Curium-234/244	NA	NT		NT		NT		NT		NT	
Plutonium-238	57	-0.0334	U	NT		NT		NT		NT	
Plutonium-239/240	35	-0.0334	U	NT		NT		NT		NT	
Uranium-235/236	4.6	0.0859	U	NT		NT		NT		NT	
Uranium-238	4.7	0.453	J	NT		NT		NT		NT	
Plutonium-241	NA	NT		NT		NT		NT		NT	
Rad Liquid Scintillation Analysis											
Tritium	NA	-36.6	U	39.2	U	29.1	U	18.0	U	-15.4	U
Rad Gas Flow Proportional Counting											
Strontium	15	-0.297	U	0.601	U	0.240	U	0.312	U	0.151	U
Metals											
Mercury (mg/kg)	1.84	ND	U	NT		NT		NT		NT	
Lead (mg/kg)	400	7.60		NT		NT		NT		NT	

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Building 704 and Building 802 June2010

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ND - Not detected

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UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Level:

All units are pCi/g except for Metals which are shown in mg/kg

Gamma Spec results only reported for those parameters that were recorded during the analysis

HFBR Fan Houses Project
Building 704 Dry Well
Soil Sample Locations (Rad and VOCs)

Parameter	DCGL or ECV	30044-001 704 UIC 0-1'	
Rad Gamma Spec Analysis			
Americium-241	34	-0.0103	U
Beryllium-7	NA	0.0103	U
Cesium-134	NA	0.0307	U
Cesium-137	23	-0.007	U
Cobalt-57	NA	-0.00211	U
Cobalt-60	1,260	-0.0126	U
Europium-152	51	-0.0233	U
Europium-154	180	0.0281	U
Europium-155	NA	0.0276	U
Manganese-54	NA	0.00402	U
Potassium-40	NA	NT	
Radium-226	5	0.22	
Sodium-22	NA	0.00747	U
Thorium-228	NA	NT	
Zinc-65	NA	0.00464	U
Rad Alpha Spec Analysis			
Curium-234/244	NA	NT	
Plutonium-238	57	NT	
Plutonium-239/240	35	NT	
Uranium-235/236	4.6	NT	
Uranium-238	4.7	NT	
Plutonium-241	NA	NT	
Rad Liquid Scintillation Analysis			
Tritium	NA	NT	
Rad Gas Flow Proportional Counting			
Strontium	15	NT	

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

ECV- Estimate Cleanup Value from Table 3 of the Field Sampling Plan-HFBR Underground Utilities, Building 704 and Building 802, June 2010

DL - Below the detection limit

ND - Not detected

NT-Analyte not tested for

J - Indicates an estimated concentration

U - Indicates that the compound was analyzed for, but was not detected

UI -Uncertain identification for gamma spectroscopy

Bold/Shaded text denotes concentrations exceeding OU1 Action Levels.

All units are pCi/g except for Metals which are shown in mg/kg

Gamma Spec results only reported for those parameters that were recorded during the analysis

Parameter	SCDHS Cleanup Criteria	30044-002 704 UIC 0-1'	
VOCs			
1,1,1-Trichloroethane	NA	ND	U
1,1,2,2-Tetrachloroethane	NA	ND	U
1,1,2-Trichloroethane	NA	ND	U
1,1-Dichloroethane	NA	ND	U
1,1-Dichloroethylene	NA	ND	U
1,2-Dichloroethane	NA	ND	U
1,2-Dichloroethylene (total)	NA	ND	U
1,2-Dichloropropane	NA	ND	U
2-Butanone	NA	ND	U
2-Hexanone	NA	ND	U
4-Methyl-2-pentanone	NA	ND	U
Acetone	NA	ND	U
Benzene	60	ND	U
Bromobenzene	1,400	NT	
Bromochloromethane	200	NT	
Bromodichloromethane	2,300	ND	U
Bromoform	6,300	ND	U
Bromomethane	NA	ND	U
Carbon disulfide	NA	ND	U
Carbon tetrachloride	800	ND	U
Chlorobenzene	1,100	ND	U
Chloroethane	200	ND	U
Chloroform	400	ND	U
Chloromethane	NA	ND	U
cis-1,2-Dichloroethene	250	NT	
cis-1,3-Dichloropropene	50	ND	U
Dibromochloromethane	3,100	ND	U
Dibromomethane	200	NT	
Dichlorodifluoromethane	300	NT	
Ethylbenzene	1,000	ND	U
Hexachlorobutadiene	11,000	NT	
Isopropylbenzene	4,700	NT	
p/m-Xylene	1,600	NT	
Methyl tert butyl ether	100	NT	
Methylene chloride	50	ND	U
n-Butylbenzene	5,900	NT	
n-Propylbenzene	4,000	NT	
Naphthalene	12,000	NT	
o-Xylene	1,600	ND	U
1,4-Diethylbenzene	26,000	NT	
4-Ethyltoluene	4,500	NT	
p-Isopropyltoluene	11,000	NT	
sec-Butylbenzene	5,900	NT	
Styrene	4,600	ND	U
tert-Butylbenzene	5,900	NT	
Tetrachloroethene	1,300	ND	U
Toluene	1,500	ND	U
trans-1,2-Dichloroethene	200	NT	
trans-1,3-Dichloropropene	50	ND	U
Trichloroethylene	500	ND	U
Trichlorofluoromethane	800	NT	
Vinyl chloride	50	ND	U

**HFBR Fan Houses Project
Building 704 Dry Well
Soil Sample Locations (SVOCs, PCBs Metals)**

Parameter	SCDHS Cleanup Criteria	30044-003 704 UIC 0-1'	
SVOCs			
1,2,4-Trichlorobenzene	NA	ND	U
1,2-Dichlorobenzene	NA	ND	U
1,3-Dichlorobenzene	NA	ND	U
1,4-Dichlorobenzene	NA	ND	U
2,4,5-Trichlorophenol	NA	ND	U
2,4,6-Trichlorophenol	NA	ND	U
2,4-Dichlorophenol	NA	ND	U
2,4-Dimethylphenol	NA	ND	U
2,4-Dinitrophenol	NA	ND	U
2,4-Dinitrotoluene	NA	ND	U
2,6-Dinitrotoluene	NA	ND	U
2-Chloronaphthalene	NA	ND	U
2-Chlorophenol	NA	ND	U
2-Methyl-4,6-dinitrophenol	NA	ND	U
2-Methylnaphthalene	NA	ND	U
2-Nitrophenol	NA	ND	U
3,3'-Dichlorobenzidine	NA	ND	U
4-Bromophenylphenylether	NA	ND	U
4-Chloro-3-methylphenol	NA	ND	U
4-Chloroaniline	NA	ND	U
4-Chlorophenylphenylether	NA	ND	U
4-Nitrophenol	NA	ND	U
Acenaphthene	98,000	ND	U
Acenaphthylene	NA	ND	U
Anthracene	100,000	ND	U
Benzo(a)anthracene	1,000	87.2	
Benzo(a)pyrene	22,000	119	
Benzo(b)fluoranthene	1,700	240	
Benzo(g,h,i)perylene	100,000	139	
Benzo(k)fluoranthene	1,700	ND	U
Carbazole	NA	ND	U
Chrysene	1,000	96.0	
Di-n-butylphthalate	NA	ND	U
Di-n-octylphthalate	NA	ND	U
Dibenzo(a,h)anthracene	100,000	ND	U
Dibenzofuran	NA	ND	U
Diethylphthalate	NA	ND	U
Dimethylphthalate	NA	ND	U
Diphenylamine	NA	ND	U
Fluoranthene	100,000	89.7	
Fluorene	100,000	ND	U
Hexachlorobenzene	NA	ND	U
Hexachlorobutadiene	NA	ND	U
Hexachlorocyclopentadiene	NA	ND	U
Hexachloroethane	NA	ND	U
Indeno(1,2,3-cd)pyrene	8,000	120	
Isophorone	NA	ND	U
N-Nitrosodipropylamine	NA	ND	U
Naphthalene	NA	ND	U
Nitrobenzene	NA	ND	U
Pentachlorophenol	NA	ND	U
Phenanthrene	100,000	ND	U
Phenol	NA	ND	U
Pyrene	100,000	91.9	
bis(2-Chloroethoxy)methane	NA	ND	U
bis(2-Chloroethyl) ether	NA	ND	U
bis(2-Chloroisopropyl) ether	NA	ND	U
bis(2-Ethylhexyl) phthalate	NA	ND	U
m,p-Cresols	NA	ND	U
m-Nitroaniline	NA	ND	U
o-Cresol	NA	ND	U
p-Nitroaniline	NA	ND	U
p-Nitroaniline	NA	ND	U

Parameter	SCDHS Cleanup Criteria	30044-003 704 UIC 0-1'	
Metals			
Aluminum	NA	2,440	
Antimony	NA	ND	U
Arsenic	6	0.861	J
Barium	820	4.12	
Beryllium	47	ND	U
Cadmium	7.5	ND	U
Calcium	NA	187	
Chromium	20	3.74	
Cobalt	NA	1.13	
Copper	1,700	15.7	
Iron	NA	4,410	
Lead	450	6.02	
Magnesium	NA	412	
Manganese	NA	49.1	
Mercury	0.7	ND	U
Nickel	130	2.36	
Potassium	NA	74.6	
Selenium	NA	ND	U
Silver	10	ND	U
Sodium	NA	19.6	J
Thallium	NA	NA	U
Vanadium	NA	5	
Zinc	NA	12.6	
PCBs			
Aroclor 1016	10000	ND	U
Aroclor 1221	10000	ND	U
Aroclor 1232	10000	ND	U
Aroclor 1242	10000	ND	U
Aroclor 1248	10000	ND	U
Aroclor 1254	10000	ND	U
Aroclor 1260	10000	ND	U

Notes:
DCGL-Derived Concentration Guidance Limits from the OU 1 ROD
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**HFBR Fan Houses Project
QA/QC**

Parameter	DCGL or ECV	30064-020 Field Dup. SU4	30064-021 Field Blank SU4	30067-020 Field Dup. of SU5	30067-019 Field Blank SU5	31310-012 Field Dup. SU6	31310-013 Field Blank SU6
Rad Gamma Spec Analysis							
Americium-241	34	NT	NT	NT	NT	-0.00526 U	0.026 U
Beryllium-7	NA	-0.0208 DL	0.295 DL	0.0628 DL	0.0643 DL	0.0368 U	0.0298 U
Cesium-134	NA	NT	NT	NT	NT	0.0371 U	0.0391 J-UI
Cesium-137	23	0.0424 DL	0.00998 DL	3.68 DL	0.00508 DL	0.141 J	0.00819 U
Cobalt-57	NA	-0.00736 DL	-0.00315 DL	-0.0147 DL	0.00109 DL	0.00081 U	0.00401 U
Cobalt-60	1,260	0.00751 DL	0.0116 DL	-0.0202 DL	0.00645 DL	0.00235 U	0.025 J
Europium-152	51	NT	NT	NT	NT	0.0186 U	-0.00345 U
Europium-154	180	NT	NT	NT	NT	-0.0172 U	0.0108 U
Europium-155	NA	NT	NT	NT	NT	0.0495 U	0.000932 U
Manganese-54	NA	0.0159 DL	0.00161 DL	-0.00289 DL	0.015 DL	-0.000102 U	-0.000657 U
Potassium-40	NA	4.87	4.06	4.25	4.52	NT	NT
Radium-226	5	0.308	0.311	0.31	0.285 UI	NT	NT
Sodium-22	NA	0.000655 DL	0.00962 DL	-0.00713 DL	0.00118 DL	-0.00625 U	0.00389 U
Thorium-228	NA	0.502	0.468	0.524	0.49	NT	NT
Zinc-65	NA	NT	NT	NT	NT	-0.00289 U	-0.00546 U
Rad Alpha Spec Analysis							
Curium-234/244	NA	NT U	NT	NT	NT	NT	NT
Plutonium-238	57	NT	NT	NT	NT	NT	NT
Plutonium-239/240	35	NT U	NT	NT	NT	NT	NT
Uranium-235/236	4.6	NT U	NT	NT	NT	NT	NT
Uranium-238	4.7	NT U	NT	NT	NT	NT	NT
Plutonium-241	NA	NT U	NT	NT	NT	NT	NT
Rad Liquid Scintillation Analysis							
Tritium	NA	-51.9 U	63.8 U	-17.9 U	-31.5 U	8.48 U	-5.03 U
Rad Gas Flow Proportional Counting							
Strontium	15	-0.218 U	0.258 U	0.736 U	0.155 UI	0.281 U	-0.182 U
Metals							
Mercury	1.84	NT	NT	NT	NT	NT	NT
Lead	400	NT	NT	NT	NT	NT	NT

Notes:

DCGL-Derived Concentration Guidance Limits from the OU I ROD

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RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT				
		☐ ROUTINE ☐ SPECIAL ☒ RWP # 2010-erp-010 ☐ WP # _____						
LOCATION & EQUIPT. Former Bldg. 704 fanhouse		DATE: <u>7/31/10—8/12/10</u>		TIME: 14:00				
Gamma walkovers for FSS after excavation and demolition of BGRR Fanhouse								
Attached are gamma walkover surveys performed using trimble GPS units in concert with L-2221 NAI 2x2 detector.								
LEGEND ☐ - SMEAR SURVEY LOCATION <input type="triangle-up"/> - AIR SAMPLE LOCATION ☐ - MASSLINN SURVEY LOCATION <input type="hash"/> - DIRECT FRISK LOCATION XXXX ZZZ XXX = contact reading Y = radiation type ZZZ = reading @ 30cm								
AIRBORNE ACTIVITY SURVEY								
Sample #	Duration	Flow Rate	Field Analysis		%			
N/A			cpm	µCi/cc	% DAC			
DOSE RATE (HIGHEST)								
CONTACT READING				N/A				
GENERAL AREA READING				N/A				
MASSLINN SURVEY RESULTS (in dpm)								
1. N/A			5. N/A					
2. ↓			6. ↓					
3. ↓			7. ↓					
4. ↓			8. ↓					
SMEAR SURVEY RESULTS (dpm/100cm²) α, β-γ, ³H								
1. See		8. Attached		15. Results				
2. Batch		9. Number		16. N/A				
3. ↓		10. ↓		17. ↓				
4. ↓		11. ↓		18. ↓				
5. ↓		12. ↓		19. ↓				
6. ↓		13. ↓		20. ↓				
7. ↓		14. ↓		21. ↓				

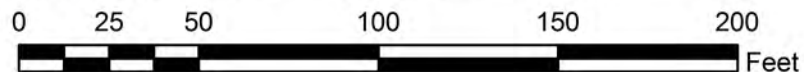
Surveyed By Schultz/Dzwonag/Merkel/Gully
 FS-SOP-1000 8/16/10
 Attachment 9.2

Date: 8/16/10 Reviewed By: Hollander Date: 8/16/10

Page 1 of 8



Coordinate System: NAD83, New York Long Island - Units: Feet



**Collimated GPS-Based Radiological Survey
Brookhaven National Laboratory
Fanhouse FSS SU-3, SU-4 & SU-5 Combined
July 31 - August 12, 2010**

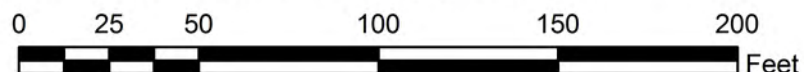
Legend

**Gamma Count Rate
COLLIMATED (cpm)**

- $\leq 5,000$
- 5,001 - 7,199
- $\geq 7,200$



Coordinate System: NAD83, New York Long Island - Units: Feet



**Collimated GPS-Based Radiological Survey
Brookhaven National Laboratory
Fanhouse FSS SU-3
August 4, 2010**

Legend

**Gamma Count Rate
COLLIMATED (cpm)**

- $\leq 5,000$
- 5,001 - 7,199
- $\geq 7,200$



Coordinate System: NAD83, New York Long Island - Units: Feet



**Collimated GPS-Based Radiological Survey
Brookhaven National Laboratory
Fanhouse FSS SU-5
August 3 - August 11, 2010**

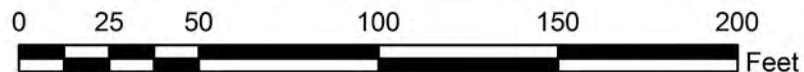
Legend

**Gamma Count Rate
COLLIMATED (cpm)**

- $\leq 5,000$
- 5,001 - 7,199
- $\geq 7,200$



Coordinate System: NAD83, New York Long Island - Units: Feet



**Collimated GPS-Based Radiological Survey
Brookhaven National Laboratory
Fanhouse FSS SU-3, SU-4, SU-5 and
North RBA Combined
July 31 - August 12, 2010**

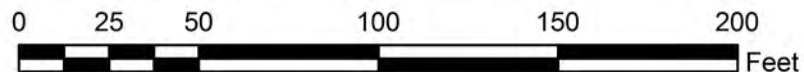
Legend

**Gamma Count Rate
COLLIMATED (cpm)**

- $\leq 5,000$
- 5,001 - 7,199
- $\geq 7,200$



Coordinate System: NAD83, New York Long Island - Units: Feet



**Collimated GPS-Based Radiological Survey
Brookhaven National Laboratory
Fanhouse FSS SU-4
July 31 - August 12, 2010**

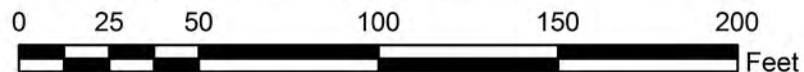
Legend

**Gamma Count Rate
COLLIMATED (cpm)**

- $\leq 5,000$
- 5,001 - 7,199
- $\geq 7,200$



Coordinate System: NAD83, New York Long Island - Units: Feet



**Collimated GPS-Based Radiological Survey
Brookhaven National Laboratory
Fanhouse FSS SU-4 and SU-5 Combined
July 31 - August 12, 2010**

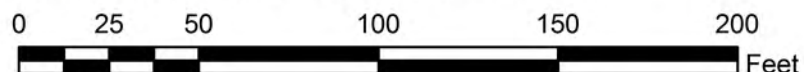
Legend

**Gamma Count Rate
COLLIMATED (cpm)**

- $\leq 5,000$
- 5,001 - 7,199
- $\geq 7,200$



Coordinate System: NAD83, New York Long Island - Units: Feet



**Collimated GPS-Based Radiological Survey
Brookhaven National Laboratory
North RBA Fanhouse
August 2, 2010**

Legend

**Gamma Count Rate
COLLIMATED (cpm)**

- $\leq 5,000$
- 5,001 - 7,199
- $\geq 7,200$

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE																					
		☐ Routine	☐ Special	Model #	Serial #																						
		☒ RWP# 2010-ERP-010	☐ WP	LB5100S4	32487	07/16/11																					
Location / Equipment: 704 Imprint Foundation Wall		Date: 08/ 12 /10	Time: 15:00	RO-20	3892	09/23/10																					
Survey: FSS of south foundation wall / by pass filter cell wall and floor areas.				LUD-3	39857	06/28/11																					
				LUD-2221	211786	01/07/11																					
				NaI Probe	IN04260	01/08/11																					
				LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION ■ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXX XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ																							
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7. ↓	14. ↓	21. ↓																									

Note:

- (A) An 80% gamma scan of the accessible surface areas of the above wall / floor sections shown was taken, bkgd. was at 11. 2K cpm and the levels ranged from 9K cpm to 12. 4 cpm.
- (B) Direct frisks taken on 80% of accessible surface areas of the aforementioned areas, all were equivalent to bkgd. at 50 cpm and < 100 ccpm.
- (C) Contact and general area dose rates taken in this area, all were < 0.2 mR/hr. .
- (D) Smears taken, see page 2 of 2 for results.
- (1) thru (10) taken on the vertical wall.
(11) thru (20) taken on the collapsed south wall.

Surveyed By: Sean A. Gully

Date: 08/ 13 /10

Reviewed By: *[Signature]*

Date: 8/13/10

Sample Report

Batch ID: 1min. Smear - 201008130831
Group: E
Device: HFBR
Batch Key: 2,122
Selected Geometry: 1/8" Stainless Steel

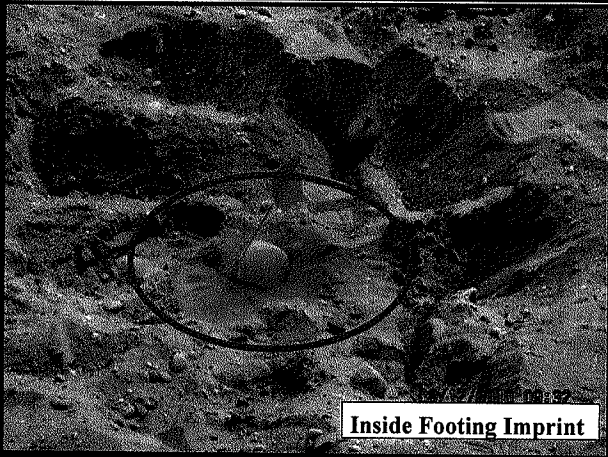
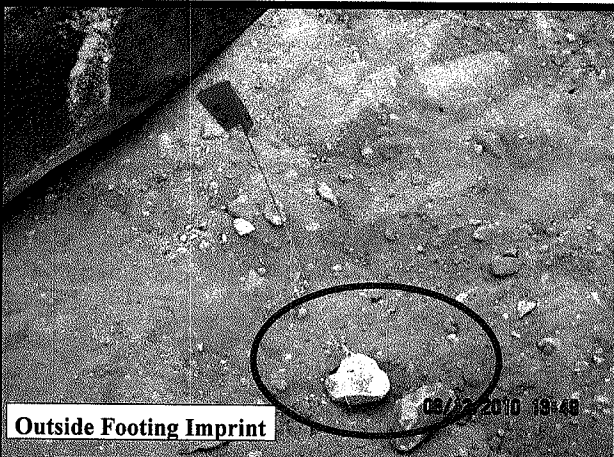
Count Date: 8/13/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20100813083233-E1	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20100813083403-E2	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20100813083523-E3	Unknown	6.96	4.94	9.45	34.66	13.34	13.64	
20100813083633-E4	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20100813083753-E5	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20100813083913-E6	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20100813084023-E7	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20100813084143-E8	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20100813084253-E9	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20100813084413-E10	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20100813084523-E11	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20100813084643-E12	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20100813084753-E13	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20100813084913-E14	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20100813085033-E15	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20100813085143-E16	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20100813085303-E17	Unknown	3.47	3.49	9.45	34.97	13.34	13.64	
20100813085413-E18	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
20100813085533-E19	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20100813085643-E20	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	

Reviewed by:

Page 2 of 2

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS	
		☐ Routine ☐ Special ☒ RWP# <u>2010-ERP-010</u> ☐ WP		Model #	Serial #
Location / Equipment: 704 Imprint, Excavator Equipt.		Date: 08/12/10	Time: 17:00	LB5100S4	32487
Survey: FSS continued sampling of the soil surface sample points and core sample locations.				RO-20	3892
 				LUD-3	44168
				LUD-2221	211786
				NaI Probe	IN04260
				LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ	
AIRBORNE ACTIVITY SURVEY					
				Field Analysis	
Sample #	Duration	Flow Rate	cpm	µCi/cc	% DAC
See ASL					→
DOSE RATE (HIGHEST)					
CONTACT READING			< 0.2 mR/hr.		
GENERAL AREA READING			< 0.2 mR/hr.		
MASSLINN SURVEY RESULTS (in dpm)					
1. < 1K		5. < 1K			
2.		6.			
3.		7.			
4.		8. thru 13.			
SMEAR SURVEY RESULTS (dpm/100cm²) α, β, ³H					
1. N/A		8. N/A		15. N/A	
2.		9.		16.	
3.		10.		17.	
4.		11.		18.	
5.		12.		19.	
6.		13.		20.	
7.		14.		21.	

Note:

(A) The following are soil surface sample points 0 - 0.5ft. depth:

4-011 1808 cpm contact with soil.
 # 4-013 2007 cpm contact with soil.
 # 4-014 1896 cpm contact with soil.

(B) The following are core sample locations from 0 - 0.5ft.; 0 - 2 ft.; 2ft. - 4ft.; 4ft. - 6ft.; 6ft. - 8ft. Depths.

4-012 1852 cpm contact with soil (5 samples taken).
 # 5-010 2316 cpm contact with soil (5 samples taken).

Note: Location 5-010 was moved to 2ft. north and 5ft. east of its original location due to the fact that there is a concrete slab beneath its original location.

(D) All NaI probe contact soil readings taken with a collimated probe.
 Dose rate taken on all samples were equivalent to < 0.2 mR/hr. .
 LAS taken on the marinelli containers, all equivalent to bkgd. at 50 cpm and , 1K dpm.
 All NaI probe contact readings taken on the marinelli containers were equivalent to general area bkgd. .
 Direct frisk taken on the marinelli containers were equivalent to bkgd. and < 100 ccpm.

Surveyed By: Dan Dove and Sean A. Gully

Date: 08/13/10

Reviewed By: [Signature]

Date: 8/13/10

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE															
Location / Equipment: 704 Foundation Walls / Imprint		☐ Routine ☐ Special ☒ RWP# 2010-ERP-010 ☐ WP		Model #	Serial #																
		Date: 08/12/10	Time: 16:00	LUD-2221	211786	01/07/11															
Survey: Post FSS 50% γ scan of accessible wall surfaces using a NaI probe [2x 2], and 10% pedestal scan [8].				NaI - Probe	INO4260	06/28/11															
				LUD-3	39857	01/29/11															
				RO-20	3892	09/23/10															
				LB5100S4	32487	07/16/11															
		LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION ■ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ																			
		AIRBORNE ACTIVITY SURVEY																			
		<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>μCi/cc</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>						Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	μCi/cc	N/A					
		Sample #	Duration	Flow Rate	Field Analysis		% DAC														
cpm	μCi/cc																				
N/A																					
DOSE RATE (HIGHEST)																					
CONTACT READING		< 0.2 mR/hr.																			
GENERAL AREA READING		< 0.2 mR/hr.																			
MASSLINN SURVEY RESULTS (in dpm)																					
1. N/A		5. N/A																			
2.		6.																			
3.		7.																			
4. ↓		8. ↓																			
SMEAR SURVEY RESULTS (dpm/100cm²) α, β-γ, ³H																					
1. See		8. Attached		15. Results																	
2. Batch		9. Number		16. 2125 & 2126																	
3.		10.		17. 2127																	
4.		11.		18.																	
5.		12.		19.																	
6.		13.		20.																	
7. ↓		14. ↓		21. ↓																	

Note:

- (A) An additional 101 verification smears taken on the walls and footing / pedestals.
- (B) The 50% gamma scan of the foundation walls using a non-collimated NaI probe, on the south wall bkgd. ranges from 12. 4K cpm [east end], 14. 2K cpm [mid-wall], and 9K cpm [west end]. Levels ranged from 9K cpm to 16. 8K cpm. The west wall bkgd. at 10. 9K cpm and levels ranged from 9K cpm to 11K cpm. On the north wall bkgd. ranged from 7K cpm to 10. 6K cpm and levels ranged from 7K cpm to 11K cpm [area high lighted in orange].
- (C) The 10% beta scan of the footing / pedestal sections, all surface areas checked were equivalent to bkgd. at 50 cpm and < 100 ccpm [area high in blue].
- (D) Also the accessible surface areas of the top sections of the aforementioned walls were direct frisked and were equivalent to bkgd. at 50 cpm and < 100 ccpm.
- (E) Contact and general area dose rates in this area are < 0.2 mR/hr. .

Surveyed By: A. Merkel, D. Dove, S. Schultz, S. A. Gully
 FS-SOP-1000
 Attachment 9. 2

Date: 08/12/10

Reviewed By:

Date: 8/13/10

Sample Report

Batch ID: 1min. Smear - 201008131038
Group: G
Device: HFBR
Batch Key: 2,125
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/13/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)	Efficiency (%)	Spillover (%)
Alpha Rate: 0.30 ± 0.10 Beta Rate: 8.33 ± 0.53	Alpha: 28.64 ± 0.08 Beta: 19.84 ± 0.07	Alpha to Beta: 6.13 ± 0.00 Beta to Alpha: 0.08 ± 0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20100813103849-G1	Unknown	5.92	4.95	15.84	33.07	19.70	62.29	
20100813104019-G2	Unknown	5.93	4.95	15.84	12.91	16.93	62.29	
20100813104139-G3	Unknown	2.46	3.51	15.84	-32.14	7.61	62.29	
20100813104249-G4	Unknown	2.46	3.51	15.84	-32.14	7.61	62.29	
20100813104409-G5	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813104529-G6	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813104639-G7	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813104759-G8	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813104909-G9	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813105029-G10	Unknown	2.46	3.51	15.84	-27.10	9.13	62.29	
20100813105139-G11	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813105259-G12	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813105409-G13	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813105529-G14	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100813105639-G15	Unknown	2.44	3.51	15.84	8.18	16.16	62.29	
20100813105759-G16	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100813105909-G17	Unknown	9.44	6.06	15.84	-17.63	11.59	62.29	
20100813110029-G18	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813110149-G19	Unknown	2.46	3.51	15.84	-32.14	7.61	62.29	
20100813110259-G20	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813110419-G21	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100813110529-G22	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813110649-G23	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813110759-G24	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813110919-G25	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100813111029-G26	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100813111149-G27	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813111309-G28	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100813111419-G29	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813111539-G30	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100813111649-G31	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813111809-G32	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100813111919-G33	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813112039-G34	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813112149-G35	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813112309-G36	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	

Page 2 of 6

Sample Report

Background (cpm)			Efficiency (%)			Spillover (%)		
Alpha Rate:	0.30	± 0.10	Alpha:	28.64	± 0.08	Alpha to Beta:	6.13	± 0.00
Beta Rate:	8.33	± 0.53	Beta:	19.84	± 0.07	Beta to Alpha:	0.08	± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100813112429-G37	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	
20100813112539-G38	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813112659-G39	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813112809-G40	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813112929-G41	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813113039-G42	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813113159-G43	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100813113309-G44	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813113429-G45	Unknown	2.46	3.51	15.84	-37.18	5.71	62.29	
20100813113539-G46	Unknown	2.45	3.51	15.84	-17.02	11.58	62.29	

Reviewed by:



Page 3 of 6

Sample Report

Batch ID: 1min. Smear - 201008131300
Group: F
Device: HFBR
Batch Key: 2,126
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/13/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)			Efficiency (%)			Spillover (%)		
Alpha Rate:	0.30	± 0.10	Alpha:	28.64	± 0.08	Alpha to Beta:	6.13	± 0.00
Beta Rate:	8.33	± 0.53	Beta:	19.84	± 0.07	Beta to Alpha:	0.08	± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100813130045-F1 47	Unknown	12.90	6.99	15.84	42.53	20.96	62.29	
20100813130215-F2 48	Unknown	2.44	3.51	15.84	3.14	15.35	62.29	
20100813130335-F3 49	Unknown	2.46	3.51	15.84	-32.14	7.61	62.29	
20100813130445-F4 50	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813130605-F5 51	Unknown	2.46	3.51	15.84	-27.10	9.13	62.29	
20100813130715-F6 52	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813130835-F7 53	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813130955-F8 54	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813131105-F9 55	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	
20100813131225-F10 56	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100813131335-F11 57	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813131455-F12 58	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813131605-F13 59	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813131725-F14 60	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813131835-F15 61	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100813131955-F16 62	Unknown	2.44	3.51	15.84	3.14	15.35	62.29	
20100813132105-F17 63	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100813132225-F18 64	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813132345-F19 65	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813132455-F20 66	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813132615-F21 67	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813132725-F22 68	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813132845-F23 69	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813132955-F24 70	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100813133115-F25 71	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813133225-F26 72	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100813133345-F27 73	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813133505-F28 74	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813133615-F29 75	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813133735-F30 76	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813133845-F31 77	Unknown	-1.05	0.35	15.84	3.45	15.35	62.29	
20100813134005-F32 78	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813134115-F33 79	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813134235-F34 80	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813134345-F37 81	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813134505-F38 82	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	

Page 4 of 6

Sample Report

Background (cpm)			Efficiency (%)			Spillover (%)		
Alpha Rate:	0.30	± 0.10	Alpha:	28.64	± 0.08	Alpha to Beta:	6.13	± 0.00
Beta Rate:	8.33	± 0.53	Beta:	19.84	± 0.07	Beta to Alpha:	0.08	± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100813134615-F39 83	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100813134735-F40 84	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813134855-F41 85	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100813135005-F42 86	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100813135125-F43 87	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813135235-F44 88	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100813135355-F45 90	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813135505-F46 91	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	

Reviewed by:

REV 010810.ELR

C:\Program Files\Tennelec Systems\Eclipse\sample report bnl.rpt

Page 5 of 6

Print Date 8/13/2010
Print Time 1:56:25PM

Sample Report

Batch ID: 1min. Smear - 201008131325
Group: G
Device: HFBR
Batch Key: 2,127
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/13/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.30 ± 0.10	Alpha:	28.64 ± 0.08	Alpha to Beta:	6.13 ± 0.00
Beta Rate:	8.33 ± 0.53	Beta:	19.84 ± 0.07	Beta to Alpha:	0.08 ± 0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> (dpm)	<u>Unc</u>	<u>Alpha MDA</u> (dpm)	<u>Beta</u> (dpm)	<u>Unc</u>	<u>Beta MDA</u> (dpm)	<u>(dpm)</u>
20100813132538-G1 92	Unknown	2.42	3.51	15.84	48.50	21.55	62.29	
20100813135738-G2 93	Unknown	9.43	6.06	15.84	2.53	15.36	62.29	
20100813135858-G3 94	Unknown	2.45	3.51	15.84	-17.02	11.58	62.29	
20100813140008-G4 95	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813140128-G5 96	Unknown	2.45	3.51	15.84	-11.98	12.63	62.29	
20100813140248-G6 97	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100813140358-G7 98	Unknown	5.94	4.95	15.84	-12.29	12.64	62.29	
20100813140518-G8 99	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100813140628-G9 100	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100813140748-G10 101	Unknown	-1.05	0.35	15.84	3.45	15.35	62.29	

Reviewed by: _____

REV 010810.ELR

Page 1 of 1

C:\Program Files\Tennelec Systems\Eclipse\sample report bnl.rpt

Print Date 8/13/2010
 Print Time 2:08:58PM

Page 6 of 6

RADIOLOGICAL SURVEY FORM FS-SOP-1000

REASON FOR SURVEY
☐ ROUTINE ☐ SPECIAL
☒ RWP # 2010-erp-010 ☐ WP #

LOCATION & EQUIPT. **Former bldg. 704 EABFF**

Date **08-02-10** TIME: 09:00

Final status survey of EABFF slab



NORTH

Sample points start in southwest corner going east w/ final sample point being #17 in north-east corner of slab.

Slab measured 36X16 feet

Marked out 17 sample points on slab per SWP 602-03 as indicated in above picture by white squares. Two core samples taken below slab grade at 0-2 foot and 2-4 foot at sample points #4 and #13. All other sample points were 0-2 inches of slab.

Floorwalked whole area w/ bkgd. ranging between 2600-3200 cpm. No increase in bkgd. noted. Also frisked each sample point and performed a random direct frisk of slab (approximately 25% of slab). No increase above bkgd. on these frisk's w/ bkgd. at 80 cpm.

Smear taken at each sample point for beta/gamma and alpha and also tritium. Results attached.

All dirt and concrete samples to be counted on gamma spec. system and then sent out to GEL for further analyses.

ALL SAMPLES SENT TO GEL under COC# 30065

INSTRUMENT		CAL DUE
Model #	Serial #	
LB5100	32487	7/16/11
LSA	128704	11/10/10
L-12 floorwalk	72713	5/27/11
Lud-3	50534	5/28/11

LEGEND
○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION
□ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION
C - CONTAMINATION * CONTACT
XXX = contact reading Y = radiation type ZZZ = reading @ 30cm

AIRBORNE ACTIVITY SURVEY					
Sample #	Duration	Flow Rate	Field Analysis		% DAC
			cpm	μCi/cc	
N/A					

DOSE RATE (HIGHEST)	
CONTACT READING	N/A
GENERAL AREA READING	N/A

MASSLINN SURVEY RESULTS (in dpm)	
1.	5. N/A
2.	6.
3.	7.
4.	8.

SMEAR SURVEY RESULTS (dpm/100cm ²) (α, β-γ, (H)		
1. See attach.	8. results	15. 2082
2.	9.	16.
3.	10.	
4.	11.	18.
	12.	19.
6.	13.	20.
7.	14.	21.

Surveyed By Hollander/Schultz

08/02/10

Date:

Reviewed By:

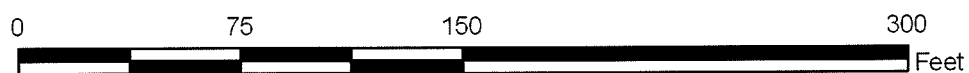
Date:

FS-SOP-1000
Attachment 9.2

Page 1 of 5



Coordinate System: NAD83, New York Long Island - Units: Feet



**GPS-Based
Radiological Survey
Brookhaven National Laboratory
EABFF Slab FSS
July 30, 2010**

Legend

**Gamma Count Rate
(cpm)**

- < 15,000
- 15,000 - 21,499
- > or = 21,500

Sample Report

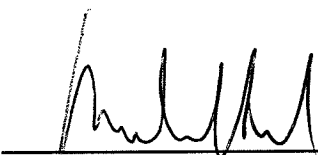
Batch: 1min. Smear - 201008021319
Group: E
Device: HFBR
Batch No: 2,082
Select Geometry: 1/8" Stainless Steel

Count Date: 8/2/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
201008021944-E1	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
201008022115-E2	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
201008022235-E3	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
201008022345-E4	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
201008022505-E5	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
201008022625-E6	Unknown	3.48	3.49	9.45	19.85	10.08	13.64	
201008022735-E7	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
201008022855-E8	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
201008023005-E9	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
201008023125-E10	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
201008023235-E11	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
201008023355-E12	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
201008023505-E13	Unknown	10.46	6.05	9.45	34.35	13.35	13.64	
201008023625-E14	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
201008023745-E15	Unknown	-0.03	0.01	9.45	50.40	15.94	13.64	
201008023855-E16	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
201008024015-E17	Unknown	3.48	3.49	9.45	29.93	12.35	13.64	

Review by:


 8/3/10

SNC Protocol

Calibration Information

Software Version IC: 2.12

Software Version EC: 2.02

Instrument Model: Tri-Carb 2900TR

Instrument Serial Number: 060943

3H Chi Square: 12.75 Date Processed: 8/2/2010 7:02:11 AM

14C Chi Square: 7.49 Date Processed: 8/2/2010 7:02:11 AM

3H E²/B (1-18.6 keV): 335.26 Date Processed: 8/2/2010 7:02:11 AM14C E²/B (4-156 keV): 579.05 Date Processed: 8/2/2010 7:02:11 AM

3H Efficiency (0-18.6 keV): 64.30 Date Processed: 8/2/2010 7:02:11 AM

14C Efficiency (0-156 keV): 95.67 Date Processed: 8/2/2010 7:02:11 AM

IPA Background Date Processed: 8/2/2010 7:02:11 AM

3H Background CPM (0-18.6 keV): 12.33 Date Processed: 8/2/2010 7:02:11 AM

14C Background CPM (0-156 keV): 19.65 Date Processed: 8/2/2010 7:02:11 AM

3H Calibration DPM: 279000

3H Reference Date: 3/9/2006

14C Calibration DPM: 143100

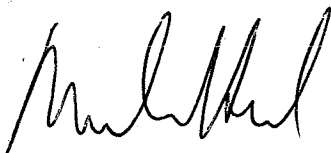
Protocol# 2 - Low Energy Surveys.lsa

User: n6455

EABFF concrete sample locations (17 total)

Cycle 1 Results

S#	Count	Time	CPMA	CPMB	tSIE	MESSAGES	DATE	TIME	DPM1
1	10.00		8	8	400.12	B	8/2/2010	11:19:18 AM	0
2	0.50		32	27	397.00	<	8/2/2010	11:31:01 AM	80
3	0.50		8	5	376.29	<	8/2/2010	11:33:02 AM	20
4	0.50		15	13	363.50	<	8/2/2010	11:35:03 AM	41
5	0.50		12	11	380.65	<	8/2/2010	11:37:03 AM	30
6	0.50		12	9	309.24	<	8/2/2010	11:39:04 AM	36
7	0.50		12	11	403.53	<	8/2/2010	11:41:04 AM	29
8	0.50		10	6	375.94	<	8/2/2010	11:43:06 AM	25
9	0.50		0	0	355.87	<	8/2/2010	11:45:05 AM	0
10	0.50		4	4	372.48	<	8/2/2010	11:47:04 AM	10
11	0.50		16	16	324.70	<	8/2/2010	11:49:05 AM	46
12	0.50		12	12	345.64	<	8/2/2010	11:51:06 AM	32
13	0.50		16	15	340.01	<	8/2/2010	11:53:11 AM	44
14	0.50		8	4	358.68	<	8/2/2010	11:55:11 AM	21
15	0.50		13	11	304.33	<	8/2/2010	11:57:13 AM	39
16	0.50		10	6	349.86	<	8/2/2010	11:59:14 AM	27
17	0.50		18	17	288.65	<	8/2/2010	12:01:18 PM	58
18	0.50		0	0	392.97	<	8/2/2010	12:03:18 PM	0

 8/3/10

ASL Prefix No.

N/A

Page 1 of 1

BROOKHAVEN
NATIONAL LABORATORY

Carrier/Waybill #

P.O. #

Chain of Custody No.

30065

Requires EDD ☒

DQL

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name:	MICK HOLLAND	Name:	STEVE SCHULTZ	Name:	GEL
Life: No:	N 6455 Ext. 4839	Contact:	ERP	Address:	2040 SAVAGE Rd.
Acct. No:	65070/65074 Dept: ERP	Phone:	X4424	City:	CHARLESTON St. S.C. Zip: 29407
Email Reports To:		Email/Fax:		Contact:	HEATHER SHAEFFER
1 LUCKWOOD @ Bnl.gov		Sampler:	SAME	Phone:	843-769-7386 (X4505)
2 HOLLAND @ Bnl.gov				Email/Fax:	
Project Name:		Project Manager:		Field Engineer:	
FANHOUSE D&D		ANDY LOCKWOOD		KENT HICKMAN	

Comments:

Type		Sample Information						Additional Sample Information										Analysis Requested				
LID	UID	Smp	Coll	Site ID/Bldg/Life #	Depth/RVP	Date	Time	Matrix	Name/Description	Cont. Vol./Units	Cont. Type	# of Cont.	Preservative	Alpha/Beta	Tritium	Gamma	Strontium	524.2	624	Nuclide-specific Alpha	PCBs	Metals
001	EG			Bnl/704/NLWS	0-.16	8/3/10	0800	S	EABFF	SAMPLE POINT #1	500ml	P	1	None								
002	G						0810			SAMPLE POINT #3												
003							0820			#5												
004							0830			#7												
005							0840			#9												
006							0850			#11												
007							0900			#13												
008							0910			#15												
009					0-2		0925			CORE @ SAMP. POINT #4												
010	C				0-.16	8/4/10	1025			COMPOSITE OF POINTS 1-8												
011	C				0-.16	8/4/10	1100			COMPOSITE OF POINTS 9-12												
012	G				0-4	8/3/10	0930			CORE @ SAMP. POINT #4												
013	G				0-2		0935			CORE @ SAMP. POINT #13												
014	G				0-4		0940			CORE @ SAMP. POINT #13												

1 Relinquished By/Date/Time		2 Relinquished By/Date/Time		3 Relinquished By/Date/Time	
Print		Print		Print	
Signature		Signature		Signature	
1 Received By/Date/Time		2 Received By/Date/Time		3 Received By/Date/Time	
Print		Print		Print	
Signature		Signature		Signature	

Contractor Lab Sample Disposal:

☐ Return To Client ☒ Disposal by Lab
☐ Archive For _____ Months
Data Package: ☐ Full ☒ Summary

Turn-Around Time Required:

☐ Rush (1 Day) ☒ 14 Days ☐ 30 Days
☐ 7 Days ☐ Other ()

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE	
Location / Equipment: 704 Foundation / Sub Imprint		☐ Routine _____ ☐ Special _____ ☒ RWP# 2010-ERP-010 ☐ WP		Model #	Serial #		
		Date: 08/11/10	Time: 17:00	LB5100S4	32487	07/16/11	
Survey: E.O.D. Post FSS core bore sample point locations on the foundation wall / sub floor pedestal [imprint].				RO-20	3892	09/23/10	
				LUD-3	44168	01/29/11	
				AVS-28A	6081	10/08/10	
				N/A			

Note:

(A) There are eleven final status survey core bore sample point locations, locations one thru eight were taken on the vertical foundation wall surfaces and locations nine thru eleven were taken on the top surface of the imprint floor pedestals, all high lighted and indicative of the smear location arrows.

(B) LAS taken on the sample locations, all were equivalent to bkgd. at 50 cpm and < 1K dpm.

(C) Direct frisks taken on these locations were all equivalent to bkgd. and < 100 ccpm.

(D) Contact and general area dose rates taken on the same, all were < 0.2 mR/hr. .

(E) Smears taken, see page 2 of 3 for particulate results and page 3 of 3 for tritium results designated as (T#).

Page 2 of 3 results:

(1) thru (8) taken on the vertical designated wall surfaces.
 (9) thru (11) taken on the designated horizontal pedestal surfaces.

Page 3 of 3 results:

(T1) thru (T8) taken on the designated wall surfaces.
 (T9) thru (T11) taken on the designated pedestal surfaces.

LEGEND

○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION
 □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION
 C - CONTAMINATION * - CONTACT
 XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm
 ZZZ

AIRBORNE ACTIVITY SURVEY

Sample #	Duration	Flow Rate	Field Analysis		% DAC
			cpm	μCi/cc	
See ASL					

DOSE RATE (HIGHEST)

CONTACT READING	< 0.2 mR/hr.
GENERAL AREA READING	< 0.2 mR/hr.

MASSLINN SURVEY RESULTS (in dpm)

1. < 1K	5. < 1K
2.	6.
3.	7.
4.	8. thru 11.

SMEAR SURVEY RESULTS (dpm/100cm²) α, β, γ, ³H

1. See	8. Attached	15. Results
2. Batch	9. Number	16. 2114
3.	10.	17.
4.	11.	18.
5.	12.	19.
6.	13.	20.
7.	14.	21.

Surveyed By: Dan Dove, Steve Schultz, Sean A. Gully

Date: 08/11/10

Reviewed By:

Date: 8/13/10

FS-SOP-1000

Attachment 9.2

Page 1 of 3

Sample Report

Batch ID: 1min. Smear - 201008111501
Group: E
Device: HFBR
Batch Key: 2,114
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/11/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)	Efficiency (%)	Spillover (%)
Alpha Rate: 0.30 ± 0.10	Alpha: 28.64 ± 0.08	Alpha to Beta: 6.13 ± 0.00
Beta Rate: 8.33 ± 0.53	Beta: 19.84 ± 0.07	Beta to Alpha: 0.08 ± 0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> (dpm)	<u>Unc</u>	<u>Alpha MDA</u> (dpm)	<u>Beta</u> (dpm)	<u>Unc</u>	<u>Beta MDA</u> (dpm)	<u>(dpm)</u>
20100811150145-E1	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100811150315-E2	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100811150435-E3	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100811150545-E4	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100811150705-E5	Unknown	5.95	4.95	15.84	-22.36	10.43	62.29	
20100811150815-E6	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100811150935-E7	Unknown	2.45	3.51	15.84	-11.98	12.63	62.29	
20100811151055-E8	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100811151205-E9	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100811151325-E10	Unknown	2.45	3.51	15.84	-1.90	14.50	62.29	
20100811151435-E11	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	

Reviewed by: 

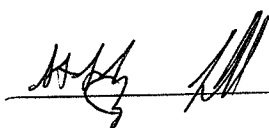
Protocol# 3 - Low Energy Surveys.lsa

User: 22098

S. FANHOUSE FOUNDATION CONCRETE SAMPLES

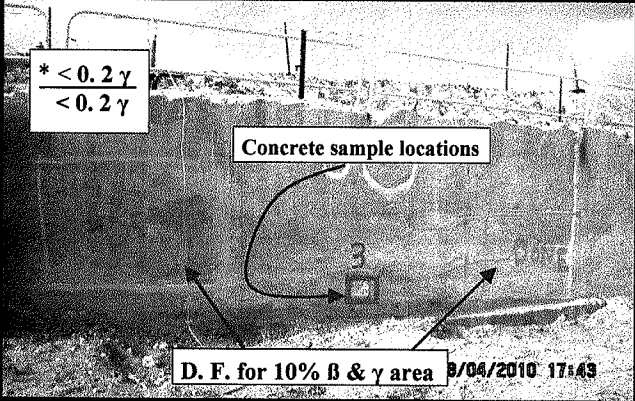
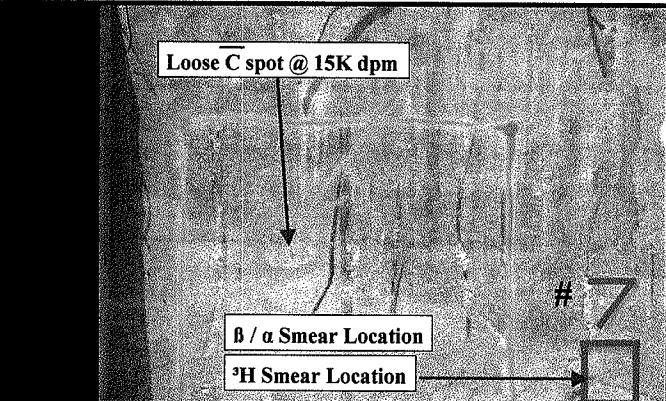
Cycle 1 Results

	S#	Count	Time	CPMA	CPMB	tSIE	MESSAGES	DATE	TIME	DPM1
BLANK	1	10.00		6	6	398.05	B	8/11/2010	3:02:14 PM	0
T1	2	0.50		8	8	361.40	<	8/11/2010	3:13:54 PM	21
T2	3	0.50		2	2	375.92	<	8/11/2010	3:15:50 PM	5
T3	4	0.50		24	19	366.02	<	8/11/2010	3:17:48 PM	64
T4	5	0.50		28	25	349.32	<	8/11/2010	3:19:49 PM	77
T5	6	0.50		20	15	335.17	<	8/11/2010	3:21:49 PM	57
T6	7	0.50		12	12	342.82	<	8/11/2010	3:23:48 PM	33
T7	8	0.50		12	12	356.63	<	8/11/2010	3:25:50 PM	32
T8	9	0.50		12	9	342.59	<	8/11/2010	3:27:51 PM	33
T9	10	0.50		18	15	336.93	<	8/11/2010	3:29:51 PM	51
T10	11	0.50		4	4	223.21	<	8/11/2010	3:31:56 PM	16
T11	12	0.50		18	14	325.43	<	8/11/2010	3:33:55 PM	52



e

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RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE																						
		☐ Routine ☐ Special ☒ RWP# <u>2010-ERP-010</u> ☐ WP		Model #	Serial #																							
Location / Equipment: 704 Foundation Walls, N. W. S.		Date: 08/04/10	Time: 17:00	LB5100S4	32487	07/16/11																						
Survey: E.O.D. Post final status survey, [D. F. 10% for β / γ , Smears for α / β and smears taken @ ^3H locations].				RO-20	3892	09/23/10																						
 				LUD-3	44168	01/29/11																						
				LUD-3	39857	06/28/11																						
				LUD-2221	211784	02/02/11																						
				LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY / ZZZ XXX = contact reading Y = radiation type ZZZ = reading @ 30cm																								
				AIRBORNE ACTIVITY SURVEY <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>μCi/cc</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	μCi/cc	N/A												
Sample #	Duration	Flow Rate	Field Analysis		% DAC																							
			cpm	μCi/cc																								
N/A																												
				DOSE RATE (HIGHEST) <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>CONTACT READING</td> <td>< 0.2 mR/hr.</td> </tr> <tr> <td>GENERAL AREA READING</td> <td>< 0.2 mR/hr.</td> </tr> </table>				CONTACT READING	< 0.2 mR/hr.	GENERAL AREA READING	< 0.2 mR/hr.																	
CONTACT READING	< 0.2 mR/hr.																											
GENERAL AREA READING	< 0.2 mR/hr.																											
				MASSLINN SURVEY RESULTS (in dpm) <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. < 1K</td> <td>5. < 1K</td> </tr> <tr> <td>2.</td> <td>6.</td> </tr> <tr> <td>3.</td> <td>7.</td> </tr> <tr> <td>4. ↓</td> <td>8. thru 20. ↓</td> </tr> </table>				1. < 1K	5. < 1K	2.	6.	3.	7.	4. ↓	8. thru 20. ↓													
1. < 1K	5. < 1K																											
2.	6.																											
3.	7.																											
4. ↓	8. thru 20. ↓																											
				SMEAR SURVEY RESULTS (dpm/100cm²) α, β, ^3H <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. See</td> <td>8. Attached</td> <td>15. Results</td> </tr> <tr> <td>2. Batch</td> <td>9. Number</td> <td>16. 2090 thru 2092</td> </tr> <tr> <td>3.</td> <td>10.</td> <td>17. 2097 & 2098</td> </tr> <tr> <td>4.</td> <td>11.</td> <td>18.</td> </tr> <tr> <td>5.</td> <td>12.</td> <td>19.</td> </tr> <tr> <td>6.</td> <td>13.</td> <td>20.</td> </tr> <tr> <td>7. ↓</td> <td>14. ↓</td> <td>21. ↓</td> </tr> </table>				1. See	8. Attached	15. Results	2. Batch	9. Number	16. 2090 thru 2092	3.	10.	17. 2097 & 2098	4.	11.	18.	5.	12.	19.	6.	13.	20.	7. ↓	14. ↓	21. ↓
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4.	11.	18.																										
5.	12.	19.																										
6.	13.	20.																										
7. ↓	14. ↓	21. ↓																										

Note:

- (A) LAS taken on the accessible surface areas of the foundation walls, all were equivalent to bkgd. at 80 cpm and < 1K dpm, except for the one large green square [see above photo], which was a small area located in a visibly seen horizontal crack, duct tape de-con performed, and a re-check direct frisk equivalent to bkgd. and follow up smears taken. Because of the contamination found, a comprehensive smear verification [96 smears] was taken above what was required.
- (B) Direct frisks taken on the aforementioned areas for β & γ , all equivalent to bkgd. and < 100 ccpm.
- (C) Contact and general area dose rates taken on the walls and the surrounding bottom imprint between them, all were < 0.2 mR/hr.
- (D) There are seventeen smear sample locations for [α / β / ^3H], see above locations #3 & #7.
 Smears taken for particulate:
 Page 2 of 10, (1) thru (10) post de-con and surrounding area of green square.
 Page 3 of 10, (1) thru (9) taken at north wall sample locations.
 Page 4 of 10, (10) thru (17) taken at south wall sample locations.
 Page 5 of 10, (1) thru (36) verification smears.
 Page 6 of 10, (37) thru (48) verification smears.
 Page 7 of 10, (1) thru (36) verification smears.
 Page 8 of 10, (37) thru (48) verification smears.
 Smears taken for tritium:
 Page 9 of 10, (T1) thru (T9) taken at north wall sample locations.
 Page 10 of 10, (T10) thru (T17) taken at south wall sample locations.

Surveyed By: Aaron Merkel, Steve Schultz, Sean A. Gully
 FS-SOP- 2010 ERP 010
 Attachment 9.2

Date: 08/04/10
 1000

Reviewed By: [Signature]

Date: 8/10/10

North WALL 10/10

Sample Report

Contamination
Flisking HOT SPOT AFTER DECON

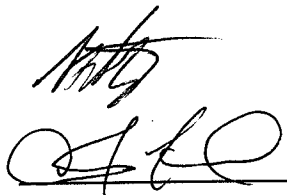
Batch ID: 1min. Smear - 201008041544
Group: E
Device: HFBR
Batch Key: 2,092
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/4/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.30 ± 0.10	Alpha:	28.64 ± 0.08	Alpha to Beta:	6.13 ± 0.00
Beta Rate:	8.33 ± 0.53	Beta:	19.84 ± 0.07	Beta to Alpha:	0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100804154414-E1	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100804154544-E2	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100804154704-E3	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100804154814-E4	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100804154934-E5	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100804155044-E6	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100804155204-E7	Unknown	-1.05	0.35	15.84	3.45	15.35	62.29	
20100804155324-E8	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100804155434-E9	Unknown	2.43	3.51	15.84	23.30	18.37	62.29	
20100804155554-E10	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	

Reviewed by:

 8-4-10

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FOUNDATION
NORTH PLASTER WALL

Sample Report

Sample Locations

Batch ID: 1min. Smear - 201008040947
Group: E
Device: HFBR
Batch Key: 2,090
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/4/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.30 ± 0.10	Alpha:	28.64 ± 0.08	Alpha to Beta:	6.13 ± 0.00
Beta Rate:	8.33 ± 0.53	Beta:	19.84 ± 0.07	Beta to Alpha:	0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100804094734-E1	Unknown	-1.05	0.35	15.84	3.45	15.35	62.29	
20100804094904-E2	Unknown	5.94	4.95	15.84	-2.21	14.51	62.29	
20100804095024-E3	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100804095134-E4	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100804095254-E5	Unknown	-1.05	0.35	15.84	3.45	15.35	62.29	
20100804095404-E6	Unknown	-1.05	0.35	15.84	13.53	16.93	62.29	
20100804095524-E7	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100804095644-E8	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100804095754-E9	Unknown	2.44	3.51	15.84	3.14	15.35	62.29	

Reviewed by:

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FOUNDATION
SOUTH PLANNING WALL

Sample Report

Sample Locations

Batch ID: 1min. Smear - 201008040947
Group: F
Device: HFBR
Batch Key: 2,091
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/4/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.30 ± 0.10	Alpha:	28.64 ± 0.08	Alpha to Beta:	6.13 ± 0.00
Beta Rate:	8.33 ± 0.53	Beta:	19.84 ± 0.07	Beta to Alpha:	0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100804094743-F10	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	*
20100804100033-F11	Unknown	2.45	3.51	15.84	-6.94	13.60	62.29	
20100804100143-F12	Unknown	2.45	3.51	15.84	-1.90	14.50	62.29	
20100804100303-F13	Unknown	2.45	3.51	15.84	-17.02	11.58	62.29	
20100804100413-F14	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100804100533-F15	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100804100643-F16	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100804100803-F17	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	

Reviewed by: *[Signature]*

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Sample Report

Batch ID: 1min. Smear - 201008051026
Group: E
Device: HFBR
Batch Key: 2,098
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/5/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)	Efficiency (%)	Spillover (%)
Alpha Rate: 0.30 ± 0.10 Beta Rate: 8.33 ± 0.53	Alpha: 28.64 ± 0.08 Beta: 19.84 ± 0.07	Alpha to Beta: 6.13 ± 0.00 Beta to Alpha: 0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100805102653-E1	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805102823-E2	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100805102943-E3	Unknown	-1.05	0.35	15.84	13.53	16.93	62.29	
20100805103053-E4	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805103213-E5	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805103323-E6	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805103443-E7	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805103553-E8	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805103713-E9	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805103833-E10	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	
20100805103943-E11	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805104103-E12	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805104213-E13	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805104333-E14	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805104443-E15	Unknown	2.46	3.51	15.84	-27.10	9.13	62.29	
20100805104603-E16	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805104713-E17	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20100805104833-E18	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805104943-E19	Unknown	5.92	4.95	15.84	22.99	18.37	62.29	
20100805105103-E20	Unknown	-1.05	0.35	15.84	8.49	16.16	62.29	
20100805105223-E21	Unknown	2.45	3.51	15.84	-17.02	11.58	62.29	
20100805105333-E22	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805105453-E23	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805105603-E24	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805105723-E25	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805105833-E26	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805105953-E27	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805110103-E28	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805110223-E29	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805110333-E30	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805110453-E31	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805110613-E32	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805110723-E33	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805110843-E34	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805110953-E35	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805111113-E36	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	

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Sample Report

Background (cpm)			Efficiency (%)			Spillover (%)		
Alpha Rate:	0.30	± 0.10	Alpha:	28.64	± 0.08	Alpha to Beta:	6.13	± 0.00
Beta Rate:	8.33	± 0.53	Beta:	19.84	± 0.07	Beta to Alpha:	0.08	± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100805111223-E37	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805111343-E38	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805111453-E39	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805111613-E40	Unknown	2.45	3.51	15.84	-11.98	12.63	62.29	
20100805111723-E41	Unknown	2.46	3.51	15.84	-27.10	9.13	62.29	
20100805111843-E42	Unknown	2.45	3.51	15.84	-1.90	14.50	62.29	
20100805111953-E43	Unknown	2.45	3.51	15.84	-11.98	12.63	62.29	
20100805112113-E44	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805112223-E45	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805112343-E46	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805112503-E1	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805112613-E2	Unknown	-1.05	0.35	15.84	13.53	16.93	62.29	

Reviewed by:

[Signature]
[Signature]
 North
 8-5-10

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Sample Report

Batch ID: 1min. Smear - 201008050923
Group: E
Device: HFBR
Batch Key: 2,097
Selected Geometry: 1/8" Stainless Steel

Count Date: 8/5/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)	Efficiency (%)	Spillover (%)
Alpha Rate: 0.30 ± 0.10	Alpha: 28.64 ± 0.08	Alpha to Beta: 6.13 ± 0.00
Beta Rate: 8.33 ± 0.53	Beta: 19.84 ± 0.07	Beta to Alpha: 0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100805092354-E1	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805092524-E2	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	
20100805092644-E3	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805092754-E4	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805092914-E5	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805093034-E6	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805093144-E7	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805093304-E8	Unknown	2.45	3.51	15.84	-11.98	12.63	62.29	
20100805093414-E9	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805093534-E10	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805093644-E11	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805093804-E12	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805093914-E13	Unknown	2.46	3.51	15.84	-32.14	7.61	62.29	
20100805094034-E14	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805094154-E15	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805094304-E16	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805094424-E17	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805094534-E18	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805094654-E19	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805094804-E20	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805094924-E21	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805095034-E22	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20100805095154-E23	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805095314-E24	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805095424-E25	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20100805095544-E26	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805095654-E27	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805095814-E28	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805095924-E29	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	
20100805100044-E30	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	
20100805100154-E31	Unknown	-1.05	0.35	15.84	3.45	15.35	62.29	
20100805100314-E32	Unknown	-1.05	0.35	15.84	3.45	15.35	62.29	
20100805100424-E33	Unknown	2.45	3.51	15.84	-6.94	13.60	62.29	
20100805100544-E34	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805100704-E35	Unknown	-1.05	0.35	15.84	-3.45	15.35	62.29	
20100805100814-E36	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	

Page 7 of 10

Sample Report

Background (cpm)			Efficiency (%)			Spillover (%)		
Alpha Rate:	0.30	± 0.10	Alpha:	28.64	± 0.08	Alpha to Beta:	6.13	± 0.00
Beta Rate:	8.33	± 0.53	Beta:	19.84	± 0.07	Beta to Alpha:	0.08	± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20100805100934-E37	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	
20100805101044-E38	Unknown	-1.04	0.35	15.84	-41.67	12.63	62.29	
20100805101204-E39	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805101314-E40	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805101434-E41	Unknown	-1.05	0.35	15.84	8.49	16.16	62.29	
20100805101544-E42	Unknown	-1.04	0.35	15.84	-21.75	10.42	62.29	
20100805101704-E43	Unknown	-1.05	0.35	15.84	8.49	16.16	62.29	
20100805101814-E44	Unknown	-1.05	0.35	15.84	-1.59	14.50	62.29	
20100805101934-E45	Unknown	-1.04	0.35	15.84	-6.63	13.60	62.29	
20100805102044-E46	Unknown	-1.04	0.35	15.84	-16.71	11.58	62.29	
20100805102204-E1	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20100805102314-E2	Unknown	5.96	4.95	15.84	-37.48	5.72	62.29	

Reviewed by:

Handwritten signature
QJZ 8-5-10 *J*
 SOUTH *SM*

Page 8 of 10

plenum north wall sample points

Cycle 1 Results

S#	Count	Time	CPMA	CPMB	tSIE	MESSAGES	DATE	TIME	DPM1
BLANK 1	10.00		8	7	408.72	B	8/4/2010	9:45:45 AM	0
(T1) 2	0.50		6	5	383.06	<	8/4/2010	9:57:22 AM	16
(T2) 3	0.50		0	1	358.67	<	8/4/2010	9:59:18 AM	1
(T3) 4	0.50		0	0	396.58	<	8/4/2010	10:01:13 AM	0
(T4) 5	0.50		2	3	401.70	<	8/4/2010	10:03:09 AM	6
(T5) 6	0.50		2	3	358.00	<	8/4/2010	10:05:04 AM	6
(T6) 7	0.50		12	11	374.29	<	8/4/2010	10:06:59 AM	33
(T7) 8	0.50		0	0	355.02	<	8/4/2010	10:08:57 AM	0
(T8) 9	0.50		0	0	331.53	<	8/4/2010	10:10:53 AM	1
(T9) 10	0.50		8	9	364.95	<	8/4/2010	10:12:49 AM	22

H/D

plenum south wall sample points

Cycle 1 Results

S#	Count	Time	CPMA	CPMB	tSIE	MESSAGES	DATE	TIME	DPM1
BLANK 1	10.00		7	7	401.40	B	8/4/2010	10:15:05 AM	0
(T10) 2	0.50		3	3	402.80	<	8/4/2010	10:26:42 AM	7
(T11) 3	0.50		5	5	400.50	<	8/4/2010	10:28:38 AM	12
(T12) 4	0.50		1	1	349.54	<	8/4/2010	10:30:32 AM	2
(T13) 5	0.50		3	3	344.75	<	8/4/2010	10:32:31 AM	8
(T14) 6	0.50		0	0	340.18	<	8/4/2010	10:34:29 AM	0
(T15) 7	0.50		7	7	370.03	<	8/4/2010	10:36:24 AM	18
(T16) 8	0.50		0	0	360.90	<	8/4/2010	10:38:21 AM	0
(T17) 9	0.50		5	5	345.71	<	8/4/2010	10:40:17 AM	13



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RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT																																																																																									
LOCATION & EQUIPT. Bldg. 704 Fanhouse		☐ ROUTINE ☒ SPECIAL FSS ☐ RWP # 2010-ER-010 ☐ WP # _____		Model #	Serial #	CAL DUE																																																																																							
		DATE: 7-31-2010 TIME: 1000		Ludlum 2221	149942	2-15-2011																																																																																							
Fanhouse Survey Unit-4 FSS Survey				Ludlum 2221	138377	7-28-11																																																																																							
Survey Unit 4 COC # 30064				N/A		→																																																																																							
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NOTE: SAMPLE #6 MOVED 33' NORTH AND 1' W DUE TO INTERFERENCES				Surveyed By: <u>Merkel/Dzvonar/ Schultz</u> Date: <u>7-31-2010</u> Reviewed By: <u>[Signature]</u> Date: <u>8/14/10</u>																																																																																									
FS-SOP-1000 Attachment 9.2				Page 1 of 2																																																																																									

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT		
LOCATION & EQUIPT. Former Bdg. 704 Fanhouse		☐ ROUTINE ☐ SPECIAL ☒ RWP # 2010-erp-010 ☐ WP #		Model # Serial # CAL DUE		
		DATE: 73-/31/10—8/12/10 TIME: 1000		Ludlum 2221 149942 2/15/11 Ludlum 2221 138377 7/28/11 ↑ ↑ ↑ N/A N/A N/A		
FSS sample point locations I.A.W. SWP 602-03 for Survey Units 4 and 5						
Attachment 4 Survey Units 4 and 5 Sample Locations and Descriptions Page 1 of 2						
SU-4: random x = 46 L = 37 ft random y = 5 0.666 f 32 ft SU-5: random x = 206 L = 24 ft random y = 15 0.666 f 21 ft						
SU4 sample point 6 was moved 33 feet north and 1 foot west due to interferences SU5 sample points moved as stated below due to interferences or being on top of EABFF slab which was previously surveyed. SU5—8 moved 8 feet north SU5—9 moved 8 feet north SU5—10 moved 1 foot north and 5 feet east SU5—11 moved 16 feet north SU5—12 moved 16 feet east						
LEGEND ○ - SMEAR SURVEY LOCATION △ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ						
AIRBORNE ACTIVITY SURVEY						
Sample #		Duration	Flow Rate	Field Analysis		% DAC
N/A				cpm	µCi/cc	
DOSE RATE (HIGHEST)						
CONTACT READING				N/A		
GENERAL AREA READING				N/A		
MASSLINN SURVEY RESULTS (in dpm)						
1. N/A		5. N/A				
2.		6.				
3.		7.				
4. ↓		8. ↓				
SMEAR SURVEY RESULTS (dpm/100cm²) α, β-γ, ³H						
1. See		8. Attached		15. Results		
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3.		10.		17.		
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7. ↓		14. ↓		21. ↓		
Surveyed By Schultz/Merkel/DZvonar		Date: 8/13/10		Reviewed By: Hollander		Date: 8/16/10
FS-SOP-1000 Attachment 9.2						
Page 2 of 2						

ASL Prefix No.

N/A

Page 1 of 3

BROOKHAVEN
NATIONAL LABORATORY

Carrier/Waybill #

P.O. #

Chain of Custody No.

30064

Requires EDD ☒

DQL

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name:	MIKE HOLLANDER	Name:	STEVE SCHULTZ	Name:	GEL
Life: No:	N6435 Ext. 4839	Contact:	FRP	Address:	2040 SAVAGE RD
Acct. No:	65070/65074 Dept: FRP	Phone:	X 4424	City:	CHARLESTON SC Zip: 29407
Email Reports To:		Email/Fax:		Contact:	HEATHER SHAPIRO
1 LOCKWOOD @ bnl.gov		Sampler:	SAME	Phone:	843-769-7386 (X4305)
2 HOLLANDER @ bnl.gov		Email/Fax:			
Project Name:		Project Manager:		Field Engineer:	
FANHOUSE D+A		ANDY LOCKWOOD		KEVIN HICKMAN	

Comments:

SEE ATTACHED SHEETS CONCERNING CORE SAMPLE RETENTION SWA 60-13 (FINAL)

Sample Information										Additional Sample Information									
LID	Type	UID	Smpl	Coll	Site ID/Bldg/Life #	Depth/RVP	Date	Time	Matrix	Name/Description	Cont. Vol./Units	Cont. Type	# of Cont.	Preservative	Alpha/Beta	Tritium	Gamma	Strontium	524.2
		001E			BML/704/4405	0-0.5'	7/31/10	0920	S	FANHOUSE SU 4	SW-1	P	1	MINI					
		002E					7/31/10	0910											
		003E					7/31/10	0905											
		004E					7/31/10	0945											
		005E					7/31/10	0900											
		006E					7/31/10	0925											
		007E					7/31/10	0930											
		008E					7/31/10	0935											
		009E					7/31/10	0940											
		010E					7/31/10	1600											
		011E					7/31/10	1530											
		012E					7/31/10	1535											
		013E					7/31/10	1545											
		014E					7/31/10	1540											

1 Relinquished By/Date/Time	2 Relinquished By/Date/Time	3 Relinquished By/Date/Time
Print	Print	Print
Signature	Signature	Signature
1 Received By/Date/Time	2 Received By/Date/Time	3 Received By/Date/Time
Print	Print	Print
Signature	Signature	Signature

Contractor Lab Sample Disposal:

☐ Return To Client ☒ Disposal by Lab
☐ Archive For _____ MonthsData Package: ☐ Full ☒ Summary

Turn-Around Time Required:

☐ Rush (1 Day) ☒ 14 Days ☐ 30 Days
☐ 7 Days ☐ Other ()

ASL Prefix No.

MA

Page

2 of 3

BROOKHAVEN
NATIONAL LABORATORY

Carrier/Waybill #

P.O.#

Chain of Custody No.

30064

Requires EDD ☒

DQL

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: MIKE HANNAH		Name: STEVE SCHULTZ		Name: GEL	
Life: No: N6455 Ext: 4839		Contact: FRP		Address: 2040 SAVAGE Rd.	
Acct. No: 65070/65074 Dept: ERP		Phone: X4424		City: CHARLESTON St: S.C. Zip: 29407	
Email Reports To:		Email/Fax:		Contact: HEATHLY SHAFER	
1 LOCKWOOD @ 10/1/90		Sampler: SAME		Phone: 843-769-7886	
2 HANNAH @ 10/1/90		Project Manager:		Email/Fax:	
Project Name: FANHOUSE D+D		Project Manager: ANDY LOCKWOOD		Field Engineer: KEVIN HECKMAN	

Comments:

Type		Sample Information								Additional Sample Information														
LID	UID	Smp	Coll	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Matrix	Name/Description	Cont. Vol/Units	Cont. Type	# of Cont.	Preservative	Alpha	Tritium	Gamma	Strontium	5242	624	Nuclides	PCBs	Metals		
	015	E	G	8M/704/NU45T	0-0.5'	7/31/10	0950	S	FANHOUSE SU 4															
	016	F				7/30/10	1550	S																
	017	E				7/30/10	1548	S																
	018	F				7/30/10	1545	S																
	019	E	F			8/3/10	1630	S	COMPOSITE OF SAMPLES 1-18															
	020	E	G	8M/704/NU45T	0-0.5'	2/10/10	0855		FIELD DUPLICATE OF #12															
	021	E	G	8M/704/NU45T	0-0.5'	2/10/10	0855		FIELD BLANK															
	022	E	G	8M/704/NU45T	0-0.5'	2/10/10	1100		FAN HOUSE #6 - CORE															
	023				3-4'	2/10/10	1125																	
	024				4-6'	2/10/10	1102																	
	025				6-8'	2/10/10	1110																	
	026				0-0.5'	2/10/10	0940		FAN HOUSE #12 - CORE															
	027				2-4'	2/10/10	0946																	
	028				4-6'	2/10/10	0935																	

1 Relinquished By/Date/Time		2 Relinquished By/Date/Time		3 Relinquished By/Date/Time	
Print: [Signature]		Print: [Signature]		Print: [Signature]	
Signature: [Signature]		Signature: [Signature]		Signature: [Signature]	
1 Received By/Date/Time		2 Received By/Date/Time		3 Received By/Date/Time	
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Signature: [Signature]		Signature: [Signature]		Signature: [Signature]	

Contractor Lab Sample Disposal:

☐ Return To Client ☒ Disposal by Lab
☐ Archive For _____ Months
Data Package: ☐ Full ☒ Summary

Turn-Around Time Required:

☐ Rush (1 Day) ☒ 14 Days ☐ 30 Days
☐ 7 Days ☐ Other ()

ASL Prefix No.

Page 3 of 3

BROOKHAVEN
 NATIONAL LABORATORY

Carrier/Waybill # _____

P.O.# _____

Chain of Custody No. 30061

Requires EDD ☒

DQL _____

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: MIKE POLLARD		Name: STEVE SCHULTZ		Name: GEL	
Life: No. 01455 Ext. 4409		Contact: ERP		Address: 3011 TRUJILLO BL.	
Acct. No. 63070/4334 Dept: ERP		Phone: 244 4444		City: BOSTON State: MA Zip: 02117	
Email Reports To:		Email/Fax:		Contact: BOSTON BUREAU	
1. 0000000000000000		Sampler:		Phone: 212-777-7777	
2. 0000000000000000				Email/Fax:	
Project Name:		Project Manager:		Field Engineer:	
FAN HOUSE #12		ANDY LUKWID		VICTOR HECKMAN	

Comments:

Type		Sample Information							Additional Sample Information														
LID	UID	Smp	Coll	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Matrix	Name/Description	Cont. Vol/Units	Cont. Type	# of Cont	Preservative	Alpha	Tritium	Gamma	Stron	5242	624	Nuclid	PCBs	Metal	
	IEG	Bldg	704	10055	6-2'	2/12/10	0732		FANHOUSE #12 CORE	30cm	P	1	None										
					6-2'	2/12/10	1410		FANHOUSE #17 CORE														
						2/12/10	1415																
						2/12/10	1416																
						2/12/10	1417																
						2/12/10	1418																
																		</					

1. Relinquished By/Date/Time		2. Relinquished By/Date/Time		3. Relinquished By/Date/Time	
Print: [Signature]		Print: [Signature]		Print: [Signature]	
Signature: [Signature]		Signature: [Signature]		Signature: [Signature]	
1. Received By/Date/Time		2. Received By/Date/Time		3. Received By/Date/Time	
Print: [Signature]		Print: [Signature]		Print: [Signature]	
Signature: [Signature]		Signature: [Signature]		Signature: [Signature]	

Contractor Lab Sample Disposal:

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RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT																																																																																					
		☐ ROUTINE ☒ SPECIAL FSS		Model # Serial # CAL DUE																																																																																					
LOCATION & EQUIPT. FSS Fanhouse survey		DATE: 8-10-2010		TIME: 1600		Ludlum 2221 149942 2-15-2011																																																																																			
FSS survey unit #5 sample points						N/A N/A N/A																																																																																			
Survey Unit 5 Fanhouse COC # 30067							LEGEND ○ - SMEAR SURVEY LOCATION △ - AIR SAMPLE LOCATION ☐ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ																																																																																		
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Note Sample #11 was moved 16' N, Sample #12 was moved 16' E, Sample #10 was moved 10' E, Sample #8 was moved 8' N and Sample #9 was moved 8' N. All these sample points were moved from the sample plan due to interferences. Surveyed By <i>[Signature]</i> Schultz Date: 8-10-2010 Reviewed By: <i>[Signature]</i> Date: 8/14/10 FS-SOP-1000 Attachment 9.2							Page 1 of 2																																																																																		

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT		
LOCATION & EQUIPT. Former Bdg. 704 Fanhouse		☐ ROUTINE ☐ SPECIAL		Model #	Serial #	CAL DUE
		RWP # 2010-erp-010 ☐ WP #		Ludlum 2221	149942	2/15/11
FSS sample point locations I.A.W. SWP 602-03 for Survey Units 4 and 5		DATE: 73-/31/10—8/12/10		TIME: 1000		Ludlum 2221
Attachment 4 Survey Units 4 and 5 Sample Locations and Descriptions Page 1 of 2 SU-4: random x = 46 random y = 2 SU-5: random x = 208 random y = 13		N/A		N/A	N/A	
		LEGEND				
		○ - SMEAR SURVEY LOCATION △ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION XXX XXX = contact reading Y = radiation type ZZZ = reading @ 30cm				
AIRBORNE ACTIVITY SURVEY						
Sample #	Duration	Flow Rate	Field Analysis		% DAC	
N/A			cpm	µCi/cc		
DOSE RATE (HIGHEST)						
CONTACT READING			N/A			
GENERAL AREA READING			N/A			
MASSLINN SURVEY RESULTS (in dpm)						
1.	N/A	5.	N/A			
2.		6.				
3.		7.				
4.		8.				
SMEAR SURVEY RESULTS (dpm/100cm ²) α, β-γ, ³ H						
1.	See	8.	Attached	15. Results		
2.	Batch	9.	Number	16. N/A		
3.		10.		17.		
4.		11.		18.		
5.		12.		19.		
6.		13.		20.		
7.		14.		21.		
Surveyed By Schultz Date: 8/13/10 Reviewed By: Hollander Date: 8/16/10						
FS-SOP-1000 Attachment 9.2 Page 2 of 2						

ASL Prefix No.

N/A

Page 1 of 3

BROOKHAVEN
NATIONAL LABORATORY

Carrier/Waybill #

P.O. #

Chain of Custody No.

30067

Requires EDD ☒

DQL

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name:	M. S. HOLLAND	Name:	STEVE SCHULTZ / DAN DAVIS	Name:	GEL
Life: No:	N6455 Ext. 4839	Contact:	FRP	Address:	2040 SAVAGE RD.
Acct. No:	65070/65074 Dept: FRP	Phone:	X4424	City:	CHARLOTTE S.C. Zip: 29407
Email Reports To:		Email/Fax:		Contact:	HEATHER SHAFER
1	LOCKWOOD @ DNL.GOV	Sampler:	SAME	Phone:	843-769-7326 (X4505)
2	HOLLAND @ DNL.GOV			Email/Fax:	
Project Name:	FANFANSI D+D	Project Manager:	ANDY LOCKWOOD	Field Engineer:	KENT HECKMAN

Comments:

SEE ATTACHED SHEET CONCERNING CORE SAMPLER RPT'S FROM SWP 602-03 (3) TOTAL

Type		Sample Information							Additional Sample Information														
LID	UID	Smp	Coll	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Matrix	Name/Description	Cont. Vol./Units	Cont. Type	# of Cont.	Preservative	Alpha	Tritium	Gamma	Stront	524.2	624	Nuclid	PCBs	Metals	
	001	EG		BNL/704/SUS	0-0.5	11/10	0810	S	FANFAN ST SUS	500ml	P	1	NONE										
	002					2/11/10	0815					1											
	003					7/11/10	0900					1											
	004					7/11/10	0915					1											
	005					7/11/10	1420					1											
	006					8/11/10	1425					1											
	007					2/11/10	1430					1											
	008					2/11/10	0850					1											
	009					2/11/10	0845					1											
	010					8/11/10	1005					1											
	011					2/11/10	1000					1											
	012					8/11/10	0950					1											
	013					2/11/10	0945					1											
	014					2/11/10	0955					1											

1 Relinquished By/Date/Time	2 Relinquished By/Date/Time	3 Relinquished By/Date/Time
Print: Mike Holland 8/13/10 1342	Print:	Print:
Signature: [Signature]	Signature:	Signature:
1 Received By/Date/Time	2 Received By/Date/Time	3 Received By/Date/Time
Print: R. [Signature] 8/13/10	Print:	Print:
Signature: [Signature]	Signature:	Signature:

Contractor Lab Sample Disposal:

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Page 2 of 3

BROOKHAVEN
NATIONAL LABORATORY

Carrier/Waybill # _____

P.O. # _____

Chain of Custody No.

30067

Requires EDD ☒

DQL _____

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: MIKE HOLLAND		Name: STEVE SCHULTZ/DAN DOW		Name: GEL	
Life: No: N6455 Ext: 4839		Contact: FRP		Address: 2040 SAVAGE RD.	
Acct. No: 65070/65074 Dept: FRP		Phone: X 4424		City: CHARLOTTE St: S.C. Zip: 29407	
Email Reports To:		Email/Fax:		Contact: HATHOR SHAFER	
1 LOCKWOOD @ BNL: gov		Sampler: SAME		Phone: 843-769-7386 (x4505)	
2 HOLLAND @ BNL: gov				Email/Fax:	
Project Name:		Project Manager:		Field Engineer:	
FAHNSH D&D		ANDY LOCKWOOD		KENT HECKMAN	

Comments:

Type		Sample Information						Additional Sample Information															
LID	UID	Smp	Coll	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Matrix	Name/Description	Cont. Vol/Units	Cont. Type	# of Cont.	Preservative	Alpha	Tritium	Gamma	Strontium	5242	624	Nuclides	PCBs	Metals	
	015	EG		BNL/24/305	0-0.5	8/11/10	0930		FAHNSH SU5	30ml	P	1	NAI										
	016					8/11/10	0930																
	017					8/11/10	1135																
	018	EG		BNL/24/305	0-0.5	8/11/10	1020		FAHNSH COMPOSITE #1-17	30ml	P	1	NAI										
	019	EG			0-0.5	8/12/10	1030		FAHNSH FIELD BLANK			1	NAI										
	020	EG			0-0.5	8/12/10	1055		FAHNSH FIELD DUP.			1	NAI										
	021			BNL/24/305	0-2'	8/11/10	1430		FAHNSH CORE #7 SU5	50ml	P	1	NAI										
	022				2-4'	8/11/10	1440																
	023				4-6'	8/11/10	1450																
	024				6-8'	8/11/10	1500																
	025				0-2'	8/12/10	1447		FAHNSH CORE #10														
	026				2-4'	8/12/10	1500																
	027				4-6'	8/12/10	1555																
	028				6-8'	8/12/10	1605																

1 Relinquished By/Date/Time		2 Relinquished By/Date/Time		3 Relinquished By/Date/Time	
Print MIKE HOLLAND 8/13/10 1342		Print		Print	
Signature [Signature]		Signature		Signature	
1 Received By/Date/Time		2 Received By/Date/Time		3 Received By/Date/Time	
Print K. M. [Signature] 8/11/10		Print		Print	
Signature [Signature] 1543		Signature		Signature	

Contractor Lab Sample Disposal:

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Data Package: ☐ Full ☒ Summary

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N/A

Page 3 of 3

BROOKHAVEN
 NATIONAL LABORATORY

Carrier/Waybill # _____

P.O. # _____

Chain of Custody No.

30067

Requires EDD ☐

DQL _____

SAMPLING CHAIN OF CUSTODY

Analysis Requested

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: MIKE HOLMAN		Name: STEVE SCHULZ / ADAM		Name: GFL	
Life: No: N6455 Ext: 4839		Contact: ERP		Address: 2440 SAVAGE RD.	
Acct. No: 65070/65074 Dept: ERP		Phone: X4424		City: Philadelphia St: S.C. Zip: 29407	
Email Reports To:		Email/Fax:		Contact: H. 47002 SHAW	
1 LOCKWOOD @ Int. 900		Sampler: SAME		Phone: 843-767-7386 (X4805)	
2 HOLMAN @ Int. 900				Email/Fax:	
Project Name:		Project Manager:		Field Engineer:	
1 ANTIMONY A+D		ANDY LOCKWOOD		KENT HICKMAN	

Comments:

Type		Sample Information				Additional Sample Information																
LID	UID	Smp	Coll	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Matrix	Name/Description	Cont. Vol./Units	Cont. Type	# of Cont.	Preservative	Alpha/Beta	Tritium	Gamma	Strontium	524.2	624	Nuclide-specific Alpha	PCBs	Metals
	129 E	G		601/2ml/505	2-4'	9/11/00	1342		FAA/Hansen COORD #15-305	500ml P	1	1	MMI									
	130				2-4'	9/11/00	1342															
	131				4-6'	9/11/00	1342															
	132				6-8'	9/11/00	1342															

1 Relinquished By/Date/Time		2 Relinquished By/Date/Time		3 Relinquished By/Date/Time	
Print: MIKE HOLMAN 9/11/00		Print:		Print:	
Signature: [Signature]		Signature:		Signature:	
1 Received By/Date/Time		2 Received By/Date/Time		3 Received By/Date/Time	
Print: [Signature] 9/11/00		Print:		Print:	
Signature: [Signature]		Signature:		Signature:	

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ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A

COUNT DATE: 08/04/2010-D

P. SULLIVAN - 631 897-3202

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	080410-013	976	FOUNDATION WALL N-1	BACKGROUND
2	080410-014	908	FOUNDATION WALL N-2	¹³⁷ Cs (0.54 pCi/gm) + BACKGROUND
3	080410-015	775	FOUNDATION WALL N-3	¹³⁷ Cs (0.14 pCi/gm) + BACKGROUND
4	080410-016	649	FOUNDATION WALL N-4	BACKGROUND
5	080410-017	745	FOUNDATION WALL N-5	¹³⁷ Cs (0.25 pCi/gm) + BACKGROUND
6	080410-018	670	FOUNDATION WALL N-6	¹³⁷ Cs (0.13 pCi/gm) + BACKGROUND
7	080410-019	1046	FOUNDATION WALL N-7	¹³⁷ Cs (0.13 pCi/gm) + BACKGROUND
8	080410-020	935	FOUNDATION WALL N-8	¹³⁷ Cs (0.09 pCi/gm) + BACKGROUND
9	080410-021	977	FOUNDATION WALL N-9	BACKGROUND
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

9 SAMPLES TOTAL

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A

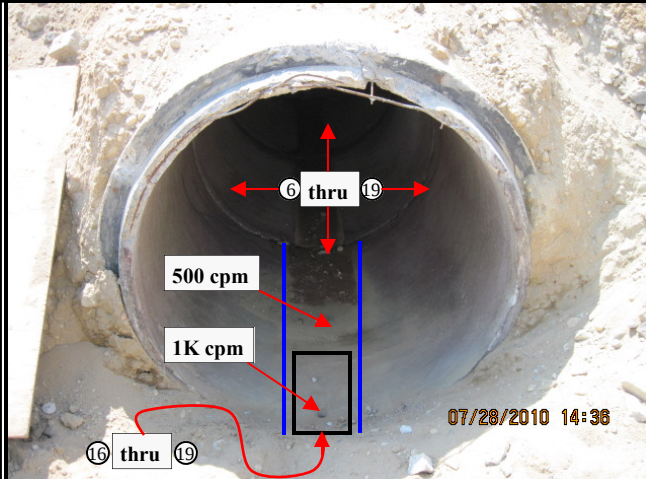
COUNT DATE: 08/11/2010-C

P. SULLIVAN - 631 897-3202

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	081110-037	668	S. FANHOUSE FOUNDATION WALL #1	BACKGROUND
2	081110-038	491	S. FANHOUSE FOUNDATION WALL #2	BACKGROUND
3	081110-039	667	S. FANHOUSE FOUNDATION WALL #3	BACKGROUND
4	081110-040	643	S. FANHOUSE FOUNDATION WALL #4	BACKGROUND
5	081110-041	657	S. FANHOUSE FOUNDATION WALL #5	BACKGROUND
6	081110-042	550	S. FANHOUSE FOUNDATION WALL #6	BACKGROUND
7	081110-043	699	S. FANHOUSE FOUNDATION WALL #7	BACKGROUND
8	081110-044	747	S. FANHOUSE FOUNDATION WALL #8	BACKGROUND
9	081110-045	606	IMPRINT FOOTING	¹³⁷ Cs (1.68 pCi/gm) + BACKGROUND
10	081110-046	796	IMPRINT FOOTING	¹³⁷ Cs (0.53 pCi/gm) + BACKGROUND
11	081110-047	688	IMPRINT FOOTING	¹³⁷ Cs (0.07 pCi/gm) + BACKGROUND
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

11 SAMPLES TOTAL

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE																						
Location / Equipment: 704 W. End of Imprint, Duct		☐ Routine _____ ☐ Special _____ ☒ RWP# 2010-ERP-010 ☐ WP _____		Model #	Serial #																							
		Date: 07/ 28 /10	Time: 17:00	LB5100S4	32487	07/16/11																						
Survey: First section of the cement secondary cooling air return duct to Bldg. 701.				RO-20	3829	08/24/10																						
 				LUD-3	44168	01/29/11																						
				E-600	01642	02/22/11																						
				SHP 380A	00159	01/19/11																						
		LEGEND ○ - SMEAR SURVEY LOCATION ■ - MASSLINN SURVEY LOCATION Ⓒ - CONTAMINATION XXX ZZZ ▲ - AIR SAMPLE LOCATION # - DIRECT FRISK LOCATION * CONTACT XXX = contact reading Y = radiation type ZZZ = reading @ 30cm																										
AIRBORNE ACTIVITY SURVEY <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>µCi/cc</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>								Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	µCi/cc	N/A												
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			cpm	µCi/cc																								
N/A																												
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2. ↓	6.																											
3. N/A	7.																											
4. ↓	8. ↓																											
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4.	11.	18.																										
5.	12.	19.																										
6.	13.	20.																										
7. ↓	14. ↓	21. ↓																										
Note: (A) LAS taken on the accessible surface areas of the external and internal cement duct [about 4 ft.], all were equivalent to bkgd. at 70 cpm. (B) Spot check direct frisks taken on the sides and top of the duct/ pipe were equivalent to bkgd. at 70 cpm and < 100 ccpm. On the bottom of the duct/pipeline [out lined between the blue lines] frisking at the edge of the open plane at 1K ccpm [black rectangle] and as the probe moves towards the first connective joint of the inner pipe, the activity reduces to 500 ccpm. E-600 used to check the first section of the inner pipe surrounding wall for α, all surface areas checked were equivalent to bkgd. at 0. 0 cpm. (C) Contact and general area dose rates taken on the internal duct [edge of open orifice plane to 2 ft. internal] were < 0. 2 γ. (D) Smears taken, see page 2 of 2 for results. (1) thru (5) taken on the external duct. (6) thru (15) taken on the sides, top, bottom dirt debris. (16) thru (19) taken on the bottom post clean away of the debris [inside of the black rectangle.																												

Surveyed By: Dan Dove and Sean A. Gully Date: 07/ 29 /10 Reviewed By: _____ Date: _____

FS-SOP-1000

Attachment 9. 2

Page 1 of 2

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE																		
Location / Equipment: Bldg. 705		☐ Routine ☐ Special ☒ RWP# 2010-ERP-021 ☐ WP		Model #	Serial #																			
				LB5100S4	32487	07/16/11																		
Survey: E. O. D. For Stack		Date: 11/17/10 Time: 1545		RO-20	3892	09/28/11																		
				LUD-3	44141	04/19/11																		
				LUD-3	72518	09/22/11																		
				E-600	01652	02/09/11																		
				LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION ■ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY / ZZZ XXX = contact reading Y = radiation type ZZZ = reading @ 30cm																				
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See note																								
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6.	13.	20.																						
7. ↓	14. ↓	21. ↓																						

Note:

- (A) LAS taken on the external areas of the sump drain & of 42" duct all were ≤ bkgd. Bkgd was 100 cpm
- (B) General area dose rates in both locations < 0.2 γ
- (C) Sump drain, smear # 1 taken ~ 6' down inside pipe where pipe was cut. (batch 2453)
- (D) 42" duct was removed both ends of pipe were sealed with plastic, pipe was reduced & loaded into intermodal.
- (E) All workers in the above areas completed a whole body frisk upon exiting. No activity above bkgd. detected. Lud-3 bkgd. at 80 cpm and E-600 bkgd. at 0 cpm.
- (F) note: Air sample taken at cutting location See air sample log for results.

Surveyed By: Daniel Dove

Date: 11/17/10

Reviewed By:

Date: 11/18/10

FS-SOP-1000

Attachment 9.2

Page 1 of 3

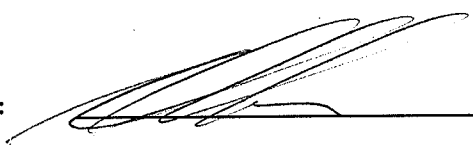
Sample Report

Batch ID: 1min. Smear - 201011171121
Group: E
Device: HFBR
Batch Key: 2,453
Selected Geometry: 1/8" Stainless Steel

Count Date: 11/17/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.30 ± 0.10	Alpha:	28.64 ± 0.08	Alpha to Beta:	6.13 ± 0.00
Beta Rate:	8.33 ± 0.53	Beta:	19.84 ± 0.07	Beta to Alpha:	0.08 ± 0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20101117112156-E31	Unknown	18.57	8.57	15.84	2,531.59	114.28	62.29	

Reviewed by: 

Sample Report

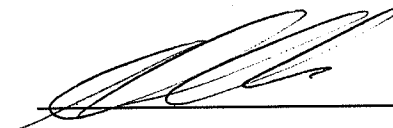
Batch ID: 1min. Smear - 201011171122
Group: F
Device: HFBR
Batch Key: 2,454
Selected Geometry: 1/8" Stainless Steel

Count Date: 11/17/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.30 ± 0.10	Alpha:	28.64 ± 0.08	Alpha to Beta:	6.13 ± 0.00
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<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20101117112203-F1	Unknown	-1.12	0.35	15.84	139.53	30.36	62.29	
20101117112443-F2	Unknown	2.44	3.51	15.84	3.14	15.35	62.29	
20101117112603-F3	Unknown	-1.07	0.35	15.84	33.69	19.70	62.29	
20101117112723-F4	Unknown	-1.06	0.35	15.84	18.57	17.66	62.29	
20101117112833-F5	Unknown	2.36	3.51	15.84	154.34	31.59	62.29	
20101117112953-F6	Unknown	-1.14	0.35	15.84	169.77	32.77	62.29	

Reviewed by:



Memo

Date: March 21, 2011

To: File

From: M. Hollander

Subject: *Building 802 Free Release (Tritiated water evaporation facility and fan house equipment)*

This memo has been prepared to document the free release survey performed on Building 802, which has been performed in accordance with *Work Procedure 603-35, Bldg. 802 Radiological Release Survey*. The material that is currently ready to be free released is all walls/floors/roof/doors and windows with the exception of 30% of the southwest floor (this area will be disposed of as LLRW). All material free released will be transported to a Subtitle D landfill.

The release surveys and physical samples were completed according to the requirements provided in the WP. These requirements are summarized in Table 1. Results of the release survey are summarized in Table 2. The results for free release satisfy the requirements of the *BNL Radiological Control Manual*, specifically Table 2-2, and the requirements of FS-SOP-1005, "*Radiological Surveys required for Release of Materials from Areas Controlled for Radiological Purposes*".

The following information provides the final survey and sample backup data considered necessary to prove that Building 802, as shown in Attachment A "Building 802 Floor Plan", is ready for free release.

Table 1 – Building 802 Free Release Final Survey Requirements

Building Location	Survey Requirement	Method of Survey
Floor	100% beta/gamma	Direct Frisk
Floor	10% alpha	Direct Frisk
Interior wall up to 6 feet	100% beta/gamma and 10% alpha	Direct Frisk
Exterior wall up to 6 feet	100% beta/gamma and 10% alpha	Direct Frisk
Interior wall	50 smears for beta/gamma and alpha	Tennelec
Exterior wall	50 smears for beta/gamma and alpha	Tennelec
Floor	50 smears for beta/gamma and alpha	Tennelec
Interior walls above 6 feet	10% beta/gamma and alpha	Direct Frisk
Exterior walls above 6 feet	10% beta/gamma and alpha	Direct Frisk
Ceiling 2 feet out from all roof penetrations	10% beta/gamma and alpha	Direct Frisk
Ceiling	25 smears for beta/gamma and alpha	Tennelec

Table 1(continued) – Building 802 Free Release Final Survey Requirements

Building Location	Survey Requirement	Method of Survey
Floor	4 samples counted as one composite	Physical Sample
Exterior Walls	4 samples counted as one composite	Physical Sample
Interior Walls	4 samples counted as one composite	Physical Sample
Roof	4 samples counted as one composite	Physical Sample
Remediated areas following initial characterization	Concrete pad in Tritiated tank room	Physical Sample
Roof	100% gamma	NAI Walkover
Roof	50% beta/gamma	Direct Frisk
Roof	10 smears for beta/gamma and alpha	Tennelec
Roof	5 Tritium smears	LSC
All areas distributed throughout Bldg 802	40 Tritium smears	LSC

Table 2 – Building 802 Free Release Final Survey Results

Building Location	Survey Requirement	Survey Result ¹ (dpm/100 cm²)
Floor	100% beta/gamma	<5,000
Floor	10% alpha	<500
Interior wall up to 6 feet	100% beta/gamma and 10% alpha	<5,000 beta/gamma <500 alpha
Exterior wall up to 6 feet	100% beta/gamma and 10% alpha	<5,000 beta/gamma <500 alpha
Interior wall	50 smears for beta/gamma and alpha	<1,000 beta/gamma <20 alpha
Exterior wall	50 smears for beta/gamma and alpha	<1,000 beta/gamma <20 alpha
Floor	50 smears for beta/gamma and alpha	< 1000 beta/gamma < 20 alpha
Interior walls above 6 feet	10% beta/gamma and alpha	<5,000 beta/gamma <500 alpha
Exterior walls above 6 feet	10% beta/gamma and alpha	<5,000 beta/gamma <500 alpha
Ceiling 2 feet out from all roof penetrations	10% beta/gamma and alpha	<5,000 beta/gamma <500 alpha
Ceiling	25 smears for beta/gamma and alpha	<1,000 beta/gamma <20 alpha
Roof	100% gamma	<21,500 CPM gamma
Roof	50% beta/gamma	<5,000 beta/gamma
Roof	10 smears for beta/gamma and alpha	< 1,000 beta/gamma <20 alpha
Roof	5 Tritium smears	< 10,000 beta
Bldg. 802	40 tritium smears	< 10,000 beta

¹The Radiological survey results satisfy the requirements found in Table 2-2 of the BNL Radiological Control Manual and the requirements of FS-SOP-1005, "Radiological Surveys required for Release of Materials from Areas Controlled for Radiological Purposes".

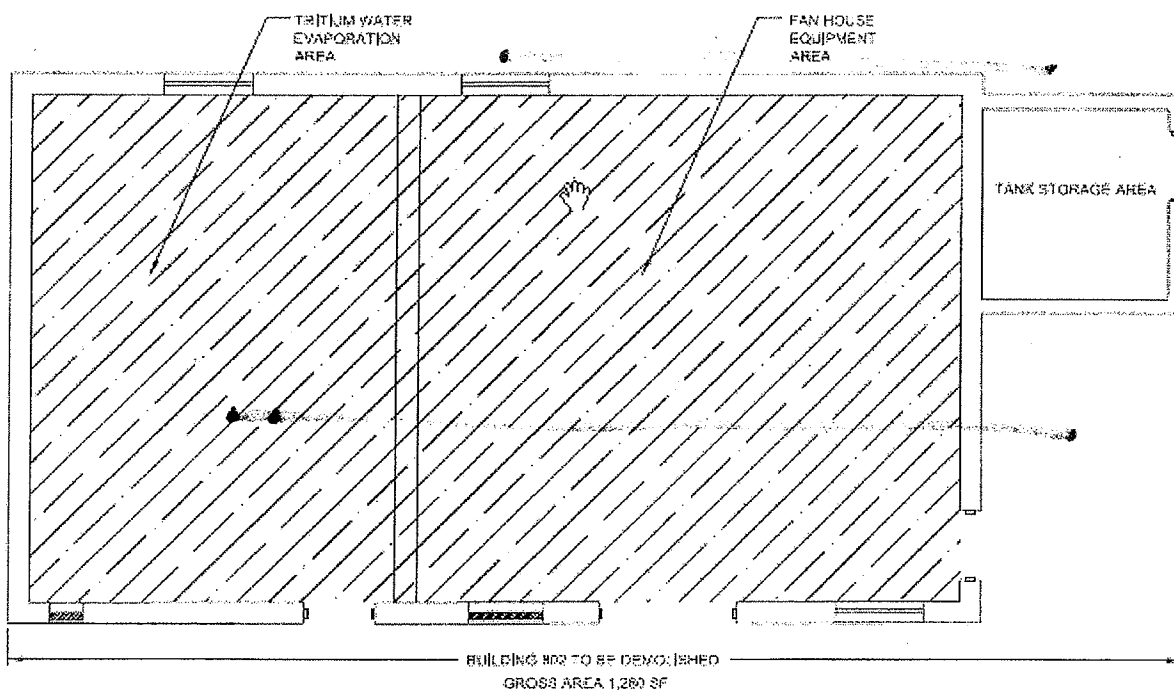
The Physical sample results (walls/floor/roof composites) satisfy the requirements found in Table 1-4 of the BNL OU1 and Radiologically Contaminated Soils FS, Final Report March 31, 1999 and the requirements of FS-SOP-1005, "Radiological Surveys required for Release of Materials from Areas Controlled for Radiological Purposes".

Attachments

- A. Building 802 Floor Plan
- B. Table 2-2, *Surface Contamination Values*; BNL Radiological Control Manual
- C. GEL Laboratories results and onsite HPGE results
- D. Radiological Survey Forms

BROOKHAVEN NATIONAL LABORATORY	<i>Environmental Restoration Projects</i>	603-35	Rev. 0
	WORK PROCEDURE	Page 7 of 7	
Bldg 802 Radiological Release Survey			

ATTACHMENT 1
BLDG 802 FLOOR PLAN



BUILDING 802

SCALE: 1" = 80'
 0 60 120



ATTACHMENT B – TABLE 2-2, SURFACE CONTAMINATION VALUES; BNL RADIOLOGICAL CONTROL MANUAL

The data presented here are to be used in identifying and posting contamination and high contamination areas in accordance with 10CFR835.603(e) and (f) and identifying the need for surface contamination monitoring and control in accordance with 10CFR835.1101 and 10CFR835.1102.

Surface Contamination Values¹ in dpm/100 cm²

Radionuclide	Removable ^{2,4}	Total (Fixed + Removable) ^{2,3}
U-natural, U-235, U-238 and associated decay products	⁷ 1,000	⁷ 5,000
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above ⁵	1,000 beta-gamma	5,000 beta-gamma
Tritium and STCs ⁶	10,000	See Footnote 6

¹ The values in this appendix, with the exception noted in footnote 6 below, apply to radioactive contamination deposited on, but not incorporated into the interior or matrix of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides apply independently.

² As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

³ The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm² is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if: (1) from measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm² area exceeds three times the applicable value.

⁴ The amount of removable radioactive material per 100 cm² of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency.

(**Note:** The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area shall be based on the actual area and the entire surface shall be wiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

⁵ This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

⁶ Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore, a "Total" value does not apply. In certain cases, a "Total" value of 10,000 dpm/ 100 cm^2 may be applicable either to metals of the types from which insoluble special tritium compounds (STCs) are formed, that have been exposed to tritium, or to bulk materials to which insoluble special tritium compound particles are fixed to a surface.

⁷ These limits apply only to the alpha emitters within the respective decay series.

Requires EDD ☒

SAMPLING CHAIN OF CUSTODY

Analyst Requested By:		Sampling Contractor:		Analytical Laboratory:	
Name: MIKE HOLLANDER		Name: KANT HECKMAN		Name: GBL	
Life No: N6455 Ext. 4839		Contact: ERP		Address: 2040 SAVAGE Rd	
Acct. No: 65070/65073 Dept: ERP		Phone: 303 585 0134		City: CHARLOTTE SC Zip: 29407	
Email Reports To:		Email/Fax:		Contact: HEATHER SHAFER	
1 holland.m@bnl.gov		Sampler: SAME		Phone:	
2 LOCKWOOD@bnl.gov				Email/Fax:	
Project Name: HEBERFANWISER O&D		Project Manager: ANDY LOCKWOOD		Field Engineer: KANT HECKMAN	

Comments:

Sample Information								Additional Sample Information													
UID	Seq	Col	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Mark	Name/Description	Cont. Vol/Units	Cont. Type	# of Cont.	Preservative	Alpha/Beta	Tritium	Gamma	Strontium	524.2	624	Nuclides	PCBs	Metals
001	EC	BNL	705/N6455	8'	3/1/11	1415	S	STACK VAULT FLOOR COMPOSITE	500m	P	1	NONE	✓	✓	✓				✓		
002	EG	BNL	802/N6455	0'	2/24/11	1610	R	BLOC. 802 H3 RM PAD (REMEDIAED)	500m	P	1	NONE	✓	✓	✓				✓		
003	EC	BNL	802/N6455	0'	10/9/10	1330	R	BLOC. 802 ROOF MAT'L COMPOSITE	500m	P	1	NONE	✓	✓	✓	✓					
004	EC	BNL	802/N6455	0'	3/4/11	0930	R	" " OUTSIDE WALLS COMPOSITE	500m	P	1	NONE	✓	✓	✓				✓		
005	EC	BNL	802/N6455	0'	2/24/11	1610	R	" " TANK RM FLOOR COMPOSITE	500m	P	1	NONE	✓	✓	✓				✓		
006	EC	BNL	802/N6455	0'	3/4/11	1340	R	" " " " WALLS COMPOSITE	500m	P	1	NONE	✓	✓	✓				✓		
007	EC	BNL	802/N6455	0'	3/4/11	1440	R	" " PAN ROOM FLOOR COMPOSITE	500m	P	1	NONE	✓	✓	✓				✓	✓	
008	EC	BNL	802/N6455	0'	3/4/11	1420	R	" " PAN ROOM WALL COMPOSITE	500m	P	1	NONE	✓	✓	✓				✓	✓	

1 Relinquished By/Date/Time		2 Relinquished By/Date/Time		3 Relinquished By/Date/Time	
Print MIKE HOLLANDER 3/8/11 0815		Print R. MEDO 3/8/11 1130		Print	
Signature [Signature]		Signature [Signature]		Signature	
1 Received By/Date/Time		2 Received By/Date/Time		3 Received By/Date/Time	
Print R. MEDO 3/8/11 0816		Print Mike Kasper 3-9-11		Print	
Signature [Signature]		Signature [Signature]		Signature	

Contractor Lab Sample Disposal:	
☐ Return To Client	☒ Disposal by Lab
☐ Archive For _____ Months	
Data Package: ☐ Full ☒ Summary	
Turn-Around Time Required:	
☐ Rush (1 Day)	☐ 14 Days ☐ 30 Days
☒ 7 Days	☐ Other ()



Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: <u>BKLL</u>		SDG/AR/COC/Work Order: <u>31309</u>	
Received By: <u>MF</u>		Date Received: <u>3-9-11</u>	
Suspected Hazard Information	Yes	No	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.
COC/Samples marked as radioactive?		☒	Maximum Counts Observed*: <u>4m20</u>
Classified Radioactive II or III by RSO?		☒	
COC/Samples marked containing PCBs?		☒	
Shipped as a DOT Hazardous?		☒	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		☒	

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	☒			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?	☒			2c Preservation Method: <u>Ice bags</u> Blue ice Dry ice None Other (describe)
2a	Daily check performed and passed on IR temperature gun?	☒			Temperature Device Serial #: <u>4150182</u> Secondary Temperature Device Serial # (If Applicable):
3	Chain of custody documents included with shipment?	☒			
4	Sample containers intact and sealed?	☒			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5	Samples requiring chemical preservation at proper pH?		☒		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		☒		Sample ID's and containers affected:
7	Are Encore containers present?			☒	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	☒			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	☒			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?			☒	Sample ID's affected: <u>SAMPLE 005 - TIME = 1610 ON CHAIN / 1600 ON SAMPLE</u>
11	Number of containers received match number indicated on COC?	☒			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	☒			
13	Carrier and tracking number.	☒			Circle Applicable: <u>FedEx Air</u> FedEx Ground UPS Field Services Courier Other <u>9800 5396 7434</u>

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials

(N)

Date

3.9.11

Page

1 of 1

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID:	31309-001	Project:	BRKL00608
Sample ID:	273656001	Client ID:	BRKL006
Matrix:	S	COC:	31309
Collect Date:	01-MAR-11 14:15	Samp Recv.:	
Receive Date:	09-MAR-11 09:35	Client Desc.:	BNL/705/N6455
Collector:	Client	Vol. Recv.:	

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Am241 Solid "Dry Weight Corrected"												
Americium-241	U	0.00772	+/-0.0243	0.0372	1.00	pCi/g		JXH2	03/11/11	2138	1081753	1
Alphaspec Pu, Solid "Dry Weight Corrected"												
Plutonium-239/240	U	0.000435	+/-0.0237	0.0717	1.00	pCi/g		JXH2	03/11/11	2140	1081754	2
Alphaspec U, Solid "Dry Weight Corrected"												
Uranium-235/236	U	0.00	+/-0.168	0.257	0.900	pCi/g		JXH2	03/13/11	1408	1081755	3
Uranium-238	J	0.347	+/-0.304	0.208	0.900	pCi/g						
Liquid Scint Pu241, Solid "Dry Weight Corrected"												
Plutonium-241	U	0.250	+/-4.79	8.28	15.0	pCi/g		JXH2	03/16/11	0833	1081757	4
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Americium-241	U	0.0113	+/-0.0625	0.121	4.00	pCi/g		MXR1	03/16/11	0542	1081974	5
Beryllium-7	U	0.0689	+/-0.140	0.250	0.300	pCi/g						
Bismuth-214		0.257	+/-0.0742	0.0503	0.200	pCi/g						
Cesium-134	U	0.028	+/-0.0184	0.0356	0.040	pCi/g						
Cesium-137	J	0.184	+/-0.0332	0.0263	2.30	pCi/g						
Cobalt-57	U	0.00394	+/-0.0102	0.0188	0.020	pCi/g						
Cobalt-60	U	-0.00635	+/-0.0165	0.0265	0.300	pCi/g						
Europium-152	U	0.00894	+/-0.0435	0.0757	4.80	pCi/g						
Europium-154	U	-0.0339	+/-0.0448	0.0684	17.0	pCi/g						
Europium-155	U	0.0188	+/-0.0406	0.0762	0.300	pCi/g						
Lead-212		0.453	+/-0.0673	0.0422	0.100	pCi/g						
Lead-214		0.385	+/-0.0904	0.0566	0.100	pCi/g						
Manganese-54	U	-0.0045	+/-0.0163	0.0271	0.050	pCi/g						
Potassium-40		3.98	+/-0.614	0.221	0.180	pCi/g						
Sodium-22	U	-0.0124	+/-0.0157	0.024	0.050	pCi/g						
Thallium-208		0.132	+/-0.038	0.024	0.080	pCi/g						
Zinc-65	U	0.0198	+/-0.0375	0.0603	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	U	-0.328	+/-0.356	0.801	2.00	pCi/g		JXR1	03/17/11	1710	1081921	6
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	-95	+/-101	199	300	pCi/g		MYM1	03/13/11	0812	1081917	7

The following Prep Methods were performed

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-001
Sample ID: 273656001

Project: BRKL00608
Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRS1	03/09/11	1748	1081696

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	DOE EML HASL-300, Pu-11-RC Modified	
3	DOE EML HASL-300, U-02-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE HASL 300, 4.5.2.3/Ga-01-R	
6	EPA 905.0 Modified	
7	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Am241 Solid "Dry Weight Corrected"			92.1	(30%-110%)
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			106	(30%-110%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			104	(30%-110%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			106	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			95.3	(25%-125%)

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-002

Project: BRKL00608

Sample ID: 273656002

Client ID: BRKL006

Matrix: R

COC: 31309

Collect Date: 22-FEB-11 16:10

Samp Recv.:

Receive Date: 09-MAR-11 09:35

Client Desc.: BNL/802/N6455

Collector: Client

Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Am241 Solid "Dry Weight Corrected"												
Americium-241	U	-0.00943	+/-0.0207	0.0553	1.00	pCi/g		JXH2	03/11/11	2138	1081753	1
Alphaspec Pu, Solid "Dry Weight Corrected"												
Plutonium-239/240	U	-0.00238	+/-0.0265	0.0834	1.00	pCi/g		JXH2	03/11/11	2140	1081754	2
Alphaspec U, Solid "Dry Weight Corrected"												
Uranium-235/236	U	0.00	+/-0.198	0.302	0.900	pCi/g		JXH2	03/13/11	1408	1081755	3
Uranium-238	U	0.0816	+/-0.160	0.245	0.900	pCi/g						
Liquid Scint Pu241, Solid "Dry Weight Corrected"												
Plutonium-241	U	-3.08	+/-5.11	9.03	15.0	pCi/g		JXH2	03/16/11	0904	1081757	4
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Americium-241	U	0.014	+/-0.0337	0.056	4.00	pCi/g		MXR1	03/16/11	0542	1081974	5
Beryllium-7	U	-0.0173	+/-0.148	0.247	0.300	pCi/g						
Bismuth-214	J	0.166	+/-0.0542	0.0458	0.200	pCi/g						
Cesium-134	U	0.00662	+/-0.0152	0.0266	0.040	pCi/g						
Cesium-137	J	1.06	+/-0.103	0.0222	2.30	pCi/g						
Cobalt-57	U	0.00729	+/-0.00813	0.0146	0.020	pCi/g						
Cobalt-60	U	0.0307	+/-0.0166	0.0318	0.300	pCi/g						
Europium-152	U	0.0246	+/-0.0391	0.0648	4.80	pCi/g						
Europium-154	U	-0.0246	+/-0.0403	0.0639	17.0	pCi/g						
Europium-155	U	-0.000655	+/-0.0326	0.0573	0.300	pCi/g						
Lead-212		0.314	+/-0.0493	0.0341	0.100	pCi/g						
Lead-214		0.284	+/-0.0637	0.0489	0.100	pCi/g						
Manganese-54	U	0.00118	+/-0.0121	0.0205	0.050	pCi/g						
Potassium-40		4.05	+/-0.550	0.229	0.180	pCi/g						
Sodium-22	U	-0.00829	+/-0.0142	0.0225	0.050	pCi/g						
Thallium-208		0.0872	+/-0.0255	0.0209	0.080	pCi/g						
Zinc-65	U	-0.0149	+/-0.0318	0.0441	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	U	-0.039	+/-0.373	0.754	2.00	pCi/g		JXR1	03/17/11	1710	1081921	6
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	11.0	+/-115	207	300	pCi/g		MYM1	03/13/11	0828	1081917	7

The following Prep Methods were performed

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke

Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-002

Project: BRKL00608

Sample ID: 273656002

Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRSI	03/09/11	1748	1081696

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	DOE EML HASL-300, Pu-11-RC Modified	
3	DOE EML HASL-300, U-02-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE HASL 300, 4.5.2.3/Ga-01-R	
6	EPA 905.0 Modified	
7	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Am241 Solid "Dry Weight Corrected"			106	(30%-110%)
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			96.2	(30%-110%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			83.1	(30%-110%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			96.2	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			90.7	(25%-125%)

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-003

Project: BRKL00608

Sample ID: 273656003

Client ID: BRKL006

Matrix: R

COC: 31309

Collect Date: 19-OCT-10 13:30

Samp Recv.:

Receive Date: 09-MAR-11 09:35

Client Desc.: BNL/802/N6455

Collector: Client

Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Actinium-228		1.23	+/-0.188	0.0726	0.800	pCi/g						
Americium-241	U	-0.00236	+/-0.0481	0.0778	4.00	pCi/g						
Beryllium-7		4.18	+/-1.01	1.09	0.300	pCi/g						
Bismuth-212		1.29	+/-0.347	0.277	0.500	pCi/g						
Bismuth-214		1.65	+/-0.178	0.0393	0.200	pCi/g						
Cesium-134	UI	0.0555	+/-0.0321	0.0344	0.040	pCi/g						
Cesium-137	J	0.474	+/-0.0474	0.0203	2.30	pCi/g						
Cobalt-57	DL	0.00512	+/-0.0115	0.0215	0.020	pCi/g						
Cobalt-60	U	-0.00382	+/-0.0135	0.0221	0.300	pCi/g						
Europium-152	U	-0.0105	+/-0.0352	0.059	4.80	pCi/g						
Europium-154	U	0.0103	+/-0.0424	0.0656	17.0	pCi/g						
Europium-155	J-UI	0.0731	+/-0.0614	0.0633	0.300	pCi/g						
Lead-210		6.84	+/-2.11	1.50	4.00	pCi/g						
Lead-212		1.30	+/-0.144	0.0345	0.100	pCi/g						
Lead-214		2.14	+/-0.239	0.0425	0.100	pCi/g						
Manganese-54	J-UI	0.0352	+/-0.0213	0.0278	0.050	pCi/g						
Potassium-40		4.30	+/-0.552	0.198	0.180	pCi/g						
Sodium-22	U	0.0033	+/-0.0161	0.0248	0.050	pCi/g						
Thallium-208		0.375	+/-0.0457	0.0193	0.080	pCi/g						
Zinc-65	U	-0.0496	+/-0.0439	0.0579	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Gross A/B, solid "Dry Weight Corrected"												
Alpha		23.9	+/-5.55	3.92	4.00	pCi/g						
Beta		31.5	+/-4.55	5.32	10.0	pCi/g						
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	J	1.14	+/-0.441	0.630	2.00	pCi/g						
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	-15.5	+/-112	205	300	pCi/g						

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRS1	03/09/11	1748	1081696

The following Analytical Methods were performed

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke

Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-003

Project: BRKL00608

Sample ID: 273656003

Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE HASL 300, 4.5.2.3/Ga-01-R	
2	EPA 900.0/SW846 9310/SM 7110B Modified	
3	EPA 905.0 Modified	
4	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			98.8	(25%-125%)

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000
Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary
Client Sample ID: 31309-004
Sample ID: 273656004
Matrix: R
Collect Date: 04-MAR-11 09:30
Receive Date: 09-MAR-11 09:35
Collector: Client

Project: BRKL00608
Client ID: BRKL006
COC: 31309
Samp Recv.:
Client Desc.: BNL/802/N6455
Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Am241 Solid "Dry Weight Corrected"												
Americium-241	U	0.00445	+/-0.0242	0.0576	1.00	pCi/g		JXH2	03/13/11	1441	1081753	1
Alphaspec Pu, Solid "Dry Weight Corrected"												
Plutonium-239/240	U	-0.0168	+/-0.0312	0.0983	1.00	pCi/g		JXH2	03/11/11	2140	1081754	2
Alphaspec U, Solid "Dry Weight Corrected"												
Uranium-235/236	U	0.027	+/-0.205	0.590	0.900	pCi/g		JXH2	03/13/11	1408	1081755	3
Uranium-238		1.02	+/-0.577	0.515	0.900	pCi/g						
Liquid Scint Pu241, Solid "Dry Weight Corrected"												
Plutonium-241	U	-2.68	+/-5.60	9.85	15.0	pCi/g		JXH2	03/16/11	0936	1081757	4
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Actinium-228		1.48	+/-0.238	0.0837	0.800	pCi/g		MXR1	03/16/11	0543	1081974	5
Americium-241	U	0.0517	+/-0.0617	0.106	4.00	pCi/g						
Beryllium-7	U	0.170	+/-0.130	0.195	0.300	pCi/g						
Bismuth-212		1.71	+/-0.373	0.298	0.500	pCi/g						
Bismuth-214		1.26	+/-0.141	0.0429	0.200	pCi/g						
Cesium-134	UI	0.0885	+/-0.0274	0.0359	0.040	pCi/g						
Cesium-137	J	0.0542	+/-0.0212	0.0243	2.30	pCi/g						
Cobalt-57	U	-0.00827	+/-0.00903	0.0159	0.020	pCi/g						
Cobalt-60	U	-3.35E-05	+/-0.0134	0.0227	0.300	pCi/g						
Europium-152	U	0.00186	+/-0.0376	0.0617	4.80	pCi/g						
Europium-154	U	-0.0309	+/-0.0378	0.0612	17.0	pCi/g						
Europium-155	J-UI	0.139	+/-0.0736	0.0649	0.300	pCi/g						
Lead-212		1.75	+/-0.178	0.036	0.100	pCi/g						
Lead-214		1.56	+/-0.182	0.0457	0.100	pCi/g						
Manganese-54	U	-0.0064	+/-0.0136	0.0228	0.050	pCi/g						
Potassium-40		10.5	+/-1.17	0.193	0.180	pCi/g						
Sodium-22	U	-0.0109	+/-0.0133	0.0216	0.050	pCi/g						
Thallium-208		0.505	+/-0.0581	0.0213	0.080	pCi/g						
Zinc-65	U	-0.0314	+/-0.0344	0.0481	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	U	-0.155	+/-0.371	0.776	2.00	pCi/g		JXR1	03/17/11	1710	1081921	6
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	33.4	+/-106	187	300	pCi/g		MYM1	03/13/11	0901	1081917	7

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-004

Sample ID: 273656004

Project: BRKL00608

Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRS1	03/09/11	1748	1081696

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	DOE EML HASL-300, Pu-11-RC Modified	
3	DOE EML HASL-300, U-02-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE HASL 300, 4.5.2.3/Ga-01-R	
6	EPA 905.0 Modified	
7	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Am241 Solid "Dry Weight Corrected"			93.7	(30%-110%)
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			89.3	(30%-110%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			87.2	(30%-110%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			89.3	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			96.5	(25%-125%)

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke

Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-005

Sample ID: 273656005

Matrix: R

Collect Date: 22-FEB-11 16:00

Receive Date: 09-MAR-11 09:35

Collector: Client

Project: BRKL00608

Client ID: BRKL006

COC: 31309

Samp Recv.:

Client Desc.: BNL/802/N6455

Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Am241 Solid "Dry Weight Corrected"												
Americium-241	U	-0.00423	+/-0.0234	0.071	1.00	pCi/g		JXH2	03/11/11	2138	1081753	1
Alphaspec Pu, Solid "Dry Weight Corrected"												
Plutonium-239/240	U	0.0099	+/-0.0367	0.0868	1.00	pCi/g		JXH2	03/13/11	1441	1081754	2
Alphaspec U, Solid "Dry Weight Corrected"												
Uranium-235/236	U	0.202	+/-0.281	0.304	0.900	pCi/g		JXH2	03/13/11	1408	1081755	3
Uranium-238	J	0.472	+/-0.395	0.393	0.900	pCi/g						
Liquid Scint Pu241, Solid "Dry Weight Corrected"												
Plutonium-241	U	-3.11	+/-5.31	9.37	15.0	pCi/g		JXH2	03/16/11	1008	1081757	4
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Actinium-228	J	0.467	+/-0.0996	0.079	0.800	pCi/g		MXR1	03/16/11	0544	1081974	5
Americium-241	U	0.00917	+/-0.0403	0.0638	4.00	pCi/g						
Beryllium-7	U	-0.0895	+/-0.125	0.206	0.300	pCi/g						
Bismuth-214		0.328	+/-0.0568	0.0432	0.200	pCi/g						
Cesium-134	U	0.00951	+/-0.0149	0.0269	0.040	pCi/g						
Cesium-137	J	0.356	+/-0.0441	0.0218	2.30	pCi/g						
Cobalt-57	U	0.00248	+/-0.0083	0.0146	0.020	pCi/g						
Cobalt-60	J	0.0667	+/-0.0276	0.0205	0.300	pCi/g						
Europium-152	U	-0.00515	+/-0.0397	0.0598	4.80	pCi/g						
Europium-154	U	-0.01	+/-0.0383	0.063	17.0	pCi/g						
Europium-155	U	0.0169	+/-0.0323	0.0574	0.300	pCi/g						
Lead-212		0.415	+/-0.0541	0.0317	0.100	pCi/g						
Lead-214		0.371	+/-0.0627	0.0428	0.100	pCi/g						
Manganese-54	U	0.00593	+/-0.0117	0.0209	0.050	pCi/g						
Potassium-40		3.71	+/-0.504	0.199	0.180	pCi/g						
Sodium-22	U	-0.00343	+/-0.0136	0.0224	0.050	pCi/g						
Thallium-208		0.121	+/-0.0248	0.0193	0.080	pCi/g						
Zinc-65	U	-0.014	+/-0.0297	0.0409	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	U	0.0717	+/-0.429	0.821	2.00	pCi/g		JXR1	03/17/11	1710	1081921	6
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	0.00	+/-105	190	300	pCi/g		MYM1	03/13/11	0917	1081917	7

GEL LABORATORIES LLC

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Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-005
Sample ID: 273656005

Project: BRKL00608
Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRS1	03/09/11	1748	1081696

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	DOE EML HASL-300, Pu-11-RC Modified	
3	DOE EML HASL-300, U-02-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE HASL 300, 4.5.2.3/Ga-01-R	
6	EPA 905.0 Modified	
7	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Am241 Solid "Dry Weight Corrected"			99.6	(30%-110%)
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			92.4	(30%-110%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			92.1	(30%-110%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			92.4	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			87.2	(25%-125%)

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Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-006

Project: BRKL00608

Sample ID: 273656006

Client ID: BRKL006

Matrix: R

COC: 31309

Collect Date: 04-MAR-11 13:40

Samp Recv.:

Receive Date: 09-MAR-11 09:35

Client Desc.: BNL/802/N6455

Collector: Client

Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Am241 Solid "Dry Weight Corrected"												
Americium-241	U	-0.00985	+/-0.0224	0.0601	1.00	pCi/g		JXH2	03/11/11	2138	1081753	1
Alphaspec Pu, Solid "Dry Weight Corrected"												
Plutonium-239/240	U	0.00337	+/-0.032	0.0815	1.00	pCi/g		JXH2	03/11/11	2140	1081754	2
Alphaspec U, Solid "Dry Weight Corrected"												
Uranium-235/236	U	0.267	+/-0.332	0.464	0.900	pCi/g		JXH2	03/13/11	1408	1081755	3
Uranium-238	U	0.235	+/-0.266	0.235	0.900	pCi/g						
Liquid Scint Pu241, Solid "Dry Weight Corrected"												
Plutonium-241	U	-1.6	+/-5.06	8.86	15.0	pCi/g		JXH2	03/16/11	1039	1081757	4
Rad Gamma Spec Analysis												
Gammascpec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Actinium-228	J	0.571	+/-0.124	0.0727	0.800	pCi/g		MXR1	03/16/11	1136	1081974	5
Americium-241	U	0.00768	+/-0.0176	0.0287	4.00	pCi/g						
Beryllium-7	U	-0.112	+/-0.0956	0.156	0.300	pCi/g						
Bismuth-214		0.472	+/-0.0792	0.0382	0.200	pCi/g						
Cesium-134	U	0.0206	+/-0.0158	0.0293	0.040	pCi/g						
Cesium-137	J	0.0495	+/-0.0239	0.0234	2.30	pCi/g						
Cobalt-57	U	-0.00245	+/-0.006	0.0109	0.020	pCi/g						
Cobalt-60	U	-0.00398	+/-0.0124	0.0208	0.300	pCi/g						
Europium-152	U	-0.00659	+/-0.0292	0.0503	4.80	pCi/g						
Europium-154	U	-0.00175	+/-0.0374	0.0646	17.0	pCi/g						
Europium-155	U	0.0275	+/-0.0241	0.0457	0.300	pCi/g						
Lead-212		0.585	+/-0.0703	0.0272	0.100	pCi/g						
Lead-214		0.568	+/-0.0882	0.0364	0.100	pCi/g						
Manganese-54	U	0.0108	+/-0.0118	0.0215	0.050	pCi/g						
Potassium-40		6.15	+/-0.681	0.175	0.180	pCi/g						
Sodium-22	U	0.00172	+/-0.013	0.0227	0.050	pCi/g						
Thallium-208		0.171	+/-0.0362	0.0192	0.080	pCi/g						
Zinc-65	U	-0.0101	+/-0.0333	0.0468	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	U	0.404	+/-0.433	0.720	2.00	pCi/g		JXR1	03/17/11	1710	1081921	6
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	-14.4	+/-103	190	300	pCi/g		MYM1	03/13/11	0933	1081917	7

GEL LABORATORIES LLC

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Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-006
Sample ID: 273656006

Project: BRKL00608
Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRS1	03/09/11	1748	1081696

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	DOE EML HASL-300, Pu-11-RC Modified	
3	DOE EML HASL-300, U-02-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE HASL 300, 4.5.2.3/Ga-01-R	
6	EPA 905.0 Modified	
7	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Am241 Solid "Dry Weight Corrected"			99.6	(30%-110%)
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			98.1	(30%-110%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			86.7	(30%-110%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			98.1	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			100	(25%-125%)

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-007

Sample ID: 273656007

Matrix: R

Collect Date: 04-MAR-11 14:40

Receive Date: 09-MAR-11 09:35

Collector: Client

Project: BRKL00608

Client ID: BRKL006

COC: 31309

Samp Recv.:

Client Desc.: BNL/802/N6455

Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Am241 Solid "Dry Weight Corrected"												
Americium-241	U	-0.00415	+/-0.0272	0.0824	1.00	pCi/g		JXH2	03/11/11	2138	1081753	1
Alphaspec Pu, Solid "Dry Weight Corrected"												
Plutonium-239/240	U	0.00308	+/-0.0234	0.0672	1.00	pCi/g		JXH2	03/11/11	2140	1081754	2
Alphaspec U, Solid "Dry Weight Corrected"												
Uranium-235/236	U	-0.0439	+/-0.189	0.506	0.900	pCi/g		JXH2	03/13/11	1408	1081755	3
Uranium-238	J	0.426	+/-0.357	0.354	0.900	pCi/g						
Liquid Scint Pu241, Solid "Dry Weight Corrected"												
Plutonium-241	U	0.540	+/-5.18	8.94	15.0	pCi/g		JXH2	03/16/11	1111	1081757	4
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Americium-241	U	0.0323	+/-0.0759	0.140	4.00	pCi/g		MXR1	03/16/11	1219	1081974	5
Beryllium-7	DL	0.0728	+/-0.195	0.335	0.300	pCi/g						
Cesium-134	DL	0.00549	+/-0.0235	0.0407	0.040	pCi/g						
Cesium-137	J	0.287	+/-0.0554	0.033	2.30	pCi/g						
Cobalt-57	DL	0.0109	+/-0.0124	0.0225	0.020	pCi/g						
Cobalt-60	J	0.0672	+/-0.0314	0.0408	0.300	pCi/g						
Europium-152	U	0.00414	+/-0.0633	0.0957	4.80	pCi/g						
Europium-154	U	-0.0225	+/-0.056	0.0872	17.0	pCi/g						
Europium-155	U	0.00848	+/-0.0516	0.0907	0.300	pCi/g						
Manganese-54	U	0.00921	+/-0.0194	0.0343	0.050	pCi/g						
Potassium-40		2.60	+/-0.572	0.321	0.180	pCi/g						
Sodium-22	U	-0.00862	+/-0.0196	0.0303	0.050	pCi/g						
Zinc-65	U	0.0233	+/-0.0517	0.0821	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	U	-0.535	+/-0.363	0.865	2.00	pCi/g		JXR1	03/17/11	1711	1081921	6
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	34.4	+/-110	194	300	pCi/g		MYM1	03/13/11	0950	1081917	7

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRS1	03/09/11	1748	1081696

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000
Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-007
Sample ID: 273656007

Project: BRKL00608
Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	DOE EML HASL-300, Pu-11-RC Modified	
3	DOE EML HASL-300, U-02-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE HASL 300, 4.5.2.3/Ga-01-R	
6	EPA 905.0 Modified	
7	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Am241 Solid "Dry Weight Corrected"			84.9	(30%-110%)
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			96.9	(30%-110%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			99.7	(30%-110%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			96.9	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			93.0	(25%-125%)

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke

Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-008

Sample ID: 273656008

Matrix: R

Collect Date: 04-MAR-11 14:20

Receive Date: 09-MAR-11 09:35

Collector: Client

Project: BRKL00608

Client ID: BRKL006

COC: 31309

Samp Recv.:

Client Desc.: BNL/802/N6455

Vol. Recv.:

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec Analysis												
Alphaspec Am241 Solid "Dry Weight Corrected"												
Americium-241	U	-0.0127	+/-0.0235	0.0675	1.00	pCi/g		JXH2	03/11/11	2138	1081753	1
Alphaspec Pu, Solid "Dry Weight Corrected"												
Plutonium-239/240	U	0.019	+/-0.0304	0.0518	1.00	pCi/g		JXH2	03/11/11	2140	1081754	2
Alphaspec U, Solid "Dry Weight Corrected"												
Uranium-235/236	U	0.0909	+/-0.178	0.273	0.900	pCi/g		JXH2	03/13/11	1408	1081755	3
Uranium-238	U	0.406	+/-0.356	0.407	0.900	pCi/g						
Liquid Scint Pu241, Solid "Dry Weight Corrected"												
Plutonium-241	U	-1.07	+/-5.06	8.82	15.0	pCi/g		JXH2	03/16/11	1143	1081757	4
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Solid (Long List) Remediation "Dry Weight Corrected"												
Actinium-228	J	0.442	+/-0.138	0.0876	0.800	pCi/g		MXR1	03/16/11	1219	1081974	5
Americium-241	U	0.0241	+/-0.0486	0.0826	4.00	pCi/g						
Beryllium-7	U	0.00365	+/-0.118	0.210	0.300	pCi/g						
Bismuth-214		0.279	+/-0.0699	0.0481	0.200	pCi/g						
Cesium-134	J-UI	0.0395	+/-0.0188	0.0376	0.040	pCi/g						
Cesium-137	U	0.0275	+/-0.0196	0.0277	2.30	pCi/g						
Cobalt-57	U	-0.00122	+/-0.00827	0.0154	0.020	pCi/g						
Cobalt-60	U	-0.00129	+/-0.0162	0.0267	0.300	pCi/g						
Europium-152	U	0.0252	+/-0.039	0.0634	4.80	pCi/g						
Europium-154	U	-0.00912	+/-0.0469	0.0766	17.0	pCi/g						
Europium-155	U	0.0357	+/-0.0346	0.0685	0.300	pCi/g						
Lead-212		0.386	+/-0.0608	0.0343	0.100	pCi/g						
Lead-214		0.264	+/-0.0719	0.0474	0.100	pCi/g						
Manganese-54	U	0.0091	+/-0.0149	0.0277	0.050	pCi/g						
Potassium-40		7.39	+/-0.954	0.249	0.180	pCi/g						
Sodium-22	U	-0.000817	+/-0.0162	0.027	0.050	pCi/g						
Thallium-208		0.105	+/-0.031	0.0241	0.080	pCi/g						
Zinc-65	U	-0.00875	+/-0.0422	0.0604	0.500	pCi/g						
Rad Gas Flow Proportional Counting												
GFPC, Sr90, solid "Dry Weight Corrected"												
Strontium-90	U	-0.00275	+/-0.450	0.852	2.00	pCi/g		JXR1	03/17/11	1753	1081921	6
Rad Liquid Scintillation Analysis												
LSC, Tritium Dist, Solid "As Received"												
Tritium	U	9.38	+/-98.3	177	300	pCi/g		MYM1	03/13/11	1006	1081917	7

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000
Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary
Client Sample ID: 31309-008
Sample ID: 273656008

Project: BRKL00608
Client ID: BRKL006

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	DRS1	03/09/11	1748	1081696

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL-300, Am-05-RC Modified	
2	DOE EML HASL-300, Pu-11-RC Modified	
3	DOE EML HASL-300, U-02-RC Modified	
4	DOE EML HASL-300, Pu-11-RC Modified	
5	DOE HASL 300, 4.5.2.3/Ga-01-R	
6	EPA 905.0 Modified	
7	EPA 906.0 Modified	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Americium-243 Tracer	Alphaspec Am241 Solid "Dry Weight Corrected"			98.5	(30%-110%)
Plutonium-242 Tracer	Alphaspec Pu, Solid "Dry Weight Corrected"			100	(30%-110%)
Uranium-232 Tracer	Alphaspec U, Solid "Dry Weight Corrected"			96.3	(30%-110%)
Plutonium-242 Tracer	Liquid Scint Pu241, Solid "Dry Weight Corrected"			100	(15%-125%)
Strontium Carrier	GFPC, Sr90, solid "Dry Weight Corrected"			98.8	(25%-125%)

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QC Summary

Report Date: March 23, 2011
Page 1 of 7

Brookhaven National Laboratory
Building 462
Upton, New York
Contact: Mr. John Burke

Workorder: 273656

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Alpha Spec											
Batch	1081753										
QC1202344820	273656001	DUP									
Americium-241	U	0.00772	U	-0.00742	pCi/g	0.00			N/A	JXH2	03/13/11 14:41
	Uncertainty	+/-0.0243		+/-0.0231							
QC1202344822	LCS										
Americium-241	2.79			2.20	pCi/g		78.6	(75%-125%)			03/11/11 21:38
	Uncertainty			+/-0.297							
QC1202344819	MB										
Americium-241			U	-0.0103	pCi/g						03/11/11 21:38
	Uncertainty			+/-0.0243							
QC1202344821	273656001	MS									
Americium-241	2.81	U	0.00772	2.36	pCi/g		84	(75%-125%)			03/11/11 21:38
	Uncertainty	+/-0.0243		+/-0.318							
Batch	1081754										
QC1202344824	273656001	DUP									
Plutonium-238	U	-0.0126	U	0.00861	pCi/g	0.00			N/A	JXH2	03/11/11 21:40
	Uncertainty	+/-0.0263		+/-0.0228							
Plutonium-239/240	U	0.000435	U	-0.00227	pCi/g	0.00			N/A		
	Uncertainty	+/-0.0237		+/-0.0252							
QC1202344826	LCS										
Plutonium-238			U	-0.00569	pCi/g						03/13/11 14:41
	Uncertainty			+/-0.0246							
Plutonium-239/240	4.00			3.89	pCi/g		97.3	(75%-125%)			
	Uncertainty			+/-0.422							
QC1202344823	MB										
Plutonium-238			U	0.0172	pCi/g						03/11/11 21:40
	Uncertainty			+/-0.0394							
Plutonium-239/240			U	0.00572	pCi/g						
	Uncertainty			+/-0.0228							
QC1202344825	273656001	MS									
Plutonium-238	U	-0.0126	U	0.0217	pCi/g						03/11/11 21:40
	Uncertainty	+/-0.0263		+/-0.0347							
Plutonium-239/240	4.03	U	0.000435	3.80	pCi/g		94.3	(75%-125%)			
	Uncertainty	+/-0.0237		+/-0.425							
Batch	1081755										
QC1202344828	273656001	DUP									
Uranium-235/236	U	0.00	U	0.108	pCi/g	0.00			N/A	JXH2	03/13/11 14:08
	Uncertainty	+/-0.168		+/-0.212							
Uranium-238	J	0.347	U	0.262	pCi/g	27.9		(0% - 100%)			
	Uncertainty	+/-0.304		+/-0.297							
QC1202344830	LCS										
Uranium-235/236				1.53	pCi/g						03/13/11 14:08
	Uncertainty			+/-0.697							
Uranium-238	24.0			19.2	pCi/g		80	(75%-125%)			

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Workorder: 273656

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Alpha Spec											
Batch	1081755										
		Uncertainty									
				+/-2.20							
QC1202344827	MB										
Uranium-235/236			U	0.00	pCi/g				JXH2	03/13/11	14:08
		Uncertainty		+/-0.174							
Uranium-238			U	0.0575	pCi/g						
		Uncertainty		+/-0.213							
QC1202344829	273656001	MS									
Uranium-235/236		U	0.00	1.63	pCi/g					03/13/11	14:08
		Uncertainty	+/-0.168	+/-0.785							
Uranium-238		25.6	J	0.347	27.0	pCi/g		104	(75%-125%)		
		Uncertainty	+/-0.304	+/-2.85							
Batch	1081757										
QC1202344832	273656001	DUP									
Plutonium-241		U	0.250	U	-2.02	pCi/g	0.00		N/A	JXH2	03/16/11 14:53
		Uncertainty	+/-4.79		+/-5.23						
QC1202344834	LCS										
Plutonium-241		132		129	pCi/g		97.6	(75%-125%)			03/16/11 15:57
		Uncertainty		+/-9.33							
QC1202344831	MB										
Plutonium-241			U	-3.75	pCi/g						03/16/11 14:22
		Uncertainty		+/-4.90							
QC1202344833	273656001	MS									
Plutonium-241		133	U	0.250	142	pCi/g		108	(75%-125%)		03/16/11 15:25
		Uncertainty	+/-4.79		+/-9.94						
Rad Gamma Spec											
Batch	1081974										
QC1202345339	273656001	DUP									
Actinium-228		J	0.316	J	0.435	pCi/g	2.68	(0% - 20%)	MXR1	03/16/11	14:59
		Uncertainty	+/-0.138		+/-0.115						
Americium-241		U	0.0113	U	0.0126	pCi/g	0.00		N/A		
		Uncertainty	+/-0.0625		+/-0.0415						
Beryllium-7		U	0.0689	U	0.154	pCi/g	0.00		N/A		
		Uncertainty	+/-0.140		+/-0.193						
Bismuth-212		J	0.497	UI	0.806	pCi/g	22.7	(0% - 100%)			
		Uncertainty	+/-0.310		+/-0.309						
Bismuth-214			0.257		0.325	pCi/g	25.9*	(0% - 20%)			
		Uncertainty	+/-0.0742		+/-0.0721						
Cesium-134		U	0.028	U	0.00937	pCi/g	0.00		N/A		
		Uncertainty	+/-0.0184		+/-0.0149						
Cesium-137		J	0.184	J	0.165	pCi/g	8.57	(0% - 20%)			
		Uncertainty	+/-0.0332		+/-0.0395						
Cobalt-57		U	0.00394	U	0.00189	pCi/g	0.00		N/A		
		Uncertainty	+/-0.0102		+/-0.00821						
Cobalt-60		U	-0.00635	U	0.00815	pCi/g	0.00		N/A		
		Uncertainty	+/-0.0165		+/-0.0159						

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QC Summary

Workorder: 273656

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gamma Spec											
Batch	1081974										
Europium-152	U	0.00894	U	-0.0146	pCi/g	0.00		N/A			
	Uncertainty	+/-0.0435		+/-0.0357							
Europium-154	U	-0.0339	U	-9.21E-05	pCi/g	0.00		N/A MXR1		03/16/11	14:59
	Uncertainty	+/-0.0448		+/-0.0351							
Europium-155	U	0.0188	U	0.0195	pCi/g	0.00		N/A			
	Uncertainty	+/-0.0406		+/-0.0351							
Lead-210	U	-0.777	J	1.55	pCi/g	107*		(0% - 100%)			
	Uncertainty	+/-1.98		+/-1.71							
Lead-212		0.453		0.460	pCi/g	8.48		(0% - 20%)			
	Uncertainty	+/-0.0673		+/-0.0615							
Lead-214		0.385		0.382	pCi/g	0.393		(0% - 20%)			
	Uncertainty	+/-0.0904		+/-0.0722							
Manganese-54	U	-0.0045	U	0.00415	pCi/g	0.00		N/A			
	Uncertainty	+/-0.0163		+/-0.013							
Potassium-40		3.98		4.24	pCi/g	9.92		(0% - 20%)			
	Uncertainty	+/-0.614		+/-0.603							
Sodium-22	U	-0.0124	U	-0.00259	pCi/g	0.00		N/A			
	Uncertainty	+/-0.0157		+/-0.0127							
Thallium-208		0.132		0.131	pCi/g	10.8		(0% - 20%)			
	Uncertainty	+/-0.038		+/-0.0282							
Zinc-65	U	0.0198	U	-0.0147	pCi/g	0.00		N/A			
	Uncertainty	+/-0.0375		+/-0.0332							
QC1202345340 LCS											
Actinium-228				2.17	pCi/g					03/16/11	22:03
	Uncertainty			+/-0.509							
Americium-241	16.3			19.8	pCi/g		122	(75%-125%)			
	Uncertainty			+/-1.86							
Beryllium-7			DL	-0.265	pCi/g						
	Uncertainty			+/-0.468							
Bismuth-212			DL	1.33	pCi/g						
	Uncertainty			+/-0.839							
Bismuth-214				0.987	pCi/g						
	Uncertainty			+/-0.237							
Cesium-134			DL	0.0778	pCi/g						
	Uncertainty			+/-0.0736							
Cesium-137	5.56			6.48	pCi/g		117	(75%-125%)			
	Uncertainty			+/-0.697							
Cobalt-57				0.0947	pCi/g						
	Uncertainty			+/-0.0486							
Cobalt-60	5.68			5.94	pCi/g		105	(75%-125%)			
	Uncertainty			+/-0.558							
Europium-152			U	-0.0884	pCi/g						
	Uncertainty			+/-0.155							
Europium-154			U	0.00387	pCi/g						
	Uncertainty			+/-0.110							

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QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gamma Spec											
Batch	1081974										
Europium-155			U	0.126	pCi/g						
	Uncertainty			+/-0.0969							
Lead-210			U	0.592	pCi/g				MXR1	03/16/11	22:03
	Uncertainty			+/-0.877							
Lead-212				1.88	pCi/g						
	Uncertainty			+/-0.262							
Lead-214				1.53	pCi/g						
	Uncertainty			+/-0.271							
Manganese-54			DL	0.0226	pCi/g						
	Uncertainty			+/-0.0614							
Potassium-40				0.744	pCi/g						
	Uncertainty			+/-0.561							
Sodium-22			DL	0.000455	pCi/g						
	Uncertainty			+/-0.0387							
Thallium-208				0.409	pCi/g						
	Uncertainty			+/-0.119							
Zinc-65			U	-0.0153	pCi/g						
	Uncertainty			+/-0.165							
QC1202345338 MB											
Actinium-228			U	-0.0229	pCi/g					03/16/11	12:49
	Uncertainty			+/-0.0562							
Americium-241			U	0.0166	pCi/g						
	Uncertainty			+/-0.0612							
Beryllium-7			U	0.0261	pCi/g						
	Uncertainty			+/-0.123							
Bismuth-212			U	0.0558	pCi/g						
	Uncertainty			+/-0.205							
Bismuth-214			U	-0.00947	pCi/g						
	Uncertainty			+/-0.0378							
Cesium-134			U	0.000747	pCi/g						
	Uncertainty			+/-0.0165							
Cesium-137			U	-0.00294	pCi/g						
	Uncertainty			+/-0.0137							
Cobalt-57			U	-0.00138	pCi/g						
	Uncertainty			+/-0.00946							
Cobalt-60			U	0.00316	pCi/g						
	Uncertainty			+/-0.0153							
Europium-152			U	-0.0442	pCi/g						
	Uncertainty			+/-0.0389							
Europium-154			U	0.0133	pCi/g						
	Uncertainty			+/-0.0476							
Europium-155			U	0.000131	pCi/g						
	Uncertainty			+/-0.0411							
Lead-210			U	-1.68	pCi/g						
	Uncertainty			+/-1.64							

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QC Summary

Workorder: 273656

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gamma Spec											
Batch	1081974										
Lead-212			U	0.00475	pCi/g						
	Uncertainty			+/-0.0506							
Lead-214			U	0.00363	pCi/g				MXR1	03/16/11	12:49
	Uncertainty			+/-0.0368							
Manganese-54			U	-0.00648	pCi/g						
	Uncertainty			+/-0.0145							
Potassium-40			DL	-0.0635	pCi/g						
	Uncertainty			+/-0.182							
Sodium-22			U	0.0027	pCi/g						
	Uncertainty			+/-0.0169							
Thallium-208			U	-0.00188	pCi/g						
	Uncertainty			+/-0.0177							
Zinc-65			U	0.00284	pCi/g						
	Uncertainty			+/-0.0272							
Rad Gas Flow											
Batch	1081921										
QC1202345204	273661001	DUP									
Strontium-90			U	0.607	pCi/g	0.00			N/A	JXR1	03/18/11 08:50
	Uncertainty			+/-0.480							
QC1202345207	LCS										
Strontium-90				42.6	pCi/g		110	(75%-125%)			03/17/11 17:51
	Uncertainty										
QC1202345203	MB										
Strontium-90			U	-0.0674	pCi/g						03/17/11 17:53
	Uncertainty			+/-0.453							
QC1202345205	273661001	MS									
Strontium-90			U	46.4	pCi/g		106	(75%-125%)			03/17/11 17:52
	Uncertainty			+/-0.480							
QC1202345206	273661001	MSD									
Strontium-90			U	47.9	pCi/g	4.43	107	(0%-20%)			03/17/11 17:51
	Uncertainty			+/-0.480							
Batch	1084973										
QC1202352720	273656003	DUP									
Alpha				23.9	pCi/g	2.35		(0% - 20%)	VXC2	03/22/11	11:58
	Uncertainty			+/-5.55							
Beta				31.5	pCi/g	38.1*		(0% - 20%)			
	Uncertainty			+/-4.55							
QC1202352723	LCS										
Alpha				235	pCi/g		111	(75%-125%)			03/22/11 13:44
	Uncertainty										
Beta				891	pCi/g		105	(75%-125%)			
	Uncertainty										
QC1202352719	MB										
Alpha			U	1.20	pCi/g						03/22/11 11:57
	Uncertainty			+/-2.22							
Beta			U	-2.91	pCi/g						

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QC Summary

Workorder: 273656

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	1084973										
	Uncertainty										
				+/-2.65							
QC1202352721	273656003	MS									
Alpha	254	23.9		132	pCi/g		42.7*	(75%-125%)	VXC2	03/22/11	13:43
	Uncertainty	+/-5.55		+/-24.4							
Beta	962	31.5		1040	pCi/g		105	(75%-125%)			
	Uncertainty	+/-4.55		+/-38.7							
QC1202352722	273656003	MSD									
Alpha	244	23.9		160	pCi/g	19.0	55.8*	(0%-35%)		03/22/11	13:44
	Uncertainty	+/-5.55		+/-26.4							
Beta	925	31.5		989	pCi/g	5.36	103	(0%-35%)			
	Uncertainty	+/-4.55		+/-36.8							
Rad Liquid Scintillation											
Batch	1081917										
QC1202345192	273656001	DUP									
Tritium	U	-95	U	-59.1	pCi/g	0.00			N/AMYM1	03/13/11	11:44
	Uncertainty	+/-101		+/-102							
QC1202345194	LCS										
Tritium	855			716	pCi/g		83.7	(75%-125%)		03/13/11	12:16
	Uncertainty			+/-155							
QC1202345191	MB										
Tritium			U	31.8	pCi/g					03/13/11	11:27
	Uncertainty			+/-101							
QC1202345193	273656001	MS									
Tritium	884	U	-95	843	pCi/g		95.3	(75%-125%)		03/13/11	12:00
	Uncertainty	+/-101		+/-164							

Notes:

The Qualifiers in this report are defined as follows:

- ** Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- DL Failed required detection limit.
- E Organics--Concentration of the target analyte exceeds the instrument calibration range
- F Estimated Value
- H Analytical holding time was exceeded
- H Holding time exceeded
- J Estimated value; the result was greater than the MDA but less than the required detection limit.

GEL LABORATORIES LLC

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QC Summary

Workorder: 273656

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Parmname	NOM	Sample Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
J	Value is estimated									
JN	Presumptive evidence of the analyte at an estimated quantity.									
M	Matrix Related Failure									
N	Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor									
N/A	RPD or %Recovery limits do not apply.									
ND	Analyte concentration is not detected above the detection limit									
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier									
P	Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, difference is also <70%									
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.									
R	Sample results are rejected									
R	The data are unusable (radionuclide may or may not be present).									
U	Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.									
U	Undetected; sample result < MDA									
UI	Uncertain identification for gamma spectroscopy.									
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier									
Y	QC Samples were not spiked with this compound									
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.									
h	Preparation or preservation holding time was exceeded									

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000
Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-007
Sample ID: 273656007
Matrix: R
Collect Date: 04-MAR-11 14:40
Receive Date: 09-MAR-11 09:35
Collector: Client

Project: BRKL00608
Client ID: BRKL006
COC: 31309
Samp Recv.:
Client Desc.: BNL/802/N6455
Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatiles-PCB											
8082/3550B PCB soil-Fed "As Received"											
Aroclor-1016	U	ND	5.55	16.7	ug/kg	5	YSI	03/10/11	1557	1081738	1
Aroclor-1221	U	ND	5.55	16.7	ug/kg	5					
Aroclor-1232	U	ND	5.55	16.7	ug/kg	5					
Aroclor-1242	U	ND	5.55	16.7	ug/kg	5					
Aroclor-1248	U	ND	5.55	16.7	ug/kg	5					
Aroclor-1254		91.5	5.55	16.7	ug/kg	5					
Aroclor-1260		43.4	5.55	16.7	ug/kg	5					
Aroclor-1262	U	ND	5.55	16.7	ug/kg	5					
Aroclor-1268		27.3	5.55	16.7	ug/kg	5					
Aroclor-Total		162	5.55	16.7	ug/kg	5					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3550B	3550B PCB Prep Soil	JPB	03/10/11	1321	1081737

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 8082	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
4cmx	8082/3550B PCB soil-Fed "As Received"	3.69 ug/kg	6.66	55.3	(23%-103%)
Decachlorobiphenyl	8082/3550B PCB soil-Fed "As Received"	5.79 ug/kg	6.66	86.9	(16%-126%)

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: March 23, 2011

Company : Brookhaven National Laboratory
Address : Building 462

Upton, New York 11973--5000

Contact: Mr. John Burke
Project: ARRA Hazardous & Radiochemical - Summary

Client Sample ID: 31309-008

Project: BRKL00608

Sample ID: 273656008

Client ID: BRKL006

Matrix: R

COC: 31309

Collect Date: 04-MAR-11 14:20

Samp Recv.:

Receive Date: 09-MAR-11 09:35

Client Desc.: BNL/802/N6455

Collector: Client

Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatiles-PCB											
8082/3550B PCB soil-Fed "As Received"											
Aroclor-1016	U	ND	1.11	3.33	ug/kg	1	YS1	03/10/11	1636	1081738	1
Aroclor-1221	U	ND	1.11	3.33	ug/kg	1					
Aroclor-1232	U	ND	1.11	3.33	ug/kg	1					
Aroclor-1242	U	ND	1.11	3.33	ug/kg	1					
Aroclor-1248	U	ND	1.11	3.33	ug/kg	1					
Aroclor-1254		25.4	1.11	3.33	ug/kg	1					
Aroclor-1260	P	17.9	1.11	3.33	ug/kg	1					
Aroclor-1262	U	ND	1.11	3.33	ug/kg	1					
Aroclor-1268	U	ND	1.11	3.33	ug/kg	1					
Aroclor-Total	P	43.3	1.11	3.33	ug/kg	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3550B	3550B PCB Prep Soil	JPB	03/10/11	1321	1081737

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 8082	

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
4cmx	8082/3550B PCB soil-Fed "As Received"	3.34 ug/kg	6.66	50.1	(23%-103%)
Decachlorobiphenyl	8082/3550B PCB soil-Fed "As Received"	3.67 ug/kg	6.66	55.1	(16%-126%)

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: March 23, 2011

Page 1 of 2

Brookhaven National Laboratory
Building 462
Upton, New York

Contact: Mr. John Burke

Workorder: 273656

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-PCB											
Batch	1081738										
QC1202344785	LCS										
Aroclor-1016	33.3			23.8	ug/kg		71.4	(36%-100%)	YS1	03/10/11	15:44
Aroclor-1260	33.3			24.6	ug/kg		73.8	(48%-111%)			
**4cmx	6.67			4.75	ug/kg		71.3	(23%-103%)			
**Decachlorobiphenyl	6.67			5.41	ug/kg		81.1	(16%-126%)			
QC1202344784	MB										
Aroclor-1016			U	ND	ug/kg					03/10/11	15:32
Aroclor-1221			U	ND	ug/kg						
Aroclor-1232			U	ND	ug/kg						
Aroclor-1242			U	ND	ug/kg						
Aroclor-1248			U	ND	ug/kg						
Aroclor-1254			U	ND	ug/kg						
Aroclor-1260			U	ND	ug/kg						
Aroclor-1262			U	ND	ug/kg						
Aroclor-1268			U	ND	ug/kg						
Aroclor-Total			U	ND	ug/kg						
**4cmx	6.67			4.70	ug/kg		70.5	(23%-103%)			
**Decachlorobiphenyl	6.67			5.37	ug/kg		80.5	(16%-126%)			
QC1202344786	273656007	MS									
Aroclor-1016	33.3	U	ND	P	41.5	ug/kg	125	(30%-152%)		03/10/11	16:09
Aroclor-1260	33.3		43.4		57.9	ug/kg	43.6	(30%-157%)			
**4cmx	6.66		3.69		2.87	ug/kg	43.1	(23%-103%)			
**Decachlorobiphenyl	6.66		5.79		4.97	ug/kg	74.6	(16%-126%)			
QC1202344787	273656007	MSD									
Aroclor-1016	33.3	U	ND	P	47.7	ug/kg	13.9	143	(0%-30%)	03/10/11	16:22
Aroclor-1260	33.3		43.4		81.0	ug/kg	33.3*	113	(0%-30%)		
**4cmx	6.65		3.69		3.92	ug/kg		59	(23%-103%)		
**Decachlorobiphenyl	6.65		5.79		6.60	ug/kg		99.2	(16%-126%)		

Notes:

The Qualifiers in this report are defined as follows:

** Analyte is a surrogate compound

< Result is less than value reported

> Result is greater than value reported

A The TIC is a suspected aldol-condensation product

B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.

C Analyte has been confirmed by GC/MS analysis

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2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Workorder: 273656

Page 2 of 2

Parmname	NOM	Sample Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
D	Results are reported from a diluted aliquot of the sample									
DL	Failed required detection limit.									
E	Organics--Concentration of the target analyte exceeds the instrument calibration range									
F	Estimated Value									
H	Analytical holding time was exceeded									
H	Holding time exceeded									
J	Estimated value; the result was greater than the MDA but less than the required detection limit.									
J	Value is estimated									
JN	Presumptive evidence of the analyte at an estimated quantity.									
M	Matrix Related Failure									
N	Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor									
N/A	RPD or %Recovery limits do not apply.									
ND	Analyte concentration is not detected above the detection limit									
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier									
P	Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, difference is also <70%									
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.									
R	Sample results are rejected									
R	The data are unusable (radionuclide may or may not be present).									
U	Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.									
U	Undetected; sample result < MDA									
UI	Uncertain identification for gamma spectroscopy.									
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier									
Y	QC Samples were not spiked with this compound									
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.									
h	Preparation or preservation holding time was exceeded									

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A
P. SULLIVAN 631 897-3202

COUNT DATE: 03/07/2011-A

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	030711-001	986	BLDG 802 H-3 ROOM N.E. WALL	BACKGROUND
2	030711-002	699	BLDG 802 H-3 ROOM W. WALL	BACKGROUND
3	030711-003	843	BLDG 802 H-3 ROOM W. FLOOR	¹³⁷ Cs (0.20 pCi/gm) + BACKGROUND
4	030711-004	831	BLDG 802 H-3 ROOM E. FLOOR	BACKGROUND
5	030711-005	901	BLDG 802 H-3 ROOM REMEDIATED PAD	¹³⁷ Cs (0.90 pCi/gm) + BACKGROUND
6	030711-006	912	BLDG 802 OUTSIDE WALL EAST	BACKGROUND
7	030711-007	1042	BLDG 802 OUTSIDE WALL SOUTH	BACKGROUND
8	030711-008	983	BLDG 802 OUTSIDE WALL WEST	BACKGROUND
9	030711-009	829	BLDG 802 OUTSIDE WALL NORTH	BACKGROUND
10	030711-010	965	BLDG 802 H-3 ROOM S. WALL	BACKGROUND
11	030711-011	1014	BLDG 802 H-3 ROOM N. WALL	BACKGROUND
12	030711-012	1034	BLDG 802 I/S F.R. WEST WALL	BACKGROUND
13	030711-013	1114	BLDG 802 I/S F.R. EAST WALL	BACKGROUND
14	030711-014	1054	BLDG 802 I/S F.R. SOUTH WALL	BACKGROUND
15	030711-015	1076	BLDG 802 I/S F.R. NORTH WALL	BACKGROUND
16	030711-016	1079	BLDG 802 I/S F.R. S.E. FLOOR	¹³⁷ Cs (0.07 pCi/gm) + BACKGROUND
17	030711-017	986	BLDG 802 I/S F.R. N. FLOOR	¹³⁷ Cs (0.08 pCi/gm) + BACKGROUND
18	030711-018	797	BLDG. 802 ROOF COMPOSITE	¹³⁷ Cs (0.18 pCi/gm) + BACKGROUND
19				
20				
21				
22				
23				
24				
25				

18 SAMPLES TOTAL

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A

COUNT DATE: 10/19/2010-A

P. SULLIVAN - 631 897-3202

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	101910-001	789	NORTH 802 ROOF BALLAST	¹³⁷ Cs (0.44 pCi/gm) + BACKGROUND
2	101910-002	766	WEST 802 ROOF BALLAST	¹³⁷ Cs (0.87 pCi/gm) + BACKGROUND
3	101910-003	768	EAST 802 ROOF BALLAST	BACKGROUND
4	101910-004	745	SOUTH 802 ROOF BALLAST	BACKGROUND
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

4 SAMPLES TOTAL

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY ☐ Routine ☒ Special <u>Free Release</u> ☐ RWP# ☒ WP 603-35		INSTRUMENTS Model # Serial # CAL DUE	
Location / Equipment: Bldg. 802, ext. / int. walls, floor, roof.		Date: 02/ 28 thru 03 / 11 / 11		Time: 11:00	
Survey: E.O.D. procedure required ³ H smears taken from int. / ext. walls, floors, ceilings, and roof.					
Note: (A) As per requirements of work procedure 603-35, (40) ³ H smears were taken on the structure of bldg. 802. (B) Smears taken: 02/ 28 /11, on external wall sides, internal ³ H tank room walls. (2) thru (5) taken on external east wall, north wall, south wall, west wall. (6) thru (9) taken on internal ³ H tank room east wall, south wall. (C) Smears taken: 03/ 07 /11, on internal ³ H tank room walls, floor, ceiling. (10) thru (13) taken on west wall, south wall. (14) thru (16) taken on floor. (17) thru (19) taken on ceiling. (D) Smears taken: 03/ 10 /11, on internal acid fan room ceiling, external roof. (20) thru (26) taken on acid fan room ceiling. (27) thru (31) taken on roof vent, east roof, west roof, east middle roof, west middle roof. (E) Smears taken: 03/ 11 /11, on internal acid fan room walls, floor. (32) thru (41) taken on east wall, south west wall, middle floor, west floor, south wall, south east floor, north wall, north floor, west wall, south wall. (F) Due to Bldg. 701 LSA being out of service, the total aggregate of ³ H smears were not counted on the day taken. But were counted at the same time and documented on this cover sheet.					
LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ					
AIRBORNE ACTIVITY SURVEY					
Sample #		Duration		Field Analysis	
		Flow Rate		cpm	% DAC
N/A					
DOSE RATE (HIGHEST)					
CONTACT READING				N/A	
GENERAL AREA READING				N/A	
MASSLINN SURVEY RESULTS (in dpm)					
1. N/A		5. N/A			
2.		6.			
3.		7.			
4.		8.			
SMEAR SURVEY RESULTS (dpm/100cm²) α, β-γ, ³H					
1. See		8. Attached		15. Results	
2. Pages		9. 2 of 3		16. 3 of 3	
3.		10.		17.	
4.		11.		18.	
5.		12.		19.	
6.		13.		20.	
7.		14.		21.	

Surveyed By: Daniel Dove and Sean A. Gully

Date: 03/ 16 /11

Reviewed By:

Date: 3/17/11

FS-SOP-1000

Attachment 9. 2

Page 1 of 3

Protocol# 4 - 3h_dpm.lsa

User: Z5932

VIALS FROM 9-929 TO 9-205 TO BE COUNTED

Assay Definition-

Assay Description:
Basic single DPM assay

Assay Type: DPM (Single)
Report Name: Report1
Output Data Path: C:\Packard\Tricarb\Results\Z5932\3h_dpm
Raw Results Path: C:\Packard\Tricarb\Results\Z5932\3h_dpm\20110314_1436.results
Assay File Name: C:\Packard\TriCarb\Assays\3h_dpm.lsa

Count Conditions-

Nuclide: 3H
Quench Indicator: tSIE/AEC
External Std Terminator (sec): 0.5 2s%
Pre-Count Delay (min): 0.00

Quench Set:

Low Energy: 3H-UG
Count Time (min): 1.00
Count Mode: Normal
Assay Count Cycles: 1 Repeat Sample Count: 1
#Vials/Sample: 1 Calculate % Reference: Off

Background Subtract: On - 1st Vial
Low CPM Threshold: Off
2 Sigma % Terminator: Off

Regions	LL	UL	Bkg Subtract
A	0.0	18.6	1st Vial
B	2.0	18.6	1st Vial
C	0.0	0.0	1st Vial

Count Corrections-

Static Controller: On Luminescence Correction: On
Colored Samples: Off Heterogeneity Monitor: Off
Coincidence Time (nsec): 18 Delay Before Burst (nsec): 75

Half Life-

Half Life Correction: Off

Regions	Half Life	Units	Reference Date	Reference Time
A				
B				
C				

Cycle 1 Results

S#	Count Time	CPMA	DPM1	CPMB	DPM2	SIS	tSIE	MESSAGES
1	Blank 10.00	5	0	8	0	8.25	395.59	B
2	1.00	0	0	0	0	0.00	375.94	
3	1.00	0	0	0	0	0.00	366.54	
4	1.00	0	0	0	0	5.97	377.28	
5	1.00	0	0	0	0	9.88	376.72	
6	1.00	0	0	0	0	0.00	348.62	
7	1.00	0	0	0	0	0.00	359.97	
8	1.00	0	0	0	0	0.55	278.49	
9	1.00	0	0	0	0	5.47	268.46	
10	1.00	0	0	0	0	4.96	362.85	
11	1.00	0	0	0	0	5.07	362.20	
12	1.00	0	0	0	0	4.60	284.71	

VIALS FROM 9-929 TO 9-205 TO BE COUNTED

13	1.00	0	0	0	0	4.67	341.33
14	1.00	139	787	140	0	6.37	165.66
15	1.00	0	0	0	0	2.44	258.65
16	1.00	0	0	0	0	4.54	281.41
17	1.00	0	0	0	0	0.00	180.11
18	1.00	0	0	0	0	0.00	248.98
19	1.00	0	0	0	0	0.00	191.68
20	1.00	0	0	0	0	0.00	244.28
21	1.00	0	0	0	0	0.00	264.84
22	1.00	0	0	0	0	2.16	141.49
23	1.00	0	0	0	0	3.16	242.16
24	1.00	0	0	0	0	5.80	291.97
25	1.00	0	0	0	0	3.81	351.50
26	1.00	0	0	0	0	0.35	330.10
27	1.00	0	0	0	0	0.00	293.02
28	1.00	0	0	0	0	3.90	198.68
29	1.00	0	0	0	0	3.02	279.48
30	1.00	0	0	0	0	0.65	374.02
31	1.00	0	0	0	0	10.47	306.54
32	1.00	0	0	0	0	0.00	340.32
33	1.00	0	0	0	0	0.00	329.70
34	1.00	0	0	0	0	0.00	196.76
35	1.00	0	0	0	0	0.00	173.18
36	1.00	0	0	0	0	0.00	321.89
37	1.00	0	0	0	0	0.00	172.70
38	1.00	0	0	0	0	0.88	350.07
39	1.00	0	0	0	0	0.00	188.41
40	1.00	0	0	0	0	0.00	391.13
41	1.00	0	0	0	0	9.97	346.55



Page 3 of 3

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE															
Location / Equipment: Bldg. 802, Roof Top		☐ Routine _____ ☐ Special _____ ☐ Free Release _____ ☐ RWP# _____ ☒ WP 605-35		Model #	Serial #																
		Date: 03/10/11	Time: 16:00	LB5100S4	32487	07/16/11															
Survey: E.O.D. pre demolition direct frisk of roof top for [$\beta/\gamma/\alpha$] and smears [$\beta/\alpha/{}^3\text{H}$].				LUD-3	44141	02/03/12															
				E-600	01629	10/13/11															
				LUD-2221	211784	12/09/10															
				N/A																	
		LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY ZZZ XXX = contact reading Y = radiation type ZZZ = reading @ 30cm																			
		AIRBORNE ACTIVITY SURVEY																			
		<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>μCi/cc</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>						Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	μCi/cc	N/A					
		Sample #	Duration	Flow Rate	Field Analysis		% DAC														
cpm	μCi/cc																				
N/A																					
DOSE RATE (HIGHEST)																					
CONTACT READING		N/A																			
GENERAL AREA READING		N/A																			
MASSLINN SURVEY RESULTS (in dpm)																					
1.	N/A	5.	N/A																		
2.		6.																			
3.		7.																			
4.		8.																			
SMEAR SURVEY RESULTS (dpm/100cm²) α , β , ${}^3\text{H}$																					
1.	See	8.	Attached	15.	Results																
2.	Batch	9.	Number	16.	2742																
3.		10.		17.																	
4.		11.		18.																	
5.		12.		19.																	
6.		13.		20.																	
7.		14.		21.																	

Note:

(A) As per work procedure 605-35, 100% survey of the roof [via man lift] with a NaI detector and 50% direct frisk survey for [β/γ], also 10% survey for [α]. The blue highlighted areas are indicative of the areas surveyed, and the bkgd. check for the NaI detector [1min. count] ranged between 9. 5Kcpm to 10. 8Kcpm, see above areas for count range. Average frisker bkgd. was at 80cpm and the areas surveyed were equivalent to bkgd. and < 100ccpm. Areas surveyed for [α], the net bkgd. was equivalent to 0cpm, and all surface areas surveyed were equivalent to bkgd. . Previously on 10/ 19 /10, 30% of the roof was surveyed and documented using a NaI detector and also direct frisked for [β/γ].

(B) Smears taken, see page 2 of 2 for particulate results, and above photo for locations. Five smears were taken for ${}^3\text{H}$, and will be recorded at later date, as LSA is out of surface.

Sample Report

Batch ID: 1min. Smear - 201103101723
Group: E
Device: HFBR
Batch Key: 2,742
Selected Geometry: 1/8" Stainless Steel

Count Date: 3/10/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

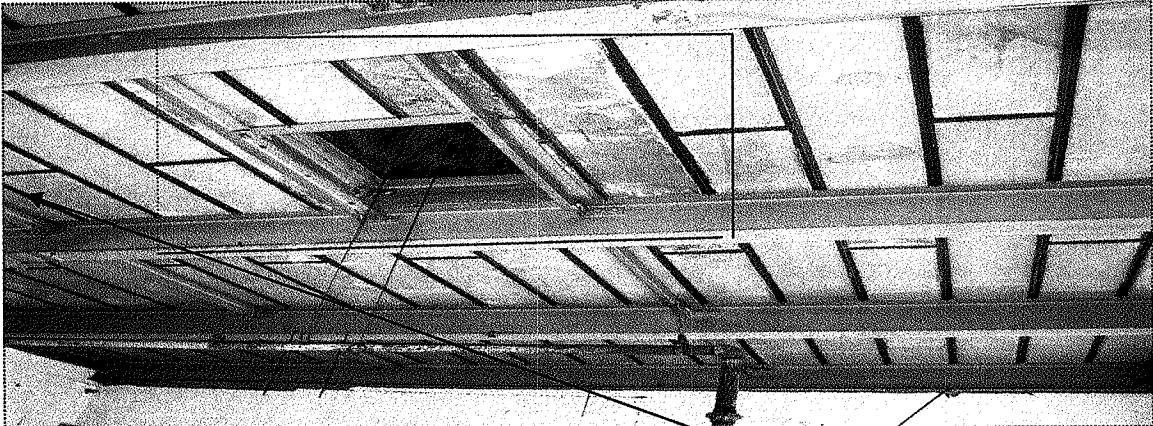
Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20110310172314-E1	Unknown	3.48	3.49	9.45	29.93	12.35	13.64	
20110310172445-E2	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20110310172605-E3	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
20110310172715-E4	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110310172835-E5	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20110310172955-E6	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110310173105-E7	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110310173225-E8	Unknown	6.98	4.94	9.45	14.50	8.74	13.64	
20110310173335-E9	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110310173455-E10	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110310173605-E11	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110310173725-E12	Unknown	3.48	3.49	9.45	29.93	12.35	13.64	
20110310173845-E13	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	

Reviewed by:



Page 2 of 2

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT		
LOCATION & EQUIPT. Building 802 ceiling		☐ ROUTINE ☒ SPECIAL Free release ☐ RWP # ☐ WP #		Model #	Serial #	CAL DUE
		DATE: 3/10/11 TIME: 09:15		tennelec	32487	7/16/11
Free release survey I.A.W. WP 603-35						
  Surveyed area's inside orange boxes and also where arrow is pointing around roof drain. ~15% of ceiling surveyed along with 4 masslinn wipes taken on horizontal surface of I-beams. → north ← north						
XXXX ZZZ XXX = contact reading Y = radiation type ZZZ = reading @ 30cm LEGEND ○ - SMEAR SURVEY LOCATION △ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION						
AIRBORNE ACTIVITY SURVEY						
Sample #	Duration	Flow Rate	Field Analysis		% DAC	
N/A			cpm	µCi/cc		
DOSE RATE (HIGHEST)						
CONTACT READING			N/A			
GENERAL AREA READING			N/A			
MASSLINN SURVEY RESULTS (in dpm)						
1.	<1k/las	5.	N/A			
2.		6.				
3.		7.				
4.		8.				
SMEAR SURVEY RESULTS (dpm/100cm²) (α, β-γ) ³H						
1.	See	8.	Attached	15.	Results	
2.	Batch	9.	Number	16.	2743	
3.		10.		17.		
4.		11.		18.		
5.		12.		19.		
6.		13.		20.		
7.		14.		21.		
Surveyed By Hollander FS-SOP-1000 Attachment 9.2 Date: 3/11/11 Reviewed By: <i>[Signature]</i> Date: 3-12-11						

Sample Report

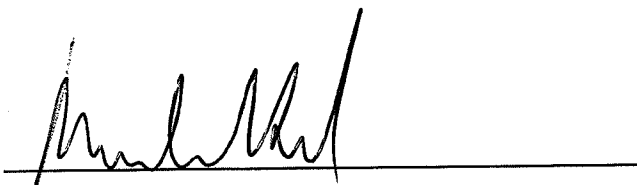
Batch ID: 1min. Smear - 201103101749
Group: E
Device: HFBR
Batch Key: 2,743
Selected Geometry: 1/8" Stainless Steel

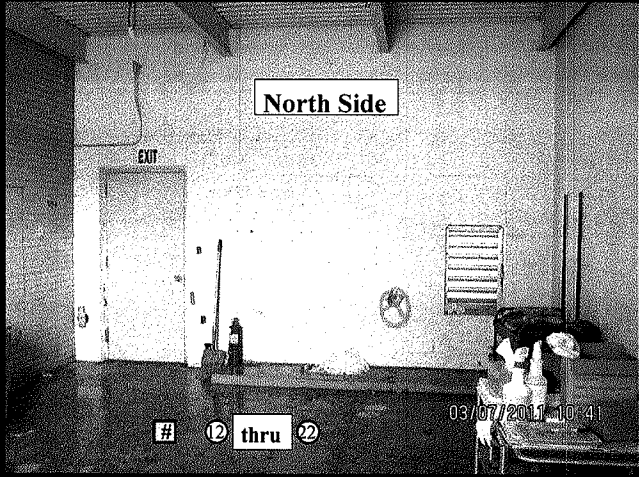
Count Date: 3/10/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20110310174939-E1	Unknown	6.96	4.94	9.45	49.78	15.94	13.64	
20110310175109-E2	Unknown	6.92	4.94	9.45	115.30	24.18	13.64	
20110310175229-E3	Unknown	-0.05	0.01	9.45	85.68	20.78	13.64	
20110310175339-E4	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110310175459-E5	Unknown	3.48	3.49	9.45	19.85	10.08	13.64	
20110310175619-E6	Unknown	3.49	3.49	9.45	4.73	5.05	13.64	
20110310175729-E7	Unknown	6.97	4.94	9.45	24.58	11.28	13.64	
20110310175849-E8	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110310175959-E9	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110310180119-E10	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110310180229-E11	Unknown	3.48	3.49	9.45	24.89	11.27	13.64	
20110310180349-E12	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110310180509-E13	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110310180619-E14	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
20110310180739-E15	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110310180849-E16	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110310181009-E17	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110310181119-E18	Unknown	3.46	3.49	9.45	55.13	16.72	13.64	
20110310181239-E19	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110310181349-E20	Unknown	-0.04	0.01	9.45	75.60	19.52	13.64	

Reviewed by:



RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE																						
		☐ Routine ☐ Special ☒ Free Release ☐ RWP# ☐ WP 603-35		Model #	Serial #																							
Location / Equipment: Bldg. 802, ³ H Tank Room Floor.		Date: 03/08/11	Time: 16:00	LB5100S4	32487	07/16/11																						
Survey: E.O.D. direct frisk on the floor & pedestal surface areas for [β/γ/α] and smears for [β/α].				LUD-3	92741	10/20/11																						
 North Side  South Side				E-600	01629	10/13/11																						
				N/A																								
				N/A																								
				LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ																								
				AIRBORNE ACTIVITY SURVEY <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>μCi/cc</th> </tr> </thead> <tbody> <tr> <td>See ASL</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	μCi/cc	See ASL												
Sample #	Duration	Flow Rate	Field Analysis		% DAC																							
			cpm	μCi/cc																								
See ASL																												
				DOSE RATE (HIGHEST) <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>CONTACT READING</td> <td>N/A</td> </tr> <tr> <td>GENERAL AREA READING</td> <td>N/A</td> </tr> </table>				CONTACT READING	N/A	GENERAL AREA READING	N/A																	
CONTACT READING	N/A																											
GENERAL AREA READING	N/A																											
				MASSLINN SURVEY RESULTS (in dpm) <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. N/A</td> <td>5. N/A</td> </tr> <tr> <td>2.</td> <td>6.</td> </tr> <tr> <td>3.</td> <td>7.</td> </tr> <tr> <td>4.</td> <td>8.</td> </tr> </table>				1. N/A	5. N/A	2.	6.	3.	7.	4.	8.													
1. N/A	5. N/A																											
2.	6.																											
3.	7.																											
4.	8.																											
				SMEAR SURVEY RESULTS (dpm/100cm²) α, β, ³ H																								
				<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. See</td> <td>8. Attached</td> <td>15. Results</td> </tr> <tr> <td>2. Batch</td> <td>9. Number</td> <td>16. 2730</td> </tr> <tr> <td>3.</td> <td>10.</td> <td>17.</td> </tr> <tr> <td>4.</td> <td>11.</td> <td>18.</td> </tr> <tr> <td>5.</td> <td>12.</td> <td>19.</td> </tr> <tr> <td>6.</td> <td>13.</td> <td>20.</td> </tr> <tr> <td>7.</td> <td>14.</td> <td>21.</td> </tr> </table>				1. See	8. Attached	15. Results	2. Batch	9. Number	16. 2730	3.	10.	17.	4.	11.	18.	5.	12.	19.	6.	13.	20.	7.	14.	21.
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3.	10.	17.																										
4.	11.	18.																										
5.	12.	19.																										
6.	13.	20.																										
7.	14.	21.																										

Note:

- (A) Direct frisk 100% of the ³H tank room floor as pre procedure for [β/γ] and direct frisk 10% of the same for [α]. Bkgd. for [β/γ] ranged from 60cpm to 80cpm and all surface areas were equivalent to bkgd. and < 100cpm. Bkgd. for [α] was at 0cpm, and all surface areas were equivalent to bkgd.
- (B) Smears taken on the floor of the ³H tank room are part of the radiological release survey required by procedure 603-35.

Surveyed By: Sean A. Gully

Date: 03/12/11

Reviewed By: *[Signature]*

Date: 3/17/11

Sample Report

Batch ID: 1min. Smear - 201103081752
Group: E
Device: HFBR
Batch Key: 2,730
Selected Geometry: 1/8" Stainless Steel

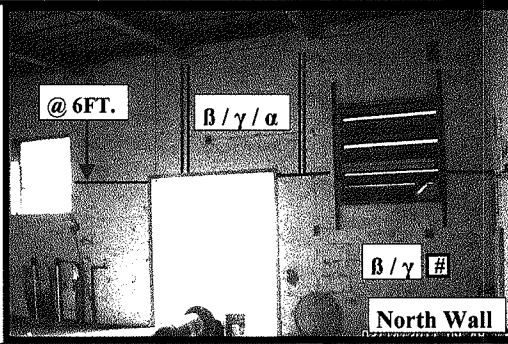
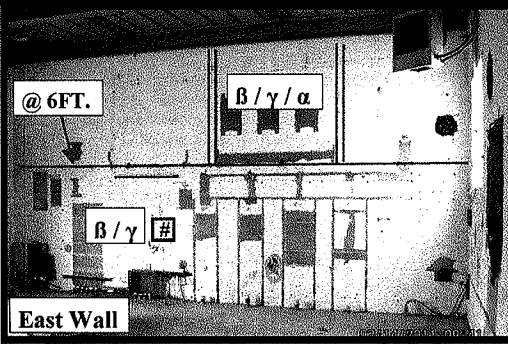
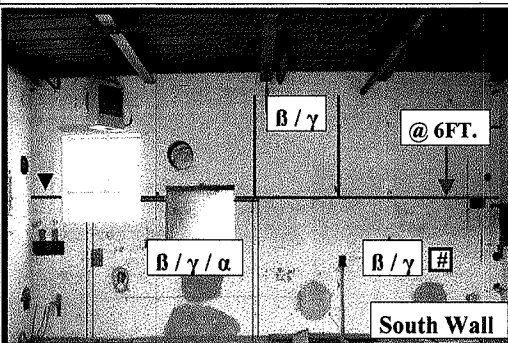
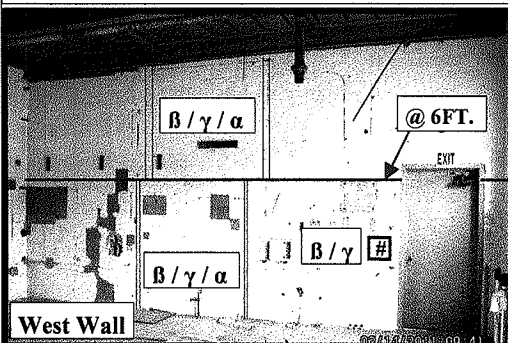
Count Date: 3/8/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20110308175258-E1	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110308175429-E2	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110308175549-E3	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
20110308175659-E4	Unknown	-0.02	0.01	9.45	45.36	15.12	13.64	
20110308175819-E5	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110308175939-E6	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110308180049-E7	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110308180209-E8	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110308180319-E9	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110308180439-E10	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110308180549-E11	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
20110308180709-E12	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110308180829-E13	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110308180939-E14	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110308181059-E15	Unknown	6.98	4.94	9.45	14.50	8.74	13.64	
20110308181209-E16	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110308181329-E17	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110308181439-E18	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110308181559-E19	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110308181709-E20	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110308181829-E21	Unknown	-0.03	0.01	9.45	55.44	16.72	13.64	
20110308181949-E22	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	

Reviewed by:

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RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE																						
		☐ Routine ☐ Special ☐ Release ☒ RWP# <u>2011-ERP-010</u> ☒ WP <u>603-35</u>		Model #	Serial #																							
Location / Equipment: <u>Bldg. 802, A. F. R., walls / floor.</u>		Date: <u>03/14/11</u> Time: <u>16:00</u>		<u>LB5100S4</u>	<u>32487</u>	<u>07/16/11</u>																						
Survey: <u>E.O.D. direct frisk on the walls, up to 6ft., 6ft. to ceiling, and on the releasable floor for [$\beta/\gamma/\alpha$], smears.</u>				<u>LUD-3</u>	<u>92741</u>	<u>10/20/11</u>																						
 North Wall  East Wall  South Wall  West Wall				<u>LUD-3</u>	<u>44141</u>	<u>02/03/12</u>																						
				<u>E-600</u>	<u>01629</u>	<u>10/13/11</u>																						
				<u>N/A</u>																								
								LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXX XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ																				
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Sample #	Duration	Flow Rate	Field Analysis		% DAC																							
			cpm	$\mu\text{Ci/cc}$																								
N/A																												
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CONTACT READING	N/A																											
GENERAL AREA READING	N/A																											
MASSLINN SURVEY RESULTS (in dpm) <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. N/A</td> <td>5. N/A</td> </tr> <tr><td>2.</td><td>6.</td></tr> <tr><td>3.</td><td>7.</td></tr> <tr><td>4.</td><td>8.</td></tr> </table>								1. N/A	5. N/A	2.	6.	3.	7.	4.	8.													
1. N/A	5. N/A																											
2.	6.																											
3.	7.																											
4.	8.																											
SMEAR SURVEY RESULTS (dpm/100cm²) α , β/γ , ³ H <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. See</td> <td>8. Attached</td> <td>15. Results</td> </tr> <tr> <td>2. Batch</td> <td>9. Number</td> <td>16. 2751 & 2752</td> </tr> <tr><td>3.</td><td>10.</td><td>17.</td></tr> <tr><td>4.</td><td>11.</td><td>18.</td></tr> <tr><td>5.</td><td>12.</td><td>19.</td></tr> <tr><td>6.</td><td>13.</td><td>20.</td></tr> <tr><td>7.</td><td>14.</td><td>21.</td></tr> </table>								1. See	8. Attached	15. Results	2. Batch	9. Number	16. 2751 & 2752	3.	10.	17.	4.	11.	18.	5.	12.	19.	6.	13.	20.	7.	14.	21.
1. See	8. Attached	15. Results																										
2. Batch	9. Number	16. 2751 & 2752																										
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4.	11.	18.																										
5.	12.	19.																										
6.	13.	20.																										
7.	14.	21.																										

Note:

- (A) 100% survey of the interior walls of the acid fan room up to 6ft., highlighted by blue boundary for [β/γ] by direct frisk. And 10% survey of the walls up to 6ft. and above 6ft. to the ceiling, highlighted in red for [α] by direct frisk. The average bkgd. on the cement block wall surface ranged between 60cpm to 80cpm for [β/γ] and all accessible wall surface areas surveyed were equivalent to bkgd. and < 100ccpm. On the aforementioned wall surfaces, bkgd. for [α] was at 0cpm and all surface areas surveyed were equivalent to bkgd. Also a 100% survey of the releasable area of the floor [not shown] for [β/γ], bkgd. ranged between 60cpm to 80cpm, all equivalent to bkgd. and < 100ccpm. Also 10% floor survey for [α], bkgd. was at 0cpm and all surface areas surveyed were equivalent to bkgd. .

(B) Smears taken:

Batch key #2751, smears taken on the walls [not shown].

(1) thru (6) taken on the east wall, (7) thru (15) taken on the south wall, (16) thru (22) taken on the west wall, (23) thru (30) taken on the north wall.

Batch key #2752 taken on the floor [not shown].

(1) thru (30) taken on the releasable floor section [about 70%].

Surveyed By: Dan Dove and Sean A. Gully

Date: 03/16/11

Reviewed By: [Signature]

Date: 3/17/11

FS-SOP-1000

Attachment 9.2

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Sample Report

Batch ID: 1min. Smear - 201103141103
Group: E
Device: HFBR
Batch Key: 2,751
Selected Geometry: 1/8" Stainless Steel

Count Date: 3/14/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20110314110430-E1	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110314110600-E2	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110314110720-E3	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314110830-E4	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314110950-E5	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314111110-E6	Unknown	3.49	3.49	9.45	4.73	5.05	13.64	
20110314111220-E7	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110314111340-E8	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110314111450-E9	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110314111610-E10	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
20110314111720-E11	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110314111840-E12	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110314112000-E13	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314112110-E14	Unknown	6.98	4.94	9.45	14.50	8.74	13.64	
20110314112230-E15	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110314112340-E16	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110314112500-E17	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110314112610-E18	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314112730-E19	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314112840-E20	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314113000-E21	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
20110314113120-E22	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110314113230-E23	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314113350-E24	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314113500-E25	Unknown	3.49	3.49	9.45	-0.31	0.31	13.64	
20110314113620-E26	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
20110314113730-E27	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110314113850-E28	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314114010-E29	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110314114120-E30	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	

Reviewed by:

Page 2 of 3

Sample Report

Batch ID: 1min. Smear - 201103141330
Group: E
Device: HFBR
Batch Key: 2,752
Selected Geometry: 1/8" Stainless Steel

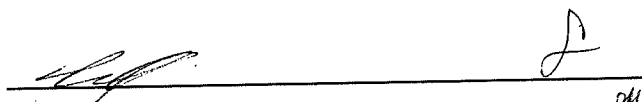
Count Date: 3/14/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20110314133159-E2	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314133319-E3	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314133429-E4	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110314133549-E5	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314133709-E6	Unknown	3.48	3.49	9.45	24.89	11.27	13.64	
20110314133819-E7	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314133939-E8	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
20110314134049-E9	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314134209-E10	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110314134319-E11	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314134439-E12	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314134559-E13	Unknown	3.48	3.49	9.45	19.85	10.08	13.64	
20110314134709-E14	Unknown	3.47	3.49	9.45	34.97	13.34	13.64	
20110314134829-E15	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314134939-E16	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314135059-E17	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314135209-E18	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314135329-E19	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314135439-E20	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110314135559-E21	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110314135719-E22	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314135829-E23	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
20110314135949-E24	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110314140059-E25	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314140219-E26	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110314140329-E27	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20110314140449-E28	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110314140609-E29	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110314140719-E30	Unknown	3.48	3.49	9.45	14.81	8.73	13.64	
20110314133029-E1		-1.03	0.35	15.84	-36.87	5.70	62.29	

Page 3 of 3

Reviewed by:

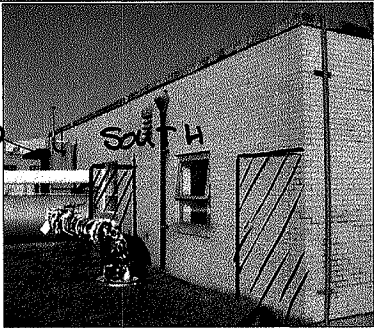


RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT	
		☐ Routine ☒ Special <i>CHARACTERIZATION</i>		Model #	Serial #
		☒ RWP# <u>2010-20</u> ☐ WP			
Location / Equipment: Bldg. <u>802</u>		Date: <u>1-20-10</u>	Time: <u>1300</u>	<u>BICKON</u>	<u>A887S</u>
				<u>LUD-3</u>	<u>72518</u>
					<u>10-14-10</u>
					<u>7-21-10</u>





DIRECT FRISK 25% OF WALLS. NO DETECTABLE COUNTS ABOVE BACKGROUND BACKGROUND 80-100 cpm



DIRECT FRISK OF SOUTHSIDE (NOT PICTURED) SEE BELOW

DOSE RATES IN *uR/hr*

← 5-7 →

BUILDING POSTED CONTROLLED AREA

5-7 ↑

OUTLET PIPE TO STACK

← 5-8 →

25 30 40 20

10 8 6 6

S ↓

LEGEND					
○ - SMEAR SURVEY LOCATION	▲ - AIR SAMPLE LOCATION				
□ - MASSLINN SURVEY LOCATION	# - DIRECT FRISK LOCATION				
C - CONTAMINATION	* - CONTACT				
XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ					

AIRBORNE ACTIVITY SURVEY					
Sample #	Duration	Flow Rate	Field Analysis		% DAC
			cpm	µCi/cc	
N/A					→

DOSE RATE (HIGHEST)	
CONTACT READING	N/A
GENERAL AREA READING	N/A

MASSLINN SURVEY RESULTS (in dpm)	
1. N/A	5. N/A
2. ↓	6. ↓
3. ↓	7. ↓
4. ↓	8. ↓

SMEAR SURVEY RESULTS (dpm/100cm²) α, β-γ, ³ H		
1. N/A	8. N/A	15. N/A
2. ↓	9. ↓	16. ↓
3. ↓	10. ↓	17. ↓
4. ↓	11. ↓	18. ↓
5. ↓	12. ↓	19. ↓
6. ↓	13. ↓	20. ↓
7. ↓	14. ↓	21. ↓

Surveyed By: *Delegran* Date: 1-20-10 Reviewed By: *[Signature]* Date: 1/21/10
 FS-SOP-1000
 Attachment 9.2 Page 1 of 1

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		
		☐ Routine ☒ Special Free Release ☐ RWP# ☒ WP 603-35		Model #	Serial #	CAL DUE
Location / Equipment: Bldg. 802, 3H Tank Room.		Date: 03/07/11	Time: 16:00	LB5100S4	32487	07/16/11
Survey: E.O.D. post final status D / F of the walls, up to 6ft. for [B / γ / α], smears on ceiling & walls for [B / α].				S5-XLB	67705	04/23/11
South Wall East Wall West Wall North Wall South Wall 				LUD-3	44141	02/03/12
				LUD-19	59979	10/18/11
				E-600	01629	10/13/11
LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ						
AIRBORNE ACTIVITY SURVEY						
Sample #	Duration	Flow Rate	Field Analysis		% DAC	
See ASL			cpm	μCi/cc		
DOSE RATE (HIGHEST)						
CONTACT READING			N/A			
GENERAL AREA READING			8 μR/hr.			
MASSLINN SURVEY RESULTS (in dpm)						
1. N/A			5. N/A			
2.			6.			
3.			7.			
4.			8.			
SMEAR SURVEY RESULTS (dpm/100cm²) α, β, 3H						
1. See	8. Attached	15. Results				
2. Batch	9. Number	16. 2725 & 27613				
3.	10.	17.				
4.	11.	18.				
5.	12.	19.				
6.	13.	20.				
7.	14.	21.				

Note:

(A) 100% survey of the interior walls of the 3H tank room up to 6ft. And by direct frisk for [B / γ] and 10% by direct frisk for [α]. Above three photos highlighted in blue, show areas surveyed for [α]. Lower two photos show wall sides 6ft. to floor, surveyed for [B / γ]. Average bkgd. for the brick wall surface was at 100cpm, while frisking for [B / γ], and the bkgd. for the cement block wall surface was at 60cpm. All accessible surface areas surveyed were equivalent to bkgd. and < 100ccpm. On the aforementioned wall surfaces, bkgd. for [α] was at 0cpm and all surface areas surveyed were equivalent to bkgd.

(B) Smears taken:
 Page 2 of 4 [batch key # 2725] (1) thru (10) taken on the ceiling, [not shown].
 Page 3 of 4 [batch key # 27613] (21) thru (65) taken on the walls, [not shown].
 Page 4 of 4 [batch key # 27613] (66) thru (70) taken on the walls [not shown].
 Smears taken for 3H, results to be added at later date, as the LSA is out of service.

(C) General area dose rates taken were equivalent to bkgd. at 8 μR/hr.

Surveyed By: Dan Dove and Sean A. Gully

Date: 03/10/11

Reviewed By:

Date: 3/16/11

FS-SOP-1000

Attachment 9.2

Page 1 of 4

Sample Report

Batch ID: 1min. Smear - 201103071409
Group: G
Device: HFBR
Batch Key: 2,725
Selected Geometry: 1/8" Stainless Steel

Count Date: 3/7/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20110307140916-G1	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110307141046-G2	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110307141206-G3	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110307141316-G4	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110307141436-G5	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110307141556-G6	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110307141706-G7	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110307141826-G8	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110307141936-G9	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110307142056-G10	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	

Reviewed by:

J

Page 2 of 4

Activity Report

3/7/11
11:55:33AI

802 EAST SIDE OF BLDG

Batch Name:	27,613	Acquisition Date:	3/7/11
Batch ID:	1 Minute Smear Analysis - 201103071102	Acquisition Time:	1.0
Group:	E	(minutes)	
Device:	S5 XLB	Operating Voltage:	1,350.0
		(volts)	

Selected Geometry: 1/8" Stainless Steel

Efficiency Factors

Alpha Efficiency:	0.27	±	0.00	Beta Efficiency:	0.19	±	0.00
(%)				(%)			

<u>Sample ID</u>	<u>Quantity</u>	<u>Alpha</u> <u>(DPM)</u>	<u>2σ</u>	<u>Alpha MDA</u> <u>(DPM)</u>	<u>Beta Activity</u> <u>(DPM)</u>	<u>2σ</u>	<u>Beta MDA</u> <u>(DPM)</u>
20110307110218-E21	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307110548-E22	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307110658-E23	0.00	0.00	0.00	9.99	5.21	10.42	14.10
20110307110818-E24	0.00	0.00	0.00	9.99	5.21	10.42	14.10
20110307110928-E25	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307111049-E26	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307111209-E27	0.00	3.68	7.39	9.99	20.70	20.85	14.10
20110307111319-E28	0.00	7.38	10.44	9.99	4.92	10.43	14.10
20110307111439-E29	0.00	-0.01	0.01	9.99	31.27	25.53	14.10
20110307111559-E30	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307111709-E31	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307111829-E32	0.00	-0.01	0.01	9.99	20.84	20.84	14.10
20110307111939-E33	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307112059-E34	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307112219-E35	0.00	-0.01	0.01	9.99	20.84	20.84	14.10
20110307112329-E36	0.00	0.00	0.00	9.99	0.00	0.00	14.10
20110307112449-E37	0.00	0.00	0.00	9.99	5.21	10.42	14.10
20110307112609-E38	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307112719-E39	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307112840-E40	0.00	0.00	0.00	9.99	5.21	10.42	14.10
20110307113000-E41	0.00	-0.01	0.01	9.99	20.84	20.84	14.10
20110307113110-E42	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307113230-E43	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307113350-E44	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307113500-E45	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307113620-E46	0.00	0.00	0.00	9.99	5.21	10.42	14.10
20110307113740-E47	0.00	-0.01	0.01	9.99	31.27	25.53	14.10
20110307113850-E48	0.00	-0.01	0.01	9.99	20.84	20.84	14.10
20110307114010-E49	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307114120-E50	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307114240-E61	0.00	-0.01	0.01	9.99	26.05	23.31	14.10
20110307114400-E62	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307114510-E63	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307114630-E64	0.00	-0.01	0.01	9.99	15.63	18.05	14.10
20110307114750-E65	0.00	0.00	0.01	9.99	10.42	14.74	14.10

Activity Report

3/7/11
11:55:33AI

Efficiency Factors

Alpha
Efficiency:
(%)

0.27 ± 0.00

Beta Efficiency:
(%)

0.19 ± 0.00

Sample ID	Quantity	Alpha (DPM)	2 σ	Alpha MDA (DPM)	Beta Activity (DPM)	2 σ	Beta MDA (DPM)
20110307114901-E66	0.00	-0.01	0.01	9.99	20.84	20.84	14.10
20110307115021-E67	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307115141-E68	0.00	0.00	0.01	9.99	10.42	14.74	14.10
20110307115251-E69	0.00	-0.01	0.01	9.99	20.84	20.84	14.10
20110307115411-E70	0.00	-0.01	0.01	9.99	20.84	20.84	14.10

Reviewed by:



Page 4 of 4

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE	
		☐ Routine _____ ☒ Special <u>Free Release</u>		Model #		Serial #	
		☐ RWP# _____ ☒ WP 603-35		LB5100S4		32487	
Location / Equipment: Bldg. 802, external wall sides.		Date: 02/ 19 /11		Time: 16:00		LUD-3	
						50534	
						11/04/11	
Survey: E.O.D. post direct frisk for [B / γ / α] and take (50) smears for verification.						E-600	
						01629	
						10/13/11	
						N/A	
						N/A	

LEGEND

○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION

■ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION

C - CONTAMINATION * - CONTACT

XXX XXX = contact reading Y = radiation type ZZZ = reading @ 30cm

AIRBORNE ACTIVITY SURVEY					
Sample #	Duration	Flow Rate	Field Analysis		% DAC
			cpm	μCi/cc	
N/A					

DOSE RATE (HIGHEST)	
CONTACT READING	N/A
GENERAL AREA READING	N/A

MASSLINN SURVEY RESULTS (in dpm)	
1. N/A	5. N/A
2.	6.
3.	7.
4.	8. thru 20.

SMEAR SURVEY RESULTS (dpm/100cm ²) α , β , ³ H		
1. See	8. Attached	15. Results
2. Batch	9. Number	16. 2700
3.	10.	17.
4.	11.	18.
5.	12.	19.
6.	13.	20.
7.	14.	21.

Note:

- (A) Area direct frisked for [B / γ], from the 6ft. mark to the ground level on the north, west, south, east sides, and it is indicative of the blue lines. The clear spaces on the wall were previously direct frisked and documented. Area surveyed for [α], 10% of exterior wall above / below 6ft. on the east wall and above 6ft. on the north east wall is indicative of the green lines.
- (B) Background ranged from 80cpm to 120cpm, the higher being affected by bldg. 801. No significant change detected and all side wall areas checked were < 100ccpm. Background for [α] was 0cpm, and all surface Areas surveyed for [α] were equivalent to background.
- (D) Smears taken, see page 2 of 3 and 3 of 3 for results. See above for locations on the side walls. All smears were marked on the side walls.

Surveyed By: Sean A. Gully

Date: 02/ 22 /11

Reviewed By: *[Signature]*

Date: 2/22/11

Sample Report

Batch ID: 1min. Smear - 201102191037
Group: F
Device: HFBR
Batch Key: 2,700
Selected Geometry: 1/8" Stainless Steel

Count Date: 2/19/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20110219103800-F1	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20110219103930-F2	Unknown	6.97	4.94	9.45	24.58	11.28	13.64	
20110219104050-F3	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219104200-F4	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110219104320-F5	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219104440-F6	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
20110219104550-F7	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219104710-F8	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219104820-F9	Unknown	-0.02	0.01	9.45	30.24	12.35	13.64	
20110219104940-F10	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219105050-F11	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110219105210-F12	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219105320-F13	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219105440-F14	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219105600-F15	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219105710-F16	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219105830-F17	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219105940-F18	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219110100-F19	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219110210-F20	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219110330-F21	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219110450-F22	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219110600-F23	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219110720-F24	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110219110830-F25	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219110950-F26	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219111100-F27	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219111220-F28	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219111330-F29	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	
20110219111450-F30	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219111610-F31	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219111720-F32	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110219111840-F33	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219111950-F34	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219112110-F35	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219112220-F36	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	

Page 2 of 3

Sample Report

Efficiency (%)

Alpha: 28.64 ± 0.08
Beta: 19.84 ± 0.07

Spillover (%)

Alpha to Beta: 6.13 ± 0.00
Beta to Alpha: 0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20110219112340-F37	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219112500-F38	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219112610-F39	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219112730-F40	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219112840-F41	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219113000-F42	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219113110-F43	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110219113230-F44	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64	
20110219113340-F45	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110219113500-F46	Unknown	0.00	0.00	9.45	0.00	0.00	13.64	
20110219113620-F1	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110219113730-F2	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110219113850-F3	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110219114000-F4	Unknown	3.49	3.49	9.45	4.73	5.05	13.64	

Reviewed by: _____

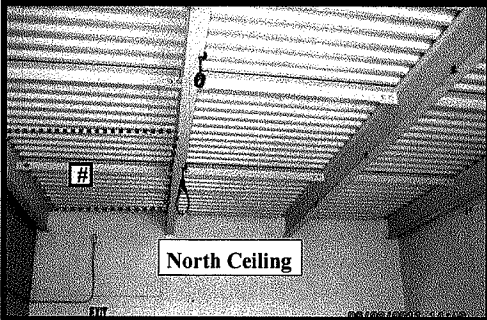
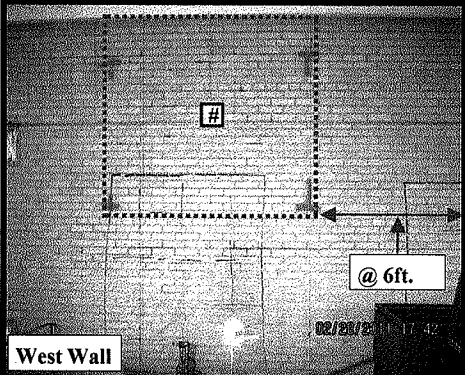
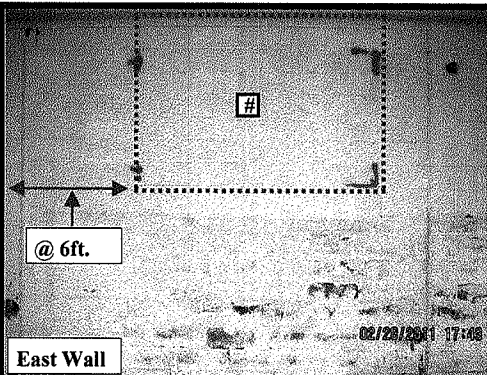
REV 010810.ELR

Page 2 of 2

C:\Program Files\Tennelec Systems\Eclipse\sample report bnl.rpt

Page 3 of 3

Print Date 2/19/2011
Print Time 11:41:20AM

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS																		
		☐ Routine ☐ Special ☐ RWP# ☒ WP 603-35		Model #	Serial #																	
Location / Equipment: Bldg. 802, 3H Tank Room.		Date: 02/28/11	Time: 17:00	E-600	01629																	
Survey: E.O.D. post final status direct frisking of the ceiling and interior walls for [β / γ / α] 10% requirement.				LUD-3	92741																	
 South Ceiling  North Ceiling  West Wall  East Wall		LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION ■ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION ⌒ - CONTAMINATION * - CONTACT XXX XXX = contact reading Y = radiation type ZZZ = reading @ 30cm																				
		AIRBORNE ACTIVITY SURVEY <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>μCi/cc</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	μCi/cc	N/A										
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cpm	μCi/cc																					
N/A																						
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2.	6.																					
3.	7.																					
4. ↓	8. thru 20. ↓																					
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4.	11.	18.																				
5.	12.	19.																				
6.	13.	20.																				
7. ↓	14. ↓	21. ↓																				

Note:

- (A) As per the Building 802 Radiological Release Survey requirements, the ³H tank room [shown above] was internally surveyed for 10% of the ceiling by direct frisk for [β / γ / α]. The highlighted in blue areas [top photos] are indicative of the area surveyed.
- (B) And as per the requirement for 10% survey of the internal walls above 6 feet by direct frisk for [β / γ / α], the highlighted in blue areas [bottom photos] are indicative of the area surveyed.
- (C) Average background for the brick wall surface was at 100cpm while frisking for [β / γ], and background for the cement block and metal ceiling was at 60cpm. All accessible surface areas surveyed were equivalent to background and < 100cpm.
- (D) Average background for the brick wall, cement block, and metal ceiling surface areas while surveying for [α] was 0cpm. All accessible surface areas surveyed were equivalent to background.

Surveyed By: Sean A. Gully

Date: 03/01/11

Reviewed By: *[Signature]*

Date: 3/1/11

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENT																																																
		☐ _____ ☒ 2010-20 ☐ _____		Model #	Serial #																																															
LOCATION / EQUIPMENT: BLDG. 802 Roof		DATE: 10/19/10	TIME: 1300	LUD-3/44-9	74417/158862																																															
				LSC/Quanta Smart	060943																																															
				LB5100	32487																																															
				E600/380	01642/00159																																															
				CAL DUE																																																
					8/13/11																																															
					11/10/10																																															
					7/16/11																																															
					3/19/11																																															
Characterization/pre-demo Survey done on 802 Roof Smears(10) taken <MDA (see attached) H3 smears (2) < limits = 10kdpm(see attached) Direct Frisk 30% of Roof ≤ Bkgd.=100 cpm/ppa Gamma Scan 30% → Range 8200-24000 cpm = bkgd. at waist level 4 — direct 1 minute (a) counts 1. N.Side — 0 cpm Bkgd. 0 cpm 2. E. Side — 0 cpm 3. S. Side — 0 cpm 4. W. Side — 0 cpm #'s 1-4 correlate (a-g) directs on roof 4 Roof marinelli samples taken. All = Bkgd. PPA=per probe area LUD.2221 S# 211780 12/8/10 2. 8400 cpm 1. 8200 3. 24000 4. 8500 cpm → This area higher due to Ducts I/S bldg. LEGEND ○ - SMEAR SURVEY LOCATION △ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION XXX = contact reading Y = radiation type ZZZ = reading @ 30cm AIRBORNE ACTIVITY SURVEY <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>μCi/cc</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> DOSE RATE (HIGHEST) mr/hr <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>CONTACT READING</td> <td>N/A</td> </tr> <tr> <td>GENERAL AREA READING</td> <td>N/A</td> </tr> </table> MASSLINN SURVEY RESULTS (in dpm) <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>1. N/A</td> <td>5. N/A</td> </tr> <tr> <td>2.</td> <td>6.</td> </tr> <tr> <td>3.</td> <td>7.</td> </tr> <tr> <td>4.</td> <td>8.</td> </tr> </table> SMEAR SURVEY RESULTS (dpm/100cm²) α, β-γ, ³H <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>See</td> <td>8. Attached</td> <td>15. Survey</td> </tr> <tr> <td>Results</td> <td>9. Batch #</td> <td>16. 2352</td> </tr> <tr> <td></td> <td>10.</td> <td>17.</td> </tr> <tr> <td></td> <td>11.</td> <td>18.</td> </tr> <tr> <td></td> <td>12.</td> <td>19.</td> </tr> <tr> <td></td> <td>13.</td> <td>20.</td> </tr> <tr> <td></td> <td>14.</td> <td>21.</td> </tr> </table>						Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	μCi/cc	N/A						CONTACT READING	N/A	GENERAL AREA READING	N/A	1. N/A	5. N/A	2.	6.	3.	7.	4.	8.	See	8. Attached	15. Survey	Results	9. Batch #	16. 2352		10.	17.		11.	18.		12.	19.		13.	20.		14.	21.
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	13.	20.																																																		
	14.	21.																																																		

Surveyed By: J. Conley

Date: 10/20/10

Reviewed By: *[Signature]*

Date: 10/20/10

Sample Report

802 ROOF BALLAST

Batch ID: 1min. Smear - 201010191611
Group: H
Device: HFBR
Batch Key: 2,352
Selected Geometry: 1/8" Stainless Steel

Count Date: 10/19/2010
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)

Alpha Rate: 0.30 ± 0.10
Beta Rate: 8.33 ± 0.53

Efficiency (%)

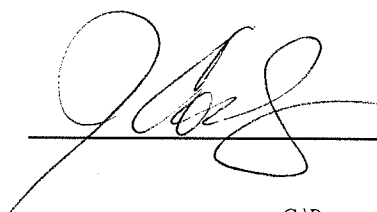
Alpha: 28.64 ± 0.08
Beta: 19.84 ± 0.07

Spillover (%)

Alpha to Beta: 6.13 ± 0.00
Beta to Alpha: 0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20101019161137-H12	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20101019162517-H11	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20101019162637-H13	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20101019162757-H14	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20101019162907-H15	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20101019163027-H16	Unknown	2.46	3.51	15.84	-22.06	10.43	62.29	
20101019163137-H17	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	
20101019163257-H18	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20101019163407-H19	Unknown	-1.04	0.35	15.84	-11.67	12.63	62.29	
20101019163527-H20	Unknown	-1.03	0.35	15.84	-36.87	5.70	62.29	

Reviewed by:

 10/20/10

Protocol# 4 - Low Energy Surveys.lsa

802 ROOF BALLAST

User: A7977

CAL DOE 11/10/2010

Cycle 1 Results

S#	Count	Time	CPMA	CPMB	tSIE	MESSAGES	DATE	TIME	DPM1
1	10.00		9	9	398.09	B	10/19/2010	3:35:47 PM	0
2	0.50		7	7	377.12	<	10/19/2010	3:47:29 PM	18
3	0.50		3	2	345.40	<	10/19/2010	3:49:30 PM	8



Memo

date: *May 9, 2011*

to: *Don Pfister, DOE*

from: *Andrew Lockwood, ERP*

subject: *32 Feet of 18-inch Vitrified Clay Pipe (VCP) from 815/830*

The Bldg. 815/830 18-inch vitrified clay pipe (VCP) off-gas line runs from a connection to the 42-inch off-gas line, between Bldgs 801 and 802, northeast to Bldgs 815 and 830. In accordance with the HFBR Record of Decision (ROD) 80-feet of the 18-inch VCP was to be removed. Immediately northeast and approximately one foot above the 18-inch VCPs connection to the 42-inch off gas line is an active high pressure steam line (HPS). The HPS is supported by a concrete culvert. The integrity of the concrete support below the HPS line was evaluated by an ERP project engineer and determined to be structurally compromised.

Previously completed projects have abandoned piping in-place including waste lines (A/B Waste Line Removal Project), sanitary lines (HFBR Underground Utilities Project), and off-gas lines (HFBR Underground Utilities Project) where interferences from structures or active utilities have hindered their removal.

The Field Sampling Plan (FSP), *Field Sampling Plan – HFBR Underground Utilities, Building 704 and Building 802, June 2010*, provides for piping to remain in place in accordance with RCD-FS-1005. The interior and exterior surfaces of the line have been surveyed. The results of these surveys are attached.

Survey results indicate no contamination above BNL Radiological Control Manual (RCM) Table 2-2 release criteria. Based on these results BSA is recommending that approximately 32-feet of the 18-inch VCP off-gas be left in place. The open ends of the 18-inch VCP will be blocked and grouted.

If you have any questions, please contact me at extension 8451.

cc: T. Jernigan
T. Kneitel
B. Deschamps



RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY ☐ Routine ☐ Special ☒ RWP# <u>2011-ERP-010</u> ☐ WP		INSTRUMENTS		CAL DUE	
Location / Equipment: 802 Imprint, 18" clay pipe.		Date: 05/03/11		Time: 1600		Model #	Serial #
						LB5100S4	32487
						LUD-3	72518
						LUD-2211	211780
						GELI γ Spec.	ERP Det. 01 & 02
						E-600	1629
						10/15/11	10/13/11
Survey: Locate / uncover clay pipe, radiological survey, video camera verification for structure integrity.							
Internal NaI Survey: Bkgd. Plane = 11600cpm @ 1ft. = 13600cpm @ 2ft. = 14800cpm @ 3ft. = 16600cpm @ 4ft. = 16900cpm @ 5ft. = 17600cpm @ 6ft. = 17500cpm @ 7ft. = 17600cpm @ 8ft. = 17400cpm @ 9ft. = 17800cpm @ 10ft. = 17800cpm @ 11ft. = 18000cpm @ 12ft. = 18300cpm							
LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION □ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm							
AIRBORNE ACTIVITY SURVEY							
Sample #		Duration		Flow Rate		Field Analysis	
						cpm	μCi/cc
N/A						% DAC	
						→	
DOSE RATE (HIGHEST)							
CONTACT READING				N/A			
GENERAL AREA READING				N/A			
MASSLINN SURVEY RESULTS (in dpm)							
1. < 1K		5. N/A		6.		7.	
2.		3.		4.		8.	
↓		↓		↓		↓	
SMEAR SURVEY RESULTS (dpm/100cm²) α, β, ³H							
1. See		8. Attached		15. Results		16. 2872 & 2873	
2. Batch		9. Numbers		10.		11.	
3.		4.		5.		6.	
7.		8.		9.		10.	
↓		↓		↓		↓	

Note:

- (A) LAS taken on the accessible surface areas of the internal pipe from the plane to 8ft., on external tools and equipment [not shown], all were equivalent to background at 50cpm and <1Kdpm .
- (B) Direct frisks taken on the accessible surface areas of the tools and equipment used, all were equivalent to background. Survey for [α] on the accessible internal surface area of the in ground pipe [shown above] net background was 0cpm and the surface areas checked were all equivalent to background. Also 100% NaI survey was taken in the first [3] section lengths of the in ground pipe and [12] one foot increment locations were recorded, see above legend. Direct frisks [β / γ] on pipe internal [plane to 5ft.] ranged from bkgd. to 30ccpm.
- (C) Smears taken, see page 2 of 4 Batch key 2872 and 3 of 4 Batch key 2873 for results.
 Page 2 of 4:
 (7) thru (11) taken on the internal pipe plane to 1. 5ft. .
 Page 3 of 4:
 (1) thru (7) taken on internal pipe with 1ft. intervals, starting at 2ft. Thru 8ft. .
 (8) thru (13) taken on the video camera and cable.
- (D) A total of [4] soil samples taken from surrounding soils, see page 4 of 4.
- (E) Video survey [not recorded] taken to verify the integrity of the pipe run, from the plane to about 50ft. .

Surveyed Sean A. Gully

Date: 05/05/11

Reviewed By: [Signature]

Date: 5/9/11

FS-SOP-1000

Attachment 9. 2

Sample Report

WEST END 18 IN. CLAY PIPE, EDGE OF PLANE TO 1.5 FT INTERNAL

Batch ID: 1min. Smear - 201105031205
Group: G
Device: HFBR
Batch Key: 2,872
Selected Geometry: 1/8" Stainless Steel

Count Date: 5/3/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Background (cpm)		Efficiency (%)		Spillover (%)	
Alpha Rate:	0.30 ± 0.10	Alpha:	28.64 ± 0.08	Alpha to Beta:	6.13 ± 0.00
Beta Rate:	8.33 ± 0.53	Beta:	19.84 ± 0.07	Beta to Alpha:	0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20110503120541-G7	Unknown	5.94	4.95	15.84	-17.33	11.59	62.29	
20110503120711-G8	Unknown	5.95	4.95	15.84	-32.44	7.62	62.29	
20110503120831-G9	Unknown	2.45	3.51	15.84	-1.90	14.50	62.29	
20110503120941-G10	Unknown	-1.03	0.35	15.84	-26.79	9.12	62.29	
20110503121101-G11	Unknown	-1.03	0.35	15.84	-31.83	7.61	62.29	

Reviewed by: _____

Page 2 of 4

Sample Report

Batch ID: 1min. Smear - 201105031756
Group: E
Device: HFBR
Batch Key: 2,873
Selected Geometry: 1/8" Stainless Steel

Count Date: 5/3/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)

Alpha: 28.64 ± 0.08
Beta: 19.84 ± 0.07

Spillover (%)

Alpha to Beta: 6.13 ± 0.00
Beta to Alpha: 0.08 ± 0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)	(dpm)
20110503175605-E1	Unknown	3.47	3.49	9.45	40.01	14.26	13.64	
20110503175735-E2	Unknown	3.46	3.49	9.45	65.21	18.18	13.64	
20110503175855-E3	Unknown	10.44	6.05	9.45	64.59	18.18	13.64	
20110503180005-E4	Unknown	3.48	3.49	9.45	19.85	10.08	13.64	
20110503180125-E5	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64	
20110503180245-E6	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20110503180355-E7	Unknown	6.93	4.94	9.45	95.14	21.97	13.64	
20110503180515-E8	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110503180625-E9	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110503180745-E10	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110503180855-E11	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64	
20110503181015-E12	Unknown	0.00	0.00	9.45	5.04	5.04	13.64	
20110503181135-E13	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64	

Reviewed by: 

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A
P. SULLIVAN 631 897-3202

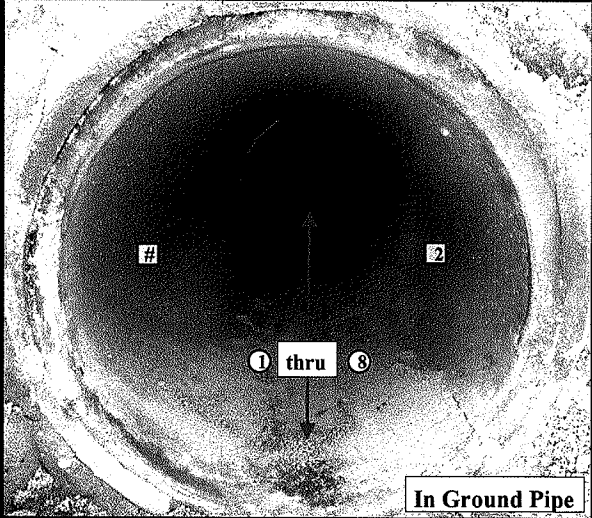
COUNT DATE: 05/04/2011-B

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	050411-003	1273	18" CLAY PIPE IMPRINT 01	BACKGROUND
2	050411-004	1186	18" CLAY PIPE IMPRINT 02	BACKGROUND
3	050411-005	1248	W. SIDE 18" CLAY PIPE OPENING	BACKGROUND
4	050411-006	1266	18" CLAY PIPE	BACKGROUND
5				
6				
7				
8				
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14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

P. Sullivan 05/04/11

4 SAMPLES TOTAL

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS		CAL DUE																						
		☐ Routine _____ ☐ Special _____ ☒ RWP# <u>2011-ERP-010</u> ☐ WP _____		Model #	Serial #																							
Location / Equipment: 802 Imprint, 18" clay pipe.		Date: 05/05/11	Time: 1600	LB5100S4	32487	07/16/11																						
Survey: Locate/uncover [12] 4ft. sections of clay pipe, radiological survey, extract, crush, package in TMDU.				LUD-3	72518	03/17/12																						
Internal NaI Survey: Bkgd. Plane = 10300cpm @ 1ft. = 15900cpm @ 2ft. = 17600cpm @ 3ft. = 17800cpm @ 4ft. = 18000cpm @ 5ft. = 18000cpm @ 6ft. = 18400cpm @ 7ft. = 18600cpm @ 8ft. = 19100cpm @ 9ft. = 18400cpm @ 10ft. = 17700cpm				LUD-2211		211780																						
				GELI γ Spec.		ERP Det. 01 & 02		10/15/11																				
				E-600		1652		10/13/11																				
18in. Clay Pipe: @ 11ft. = 17500cpm @ 12ft. = 19000cpm @ 13ft. = 18500cpm @ 14ft. = 18000cpm @ 15ft. = 18300cpm @ 16ft. = 18600cpm @ 17ft. = 18200cpm @ 18ft. = 17500cpm @ 19ft. = 17600cpm @ 20ft. = 18000cpm LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION ■ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXXY XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ																												
AIRBORNE ACTIVITY SURVEY <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Sample #</th> <th rowspan="2">Duration</th> <th rowspan="2">Flow Rate</th> <th colspan="2">Field Analysis</th> <th rowspan="2">% DAC</th> </tr> <tr> <th>cpm</th> <th>μCi/cc</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>								Sample #	Duration	Flow Rate	Field Analysis		% DAC	cpm	μCi/cc	N/A												
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			cpm	μCi/cc																								
N/A																												
DOSE RATE (HIGHEST) <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>CONTACT READING</td> <td>N/A</td> </tr> <tr> <td>GENERAL AREA READING</td> <td>N/A</td> </tr> </table>								CONTACT READING	N/A	GENERAL AREA READING	N/A																	
CONTACT READING	N/A																											
GENERAL AREA READING	N/A																											
MASSLINN SURVEY RESULTS (in dpm) <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. < 1K</td> <td>5. < 1K</td> </tr> <tr> <td>2.</td> <td>6.</td> </tr> <tr> <td>3.</td> <td>7.</td> </tr> <tr> <td>4. ↓</td> <td>8. thru 18. ↓</td> </tr> </table>								1. < 1K	5. < 1K	2.	6.	3.	7.	4. ↓	8. thru 18. ↓													
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2.	6.																											
3.	7.																											
4. ↓	8. thru 18. ↓																											
SMEAR SURVEY RESULTS (dpm/100cm²) α, β-γ, ³H <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1. See</td> <td>8. Attached</td> <td>15. Results</td> </tr> <tr> <td>2. Batch</td> <td>9. Number</td> <td>16. 2881</td> </tr> <tr> <td>3.</td> <td>10.</td> <td>17.</td> </tr> <tr> <td>4.</td> <td>11.</td> <td>18.</td> </tr> <tr> <td>5.</td> <td>12.</td> <td>19.</td> </tr> <tr> <td>6.</td> <td>13.</td> <td>20.</td> </tr> <tr> <td>7. ↓</td> <td>14. ↓</td> <td>21. ↓</td> </tr> </table>								1. See	8. Attached	15. Results	2. Batch	9. Number	16. 2881	3.	10.	17.	4.	11.	18.	5.	12.	19.	6.	13.	20.	7. ↓	14. ↓	21. ↓
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6.	13.	20.																										
7. ↓	14. ↓	21. ↓																										

Note:

- (A) LAS taken on the internal accessible surface areas of the [12] sections of the 18 inch clay pipe removed [not shown], on the first [2] sections of pipe in ground pipe, and on external surface of tools/equipment [not shown], all were equivalent to bkgd. at 50cpm and < 1Kdpm.
- (B) Direct frisks taken on the accessible internal surface area of the [12] removed sections of pipe for [B / γ] and internally on the first section of the in ground pipe, ranged between background and 20cpm to 30cpm > background. And direct frisk taken on the tools / equipment were equivalent to bkgd. and < 100ccpm. Survey for [α] on the accessible surface area of the in ground pipe, net background was 0cpm and the surface areas checked were equivalent to background. 100 % NaI survey was taken in the five sections of remaining in ground pipe, and [20] one foot increment locations were recorded, see above legend for results.
- (C) Smears taken, see page 2 of 3 for results.
 (1) thru (8) taken at 1ft. increments up to 8ft. .
- (D) A total of [20] soil samples taken from surrounding soils that encompassed the clay pipe, and [1] sample container of the crushed clay pipe, see page 3 of 3 for the results.

Sample Report

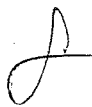
Batch ID: 1min. Smear - 201105051743
Group: E
Device: HFBR
Batch Key: 2,881
Selected Geometry: 1/8" Stainless Steel

Count Date: 5/5/2011
Count Minutes: 1.0
Count Mode: Simultaneous
Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to Beta:	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to Alpha:	0.08	±	0.00

<u>Sample ID</u>	<u>Sample Type</u>	<u>Alpha</u> <u>(dpm)</u>	<u>Unc</u>	<u>Alpha MDA</u> <u>(dpm)</u>	<u>Beta</u> <u>(dpm)</u>	<u>Unc</u>	<u>Beta MDA</u> <u>(dpm)</u>	<u>(dpm)</u>
20110505174337-E1	Unknown	3.48	3.49	9.45	19.85	10.08	13.64	
20110505174508-E2	Unknown	-0.02	0.01	9.45	35.28	13.33	13.64	
20110505174628-E3	Unknown	3.48	3.49	9.45	29.93	12.35	13.64	
20110505174738-E4	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110505174858-E5	Unknown	3.49	3.49	9.45	9.77	7.13	13.64	
20110505175018-E6	Unknown	3.47	3.49	9.45	40.01	14.26	13.64	
20110505175128-E7	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	
20110505175248-E8	Unknown	-0.01	0.01	9.45	25.20	11.27	13.64	

Reviewed by:



Page 2 of 3

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A
P. SULLIVAN 631 897-3202

COUNT DATE: 05/06/2011-A

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	050611-001	1233	CLAY PIPE OVERBURDEN - 020	¹³⁷ Cs (0.04 pCi/gm) + BACKGROUND
2	050611-002	1334	CLAY PIPE OVERBURDEN - 019	BACKGROUND
3	050611-003	1278	CLAY PIPE OVERBURDEN - 018	¹³⁷ Cs (0.05 pCi/gm) + BACKGROUND
4	050611-004	1379	CLAY PIPE OVERBURDEN - 017	BACKGROUND
5	050611-005	1284	CLAY PIPE OVERBURDEN - 016	¹³⁷ Cs (0.07 pCi/gm) + BACKGROUND
6	050611-006	1292	CLAY PIPE OVERBURDEN - 015	BACKGROUND
7	050611-007	1375	CLAY PIPE OVERBURDEN - 014	BACKGROUND
8	050611-008	1309	CLAY PIPE OVERBURDEN - 013	BACKGROUND
9	050611-009	1359	CLAY PIPE OVERBURDEN - 012	BACKGROUND
10	050611-010	1311	CLAY PIPE OVERBURDEN - 011	¹³⁷ Cs (0.05 pCi/gm) + BACKGROUND
11	050611-011	1296	CLAY PIPE OVERBURDEN - 010	BACKGROUND
12	050611-012	1241	CLAY PIPE OVERBURDEN - 009	BACKGROUND
13	050611-013	1321	CLAY PIPE OVERBURDEN - 008	BACKGROUND
14	050611-014	1268	CLAY PIPE OVERBURDEN - 007	BACKGROUND
15	050611-015	1319	CLAY PIPE OVERBURDEN - 006	BACKGROUND
16	050611-016	1307	CLAY PIPE OVERBURDEN - 005	¹³⁷ Cs (0.15 pCi/gm) + BACKGROUND
17	050611-017	1245	CLAY PIPE OVERBURDEN - 004	¹³⁷ Cs (0.10 pCi/gm) + BACKGROUND
18	050611-018	1304	CLAY PIPE OVERBURDEN - 003	¹³⁷ Cs (0.06 pCi/gm) + BACKGROUND
19	050611-019	1383	CLAY PIPE OVERBURDEN - 002	¹³⁷ Cs (0.04 pCi/gm) + BACKGROUND
20	050611-020	1333	CLAY PIPE OVERBURDEN - 001	BACKGROUND
21	050611-021	910	18" CLAY PIPE	BACKGROUND
22				
23				
24				
25				

21 SAMPLES TOTAL

Page 3 of 3

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A
P. SULLIVAN 631 897-3202

COUNT DATE: 05/06/2011-A

PAGE 1 OF 1

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5	050611-005	1284	CLAY PIPE OVERBURDEN - 016	¹³⁷ Cs (0.07 pCi/gm) + BACKGROUND
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9	050611-009	1359	CLAY PIPE OVERBURDEN - 012	BACKGROUND
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17	050611-017	1245	CLAY PIPE OVERBURDEN - 004	¹³⁷ Cs (0.10 pCi/gm) + BACKGROUND
18	050611-018	1304	CLAY PIPE OVERBURDEN - 003	¹³⁷ Cs (0.06 pCi/gm) + BACKGROUND
19	050611-019	1383	CLAY PIPE OVERBURDEN - 002	¹³⁷ Cs (0.04 pCi/gm) + BACKGROUND
20	050611-020	1333	CLAY PIPE OVERBURDEN - 001	BACKGROUND
21	050611-021	910	18" CLAY PIPE	BACKGROUND
22				
23				
24				
25				

P. Sullivan 05/06/2011

21 SAMPLES TOTAL

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: DET01

Report Generated On : 5/6/2011 1:12:05 PM

Sample Title : 050611-021
Sample Description : 18" CLAY PIPE
Sample Identification :
Sample Type :
Sample Geometry :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 2.000 keV

Sample Size : 9.100E+002 GRAM

Sample Taken On : 5/5/2011 10:45:00 AM
Acquisition Started : 5/6/2011 1:01:50 PM

Live Time : 600.0 seconds
Real Time : 600.4 seconds

Dead Time : 0.07 %

Energy Calibration Used Done On : 10/14/2010
Efficiency Calibration Used Done On : 10/15/2010
Efficiency ID : DET01 500ml Mari

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 050611-021
 Nuclide Library Used: C:\GENIE2K\CAMFILES\BNL_Soil.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GRAM)	Activity Uncertainty	Coinc Corr
K-40	0.992	1460.75*	10.67	1.75040E+001	2.86099E+000	miss
CD-109	0.976	88.03*	3.61	2.36709E+000	7.48722E-001	miss
PB-212	0.970	74.81*	10.50	1.52558E+001	1.78583E+000	miss
		77.11*	17.60	1.03974E+001	1.11759E+000	miss
		238.63*	43.60	7.24443E+000	1.28006E+000	miss
TH-232	0.968	63.81	0.27			
		968.97*	16.20	1.23452E+000	2.50242E-001	miss
U-235	0.564	143.76	10.90			
		163.33	5.00			
		185.71*	57.50	1.63743E-001	2.39473E-002	miss
		205.31	5.00			
U-238	0.840	92.60*	3.57	3.76766E+000	9.79313E-001	miss
		1001.03	0.59			

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000 keV

Nuclide confidence index threshold = 0.45

Errors quoted at 1.000 sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

 ***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/GRAM)	Wt mean Activity Uncertainty
K-40	0.992	1.750396E+001	2.860989E+000
CD-109	0.976	2.367085E+000	7.487218E-001
PB-212	0.970	1.016505E+001	7.616119E-001
TH-232	0.968	1.234520E+000	2.502416E-001
U-235	0.564	1.637433E-001	2.394727E-002
U-238	0.840	3.767660E+000	9.793134E-001

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

***** U N I D E N T I F I E D P E A K S *****

Peak Locate Performed on: 5/6/2011 1:11:51 PM
 Peak Locate From Channel: 100
 Peak Locate To Channel: 4096

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
F 7	270.16	7.4511E-002	22.00	Tol.	AC-228
F 8	295.32	2.7806E-001	25.49	Tol.	PB-214
F 9	338.17	1.9037E-001	10.94	Tol.	AC-228
F 10	351.96	5.6700E-001	12.01	Tol.	PB-214
F 11	510.82	1.4289E-001	11.84		
F 12	583.49	3.1018E-001	18.93	Tol.	EU-154
F 13	609.56	4.1330E-001	14.08	Tol.	BI-214
F 14	727.99	8.9039E-002	38.64		
F 15	768.34	4.2448E-002	29.05		
F 16	912.42	2.0037E-001	1.51	Tol.	AC-228
F 18	1120.74	9.1614E-002	15.28	Tol.	BI-214
F 20	1765.06	9.4121E-002	13.04	Tol.	BI-214

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

***** N U C L I D E M D A R E P O R T *****

Detector Name: DET01
Sample Geometry:
Sample Title: 050611-021
Nuclide Library Used: C:\GENIE2K\CAMFILES\BNL_Soil.NLB

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GRAM)	Nuclide MDA (pCi/GRAM)	Activity (pCi/GRAM)	Coinc Corr
CO-60	1173.24	99.90	8.1607E-002	7.08E-002	1.5236E-002	0.875
	1332.50	99.98	7.0810E-002		6.2131E-003	0.873
CS-137	661.66	85.21	6.6251E-002	6.63E-002	2.3874E-002	miss
EU-152	121.78	28.58	2.1002E-001	2.06E-001	1.4587E-002	0.868
	244.70	7.49	7.9406E-001		-1.0290E+000	0.848
	344.28	26.50	2.0551E-001		-1.5533E-002	0.906
	411.11	2.23	2.5735E+000		3.5483E-001	0.821
	443.98	2.78	2.0066E+000		-2.2111E-002	0.850
	778.90	12.94	4.1751E-001		1.8372E-002	0.891
	867.39	4.15	1.2841E+000		-7.6690E-002	0.865
	964.13	14.60	4.9347E-001		-2.3201E-001	0.948
	1112.12	13.64	5.3530E-001		7.0849E-002	0.978
	1212.95	1.40	5.4964E+000		-6.5299E-001	0.868
	1299.12	1.63	4.5868E+000		1.0564E+000	0.891
	1408.01	21.00	3.5491E-001		1.3871E-001	0.968
EU-154	123.07	40.40	1.4477E-001	1.45E-001	-5.4471E-003	0.863
	188.25	0.23	2.4327E+001		8.8756E+000	free
	247.93	6.83	7.8042E-001		-2.1355E-001	0.817
	401.30	0.19	2.5553E+001		6.7254E-001	miss
	444.39	0.55	8.3107E+000		-9.5372E-001	free
	478.26	0.21	2.4857E+001		1.0104E+001	free
	557.56	0.25	1.7930E+001		-4.0241E+000	free
	582.00	0.89	1.2697E+001		2.5210E+001	free
	591.76	4.91	1.0463E+000		-9.3426E-002	0.820
	625.22	0.32	1.4952E+001		1.3139E+000	free
	676.59	0.14	3.8926E+001		2.2658E-001	free
	692.42	1.78	3.1438E+000		2.1573E-001	0.873
	715.76	0.17	2.8764E+001		-3.0582E+000	free
	722.30	20.00	2.9506E-001		-1.8288E-001	0.852
	756.86	4.50	1.3388E+000		1.8398E-001	0.842
	815.55	0.50	8.8419E+000		-1.2219E-001	miss
	845.39	0.58	8.5443E+000		-7.0143E-001	free
	850.64	0.23	2.1037E+001		-1.4463E+000	free
	873.20	12.09	3.9932E-001		-1.7193E-001	0.857
	892.73	0.50	1.0098E+001		2.0707E+000	free
	904.05	0.85	6.1000E+000		-7.4446E-001	free
	996.30	10.34	4.7482E-001		-1.1585E-001	0.922
	1004.76	17.90	3.5286E-001		1.2119E-001	0.951
	1128.40	0.29	1.7575E+001		-1.2156E+001	free
	1140.90	0.22	3.3196E+001		1.3201E+001	miss
	1241.60	0.13	6.7617E+001		-7.3757E+000	miss
	1246.60	0.80	8.5032E+000		-6.5506E-001	free

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GRAM)	Nuclide MDA (pCi/GRAM)	Activity (pCi/GRAM)	Coinc Corr
	EU-154	1274.51	34.40	1.6175E-001	1.45E-001	-9.6984E-002	0.963
		1494.08	0.71	8.0813E+000		1.9577E+000	miss
		1596.45	1.80	1.5773E+000		-1.1396E-001	1.362
+	U-235	143.76	10.90	4.5287E-001	1.19E-001	-1.3930E-001	miss
		163.33	5.00	1.0249E+000		-2.4077E-001	miss
		185.71*	57.50	1.1945E-001		1.6374E-001	miss
		205.31	5.00	1.0069E+000		-1.9740E-002	miss
+	U-238	92.60*	3.57	2.5495E+000	2.55E+000	3.7677E+000	miss
		1001.03	0.59	8.0111E+000		-2.1331E+000	miss
	AM-241	59.54	35.90	5.0630E-001	5.06E-001	2.7966E-002	miss

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A
P. SULLIVAN 631 897-3202

COUNT DATE: 04/28/2011-B

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	042811-006	709	18" CLAY PIPE - BLDG. 802	BACKGROUND
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

1 SAMPLE TOTAL

***** GAMMA SPECTRUM ANALYSIS *****

Filename: DET02

Report Generated On : 4/28/2011 2:06:25 PM

Sample Title : 042811-006
Sample Description : 18" CLAY PIPE BLDG. 802
Sample Identification :
Sample Type :
Sample Geometry :

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 100 - 4096
Peak Area Range (in channels) : 100 - 4096
Identification Energy Tolerance : 2.000 keV

Sample Size : 7.090E+002 GRAM

Sample Taken On : 4/28/2011 11:00:00 AM
Acquisition Started : 4/28/2011 1:56:06 PM

Live Time : 600.0 seconds
Real Time : 600.6 seconds

Dead Time : 0.10 %

Energy Calibration Used Done On : 10/14/2010
Efficiency Calibration Used Done On : 10/15/2010
Efficiency ID : DET02 500ml Mari

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 042811-006
 Nuclide Library Used: C:\GENIE2K\CAMFILES\BNL_Soil.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/GRAM)	Activity Uncertainty	Coinc Corr
K-40	0.999	1460.75*	10.67	1.55400E+001	2.38381E+000	miss
PB-212	0.999	74.81*	10.50	2.27233E+000	3.14926E-001	miss
		77.11*	17.60	1.61751E+000	1.99544E-001	miss
		238.63*	43.60	1.37486E+000	1.16748E-001	miss
BI-214	0.672	609.31*	44.80	6.31755E+002	9.81379E+001	0.876
		1120.29*	14.80	5.28861E+002	1.68437E+002	0.876
		1764.49*	15.36	6.91818E+002	1.75878E+002	1.002
PB-214	0.805	77.11*	9.90	2.54902E+002	5.07247E+001	miss
		241.98*	7.50	1.43317E+002	3.03801E+001	miss
		295.21*	18.50	1.12395E+002	2.40163E+001	miss
		351.92*	35.80	1.22232E+002	2.24586E+001	miss
TH-232	0.973	63.81	0.27			
		968.97*	16.20	8.64734E-001	2.27417E-001	miss
U-235	0.567	143.76	10.90			
		163.33	5.00			
		185.71*	57.50	1.62044E-001	3.39115E-002	miss
		205.31	5.00			

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 2.000 keV

Nuclide confidence index threshold = 0.45

Errors quoted at 1.000 sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

 ***** I N T E R F E R E N C E C O R R E C T E D R E P O R T *****

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/GRAM)	Wt mean Activity Uncertainty
K-40	0.999	1.553998E+001	2.383806E+000
PB-212	0.999	1.340973E+000	9.117596E-002
BI-214	0.672	6.270185E+002	9.339638E+001
PB-214	0.805	1.166380E+002	1.983533E+001
TH-232	0.973	8.647338E-001	2.274174E-001
U-235	0.567	1.620442E-001	3.391154E-002

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000 sigma

***** U N I D E N T I F I E D P E A K S *****

Peak Locate Performed on: 4/28/2011 2:06:07 PM
 Peak Locate From Channel: 100
 Peak Locate To Channel: 4096

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS % Uncertainty	Peak Type	Tol. Nuclide
4	209.32	7.1300E-002	39.56	Tol.	AC-228
8	338.30	9.7129E-002	23.07	Tol.	AC-228
10	583.14	2.6454E-001	9.43	Tol.	EU-154
12	727.49	5.6163E-002	22.78		
13	911.21	1.7865E-001	11.07	Tol.	AC-228

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

***** N U C L I D E M D A R E P O R T *****

Detector Name: DET02

Sample Geometry:

Sample Title: 042811-006

Nuclide Library Used: C:\GENIE2K\CAMFILES\BNL_Soil.NLB

Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GRAM)	Nuclide MDA (pCi/GRAM)	Activity (pCi/GRAM)	Coinc Corr
CO-60	1173.24	99.90	7.5451E-002	5.74E-002	9.2573E-003	0.875
	1332.50	99.98	5.7374E-002		-1.3754E-002	0.873
CS-137	661.66	85.21	5.6939E-002	5.69E-002	-4.3808E-003	miss
EU-152	121.78	28.58	1.8165E-001	1.58E-001	3.7554E-002	0.868
	244.70	7.49	6.3851E-001		-2.7830E-001	0.848
	344.28	26.50	1.5790E-001		-9.0126E-003	0.906
	411.11	2.23	2.0657E+000		-5.6528E-001	0.821
	443.98	2.78	1.7293E+000		-2.2539E-001	0.850
	778.90	12.94	3.6802E-001		1.3531E-002	0.891
	867.39	4.15	1.3920E+000		-3.9955E-002	0.865
	964.13	14.60	5.6595E-001		-7.5831E-002	0.948
	1112.12	13.64	4.5913E-001		2.8930E-002	0.978
	1212.95	1.40	4.4297E+000		-1.7700E+000	0.868
	1299.12	1.63	4.1115E+000		6.9412E-001	0.891
	1408.01	21.00	3.4020E-001		1.3866E-001	0.968
EU-154	123.07	40.40	1.2723E-001	1.27E-001	1.0801E-002	0.863
	188.25	0.23	1.9255E+001		-6.3638E-001	free
	247.93	6.83	8.3403E-001		2.3575E-001	0.817
	401.30	0.19	2.0805E+001		-2.5962E+000	miss
	444.39	0.55	7.0400E+000		-1.7738E+000	free
	478.26	0.21	1.8772E+001		-2.1553E+000	free
	557.56	0.25	2.2031E+001		3.9589E-002	free
	582.00	0.89	1.4749E+001		2.9440E+001	free
	591.76	4.91	1.1229E+000		-1.8210E-001	0.820
	625.22	0.32	1.6820E+001		3.3890E+000	free
	676.59	0.14	3.3861E+001		-7.7951E+000	free
	692.42	1.78	3.9171E+000		1.5703E+000	0.873
	715.76	0.17	3.0912E+001		-8.4515E-001	free
	722.30	20.00	3.0107E-001		-5.2743E-002	0.852
	756.86	4.50	1.3939E+000		2.1944E-001	0.842
	815.55	0.50	8.2760E+000		-4.4991E+000	miss
	845.39	0.58	9.4726E+000		1.0526E+000	free
	850.64	0.23	3.0197E+001		1.1671E+001	free
	873.20	12.09	3.9183E-001		-2.0904E-001	0.857
	892.73	0.50	1.1109E+001		2.2763E+000	free
	904.05	0.85	7.5849E+000		2.6876E+000	free
	996.30	10.34	6.1988E-001		9.4088E-002	0.922
	1004.76	17.90	3.4902E-001		9.2708E-002	0.951
	1128.40	0.29	1.8534E+001		-4.3805E-001	free
	1140.90	0.22	2.9537E+001		7.3413E+000	miss
	1241.60	0.13	4.0743E+001		-4.2646E+001	miss
	1246.60	0.80	1.0241E+001		4.0122E+000	free

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/GRAM)	Nuclide MDA (pCi/GRAM)	Activity (pCi/GRAM)	Coinc Corr
	EU-154	1274.51	34.40	1.8635E-001	1.27E-001	1.5975E-002	0.963
		1494.08	0.71	9.2725E+000		2.3742E+000	miss
		1596.45	1.80	1.6415E+000		-1.2153E-001	1.362
+	U-235	143.76	10.90	4.4343E-001	9.69E-002	2.3819E-001	miss
		163.33	5.00	8.9388E-001		2.0161E-001	miss
		185.71*	57.50	9.6933E-002		1.6204E-001	miss
		205.31	5.00	8.7815E-001		-9.6035E-002	miss
	U-238	92.60	3.57	2.2185E+000	2.22E+000	2.4137E+000	miss
		1001.03	0.59	8.4672E+000		-1.6010E+000	miss
	AM-241	59.54	35.90	4.7046E-001	4.70E-001	-2.5376E-002	miss

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

BROOKHAVEN
NATIONAL LABORATORYmanaged by Brookhaven Science Associates
for the U.S. Department of Energy

Memo

date: May 12, 1999

to: T. Doyle

from: R. Miltenberger *RM*

subject: Disposal of Clay Pipe from Building 830 Remedial Action

As per your request, I have examined the analytical data from the clay pipe samples that you submitted for determination if there is BNL radioactivity present in/on the pipe. As I understand the history of the clay pipe samples, sample ID 99042908-01 is a representative sample of the clay storm water pipe that was in contact with radiologically contaminated soil from Building 830 operations. The principle radionuclides in the soil that was remediated were ^{137}Cs , ^{60}Co , and ^{241}Am . The remaining two samples (ID numbers 99050710-01 and 99050710-02) are representative of storm water pipe that was located upstream and down stream of the contamination area. These samples were collected as blanks to determine the natural radioactivity content present in the clay tile, since there is no expectation that radioactive material was discharged into the storm system. Each sample of storm water pipe was crushed and 300 grams were analyzed for gamma emitting radionuclides, using high purity gamma spectroscopy.

The results, common to the three samples, are presented in Table 1. The principle radionuclide of concern in the pipe sample from the soil contaminated area was ^{235}U because that radionuclide could potentially be related to BNL operations.

The results presented in Table 1 indicate that the concentrations of the radionuclides detected in the section of clay storm water pipe, that was in contact with the contaminated soil, are equivalent to the blank samples. Based on these results and the knowledge of the radionuclides present in the remediated soil, the clay pipe does not contain BNL added radioactivity. Consequently, the material can be disposed of as routine construction debris.

Should you have any questions, please contact me at extension 2503.

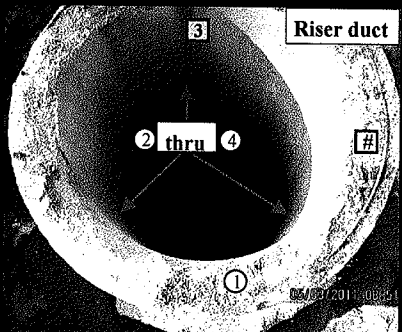
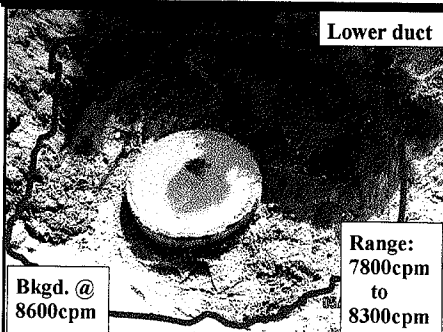
C: A. Eppler

GW3420.99

Table 1

Comparison of Analytical Results for Clay Storm-Drain Pipe from Contaminated Soil Area and Clay Pipe from Uncontaminated Soil Areas

Nuclide	Blank Sample #1		Blank Sample #2		Average Blank Concentration, uCi/g	Ratio 99042908 to Ave. Blank	Sample from Contaminated Soil	
	Sample 99050710-01	2 Sigma Error	Sample 99050710-02	2 Sigma Error			Sample 99042908-01	2 Sigma Error
	Concentration, uCi/g	uCi/g	Concentration, uCi/g	uCi/g			Concentration, uCi/g	UCi/g
K-40	2.65E-05	4.20E-06	2.66E-05	4.24E-06	2.66E-05	1.01E+00	2.68E-05	4.96E-06
CD-109	6.22E-06	1.42E-06			6.22E-06			
TL-208	7.32E-07	1.21E-07	7.14E-07	1.15E-07	7.23E-07	1.05E+00	7.62E-07	2.06E-07
BI-212	1.40E-06	2.22E-07			1.40E-06			
PB-212	2.13E-06	2.94E-07	1.91E-06	2.83E-07	2.02E-06	1.00E+00	2.02E-06	3.49E-07
BI-214	1.97E-06	1.96E-07	1.86E-06	1.98E-07	1.92E-06	9.14E-01	1.75E-06	3.54E-07
PB-214	2.02E-06	3.41E-07	1.92E-06	2.34E-07	1.97E-06	9.49E-01	1.87E-06	3.30E-07
RA-224	2.60E-06	1.51E-06	1.87E-06	1.17E-06	2.24E-06			
AC-228	1.83E-06	2.05E-07	1.94E-06	2.32E-07	1.89E-06	1.07E+00	2.02E-06	4.46E-07
TH-232	2.48E-06	4.48E-07	1.87E-06	3.62E-07	2.18E-06			
U-235	2.48E-07	2.41E-07			2.48E-07	1.20E+00	2.97E-07	1.74E-07

RADIOLOGICAL SURVEY FORM FS-SOP-1000		REASON FOR SURVEY		INSTRUMENTS	
		☐ Routine ☐ Special ☒ RWP# <u>2011-ERP-010</u> ☐ WP		Model #	Serial #
Location / Equipment: 802 Imprint, 901A off gas duct.		Date: 05/03/11	Time: 1000	LB5100S4	32487
Survey: Down size metal duct / cement duct, plug duct with cement and cap, NaI w/over soil, take [2] soil samples.				LUD-3	72518
				LUD-2221	211780
				GELI γ Spec.	ERP Det. 01 & 02
				N/A	10/15/11
  					
LEGEND ○ - SMEAR SURVEY LOCATION ▲ - AIR SAMPLE LOCATION ☐ - MASSLINN SURVEY LOCATION # - DIRECT FRISK LOCATION C - CONTAMINATION * - CONTACT XXX XXX = contact reading Y = radiation type ZZZ = reading @ 30cm ZZZ					
AIRBORNE ACTIVITY SURVEY					
Sample #	Duration	Flow Rate	Field Analysis		% DAC
N/A			cpm	μCi/cc	
DOSE RATE (HIGHEST)					
CONTACT READING			N/A		
GENERAL AREA READING			N/A		
MASSLINN SURVEY RESULTS (in dpm)					
1. < 1K			5. N/A		
2.			6.		
3.			7.		
4.			8.		
SMEAR SURVEY RESULTS (dpm/100cm²) α, β-, ³H					
1. See	8. Attached	15. Results			
2. Batch	9. Number	16. 2870			
3.	10.	17.			
4.	11.	18.			
5.	12.	19.			
6.	13.	20.			
7.	14.	21.			

Note:

- (A) LAS taken on the accessible external surface areas of the metal articulated conduit, external / internal surface areas of the cement riser / bottom elbow conduit, tools / equipment, all were equivalent to bkgd. @ 50cpm and < 1Kdpm.
- (B) Direct frisks on the cement riser top and sides, internal lower elbow duct, all were equivalent to bkgd. and < 100ccpm.
- (C) Smears taken, see page 2 of 2 for results.
 (1) taken on the riser rim surface.
 (2) thru (4) taken on the internal riser surface.
 (5) thru (6) taken on the internal lower duct elbow [not shown].
- (D) NaI walk over of the surrounding soil area of the plugged lower duct, high lighted in blue. Background was at 8600cpm and the range was between 7800cpm and 8300cpm.
- (E) Soil samples (2) taken from surrounding soils by plugged lower duct, see page 3 of 3.

Surveyed Sean A. Gully Date: 05/04/11 Reviewed By: [Signature] Date: 5/7/11
 FS-SOP-1000
 Attachment 9.2

Sample Report

I/S 901A OFF GAS COVER

Batch ID: 1min. Smear - 201105031151
 Group: E
 Device: HFBR
 Batch Key: 2,870
 Selected Geometry: 1/8" Stainless Steel

Count Date: 5/3/2011
 Count Minutes: 1.0
 Count Mode: Simultaneous
 Operating Volts: 1350

Efficiency (%)				Spillover (%)			
Alpha:	28.64	±	0.08	Alpha to	6.13	±	0.00
Beta:	19.84	±	0.07	Beta to	0.08	±	0.00

Sample ID	Sample Type	Alpha (dpm)	Unc	Alpha MDA (dpm)	Beta (dpm)	Unc	Beta MDA (dpm)
20110503115132-E1	Unknown	-0.01	0.00	9.45	15.12	8.73	13.64
20110503115302-E2	Unknown	-0.02	0.01	9.45	40.32	14.26	13.64
20110503115422-E3	Unknown	-0.01	0.00	9.45	10.08	7.13	13.64
20110503115532-E4	Unknown	0.00	0.00	9.45	0.00	0.00	13.64
20110503115652-E5	Unknown	3.47	3.49	9.45	34.97	13.34	13.64
20110503115812-E6	Unknown	-0.01	0.01	9.45	20.16	10.08	13.64

Reviewed by: _____



Page 2 of 3

ERP GAMMA ANALYSIS SUMMARY

C.O.C. # N/A
P. SULLIVAN 631 897-3202

COUNT DATE: 05/04/2011-A

PAGE 1 OF 1

LINE #	SAMPLE #	WEIGHT (GRAMS)	SAMPLE DESCRIPTION / LOCATION	RESULTS
1	050411-001	1193	901A OFFGAS LINE IMPRINT 01	BACKGROUND
2	050411-002	1237	901A OFFGAS LINE IMPRINT 02	¹³⁷ Cs (0.08 pCi/gm) + BACKGROUND
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

2 SAMPLES TOTAL

Page 3 of 3

APPENDIX B

Building 802 Legacy Fuel Oil Spill Report

Environmental Protection Division
CHEMICAL AND OIL SPILL REPORTING FORM

11-10

INITIAL NOTIFICATION		Date: 03/30/11	Time: 1100
By (Name, Affiliation):		Charles Schaefer, Environmental Restoration Projects	
Personnel Responding at Scene:		Jason Remien (Spill Response), Tom Doyle (ERP), Bill Needrith (ERP), Charles Schaefer (ERP)	
SPILL INFORMATION		Date: 3/30/11	Time: 1030
Material Spilled:	diesel fuel		
Source of spill:	Legacy Spill from an aboveground fuel oil tank associated with Building 820.		
Quantity:	<10 Gallons	Location:	South of former Building 802
Resp. Dept:	Environmental	P.O.C.	Andy Lockwood
Fire & Rescue Incident Response #:	NA	ORPS Reportable:	No
DETAILS AND REMEDIAL ACTION			
A smell of diesel fuel was detected during excavation activities associated with the demolition of Building 802 by the Environmental Restoration Projects (ERP) Group on April 30, 2011. Originally, it was thought that the impacted soil might be related to a legacy spill from an underground storage tank (UST) in the area. However, after investigating the history of this facility a determination was made that no UST's were present in the area. An older, 275-gallon aboveground storage tank (AST) was formerly located outside near the northwest corner of the building and is the most likely source of the spill. Please see the attached document titled, "Building 802 Legacy Spill Photos (3-31-11)" for photographs and more details on the initial spill cleanup efforts. Most of the impacted soil was removed as part of the initial cleanup. However, some soil could not be excavated until a 42" off-gas line was removed. Permission was granted by NYSDEC to cover the bottom of the excavation with plastic to mark the area and protect it from rain infiltration until the remainder of impacted soil could be removed. It was not until the end of April that ERP personnel were able to remove the rest of the impacted soil. Soil removed from the excavation on April 28, 2011 was scanned with a PID. The maximum reading was 2.0 ppmv with a majority of the readings at background, and no visual or olfactory evidence of petroleum was noted. One end-point sample was collected from the bottom of the excavation. The reason for this is that the area impacted (at depth) ended up being very localized. The sample was collected from inside the excavator's bucket since we could not go down into the excavation and it was too far to reach with extension poles. Additional samples were collected from the stockpile of soil in hopes of the concentrations being below limits and being able to use it as backfill. Attached to this spill report is a summary of the analytical results from the endpoint sample and the stockpile composite sample. No VOCs were detected and all SVOC results were below NYSDEC Part 375 unrestricted use Soil Cleanup Objectives. Based on these results, ERP personnel sought approval to backfill the excavation including the use of the stockpile of suspect contaminated soil. The NYSDEC reviewed the results and on May 11, 2011 informed BNL that no further actions were required regarding the excavation and the area could be backfilled. However, they did not give permission to use the stockpile of suspect soil as backfill. The reason for this is that slight to moderate odors were observed in the vicinity of the uncovered stockpile during a NYSDEC site visit. The NYSDEC representative explained that even though the analytical results indicated that concentrations were well below cleanup objectives, if the soil exhibits nuisance characteristics (i.e. odor/staining) it can not be used as backfill material. Based on this information ERP personnel agreed to dispose of the stockpile of suspect soil along with the original impacted soil. Attached are some additional photographs of the final excavation, soil sampling activities, and loading of the roll-off containers. In total, two (2) twenty yard roll-off containers of impacted and suspect petroleum contaminated soil were generated and will be disposed of by ERP. The final waste manifests will be provided to NYSDEC once received in order to close out this spill officially. Any further questions regarding this spill should be forwarded to Jason Remien, Environmental Protection Division (344-3477).			
POSSIBLE HEALTH OR FIRE HAZARDS:			No
POTENTIAL FOR GROUND WATER CONTAMINATION:			No
Sampled:	Yes		

Type of samples:	Soils Sampled,		Number of Samples:	1
Location:				
GOVERNMENT NOTIFICATION REQUIRED	NYSDEC	Yes	Person Notified	Time Notified
	EPA	No		
	SCDHS	Yes		
NYSDEC, Albany, 24-hr No.: 518-457-7362	NYDEC Spill #:	1012995		1150
EPA National Response Center: 1-800-424-8802	EPA NRC Ref. #:			
SCDHS: 631-854-2502	SCDHS Spill No.:		R. Markel	1155
NOTIFICATION OF DOE OFFICE REQUIRED	Yes		Person Notified	Time Notified
	Brookhaven Group, G. Granzen - Ext. 4089 or R. Desmarais - Ext 5434		G. Granzen	1156
NOTIFICATION OF DIRECTORS OFFICE REQUIRED	Yes		Person Notified	Time Notified
	G. Goode - Ext. 4549		G. Goode	1156
ADDITIONAL COMMENTS	0			
Report Filed By: JDR			Date: 6/2/11	

Cc:	D. Bauer	J. Haskins	G. Olsen
	A. Bou	B. Hooda	D. Paquette
	F. Craner	R. Howe	P. Pohlott
	W. Dorsch	T. Lambertson	J. Remien
	S. Ferrone	R. Lee	K. Schwager
	G. Goode	S. Moss	J. Selva
	G. Granzen	E. Murphy	J. Williams
Add'l CCs:	N. Acampora (NYSDEC)	L. Ducoing (SCDHS)	W. Needrith
	G. Condemi	T. Kneitel	C. Schaefer
	T. Doyle	A. Lockwood	

EC100ER.11

**Building 802 Legacy Diesel Fuel Oil Spill
(BNL Spill #11-10)**



Picture of Building 802 prior to D&D
Approximate location of spill site



Approx. 3 cubic yards of contaminated soil removed.

Building 802 Legacy Diesel Fuel Oil Spill (BNL Spill #11-10)

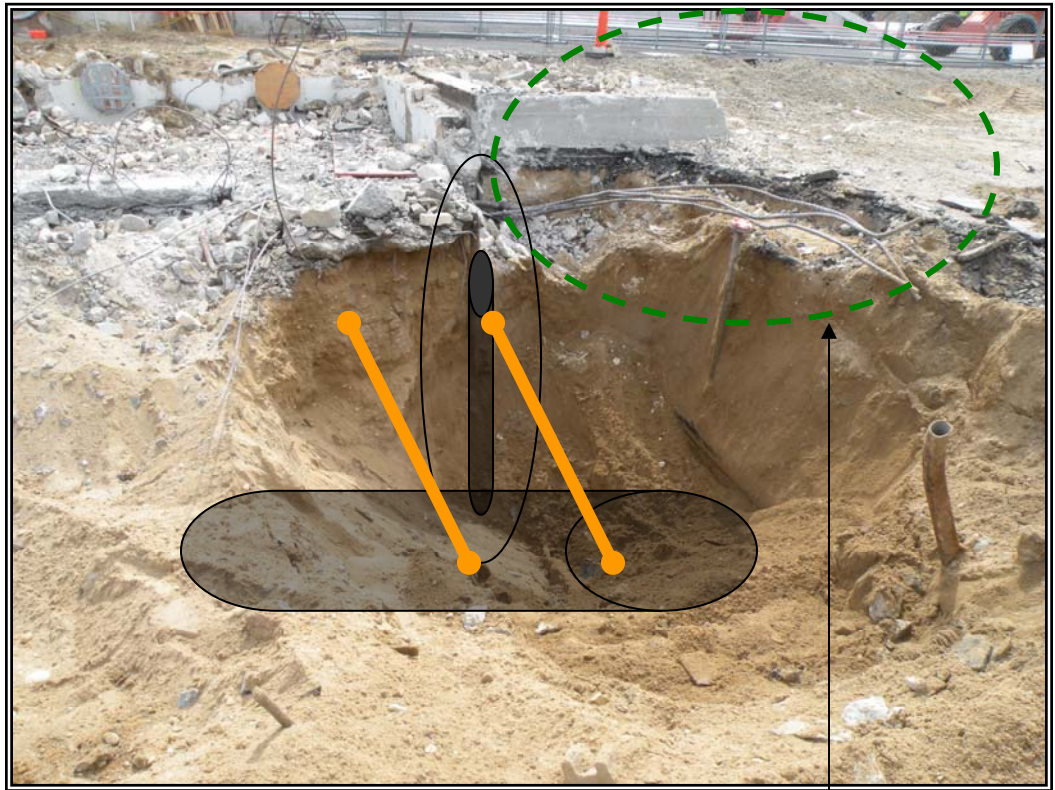
BEFORE

Legacy spill most likely occurred at ground surface and seeped into the soil along the concrete footing (orange line) and down a 4" vertical pipe penetration, which you can't really see in this picture but is superimposed in black. This vertical pipe eventually connects to a 42" acid off-gas line (not exposed yet).



AFTER (Not to Scale)

Concrete footing and rebar removed along with approximately 3 cubic yards of impacted soil. Areas to the right and left of the two orange lines were not impacted by this legacy spill. Soil between the two lines and from the top of the superimposed 42" off-gas line to ground surface was contaminated and removed from the excavation. Some impacted soil remains below the 42", which will not be removed until the line comes out. Plastic was placed on top of the pipe to mark the area of contamination and protect from rain infiltration.

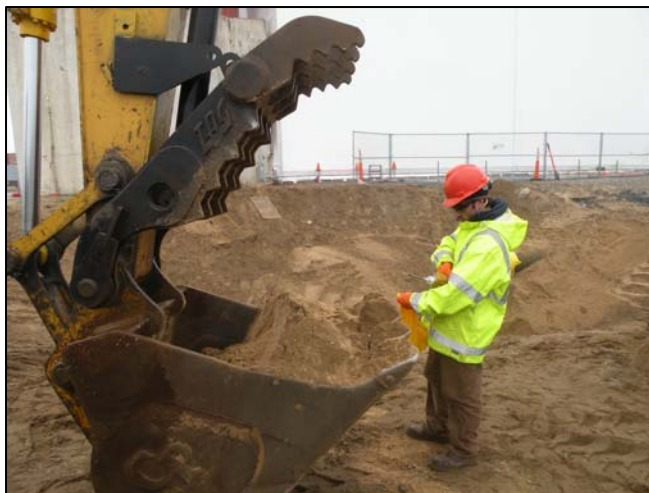


Original aboveground diesel fuel oil tank was located in this area. Copper supply and return lines went through the concrete wall into Building 802 where the emergency generator was located.

**Building 802 Legacy Spill
Photographs of Final Cleanup, Sampling and Waste Loading Activities**



Final bucket used for the collection of the endpoint sample.



Sample technician collecting endpoint sample from excavator's bucket.



Sample technician in process of collecting samples from the stockpile of suspect soil (Looking south).

**Building 802 Legacy Spill
Photographs of Final Cleanup, Sampling and Waste Loading Activities**



Heavy equipment operator in the process of loading the stockpile in a roll-off container (Looking west).



Heavy equipment operator loading soil into roll-off container.

Table 1

Soil Sample Analytical Data Summary
Volatile Organic Compounds
Fanhouse Building 802

		Restricted Use SCOs ²				BNL COC 29549	
SAMPLE ID	Unrestricted Use SCO ¹	Residential	Restricted Residential SCO	Commercial SCO	Industrial SCO	29549-001 277110001 4/28/2011 0	29549-002 277110002 4/28/2011 0
LAB SAMPLE ID							
SAMPLING DATE							
SAMPLE DEPTH (ft.)							
Volatile Organics by EPA 8260B in µg/kg							
1,1,1-Trichloroethane	680	100,000	100,000	500,000	1,000,000	0.313 U	0.314 U
1,1,2,2-Tetrachloroethane	NS	NS	NS	NS	NS	0.313 U	0.314 U
1,1,2-Trichloroethane	NS	NS	NS	NS	NS	0.313 U	0.314 U
1,1-Dichloroethane	270	19,000	26,000	240,000	480,000	0.313 U	0.314 U
1,1-Dichloroethene	330	100,000	100,000	500,000	1,000,000	0.313 U	0.314 U
1,2-Dichloroethane	20	2,300	3,100	30,000	60,000	0.313 U	0.314 U
1,2-Dichloroethylene (total)	250	100,000	100,000	500,000	1,000,000	0.313 U	0.314 U
1,2-Dichloropropane	NS	NS	NS	NS	NS	0.313 U	0.314 U
2-Butanone	120	100,000	100,000	500,000	1,000,000	1.56 U	1.57 U
2-Hexanone	NS	NS	NS	NS	NS	1.56 U	1.57 U
4-Methyl-2-pentanone	NS	NS	NS	NS	NS	1.30 U	1.31 U
Acetone	50	100,000	100,000	500,000	1,000,000	1.73 U	1.74 U
Benzene	60	2,900	4,800	44,000	89,000	0.313 U	0.314 U
Bromodichloromethane	NS	NS	NS	NS	NS	0.313 U	0.314 U
Bromoform	NS	NS	NS	NS	NS	0.313 U	0.314 U
Bromomethane	NS	NS	NS	NS	NS	0.313 U	0.314 U
Carbon disulfide	NS	NS	NS	NS	NS	1.30 U	1.31 U
Carbon tetrachloride	760	1,400	2,400	22,000	44,000	0.313 U	0.314 U
Chlorobenzene	1,100	100,000	100,000	500,000	1,000,000	0.313 U	0.314 U
Chloroethane	NS	NS	NS	NS	NS	0.313 U	0.314 U
Chloroform	370	10,000	49,000	350,000	700,000	0.313 U	0.314 U
Chloromethane	NS	NS	NS	NS	NS	0.313 U	0.314 U
Dichlorodifluoromethane	NS	NS	NS	NS	NS	0.313 U	0.314 U
Ethylbenzene	1,000	30,000	41,000	390,000	780,000	0.313 U	0.314 U
Methylene chloride	50	51,000	100,000	500,000	1,000,000	2.09 U	2.1 U
Styrene	NS	NS	NS	NS	NS	0.313 U	0.314 U
Tetrachloroethene	1,300	5,500	19,000	150,000	300,000	0.313 U	0.314 U
Toluene	700	100,000	100,000	500,000	1,000,000	0.313 U	0.314 U
Trichloroethene	470	10,000	21,000	200,000	400,000	0.344 U	0.314 U
Vinyl chloride	20	210	900	13,000	27,000	0.313 U	0.314 U
Xylene (mixed)	260	100,000	100,000	500,000	1,000,000	0.313 U	0.314 U
cis-1,3-Dichloropropene	NS	NS	NS	NS	NS	0.313 U	0.314 U
trans-1,3-Dichloropropene	NS	NS	NS	NS	NS	0.313 U	0.314 U

Notes:
¹Unrestricted Use Soil Cleanup Objectives (SCO) 6 NYCRR Part 375, Environmental Remediation Programs, December 2006
²Restricted Soil Cleanup Objectives (SCO) 6 NYCRR Part 375, Environmental Remediation Programs, December 2006
U - Analyte not detected above the laboratory MDL
J - Estimated value
NS - No standard established
Green highlighting indicates exceedance of Unrestricted Use SCO
Yellow highlighting indicates exceedance of RSCO
Orange highlighting indicates exceedance of UUSCO and RSCO

Table 2

Soil Sample Analytical Data Summary
Semi-Volatile Organic Compounds
Fanhouse Building 802

		Restricted Use SCOs ²				BNL COC 29549	
SAMPLE ID	Unrestricted Use SCO ¹	Residential	Restricted Residential SCO	Commercial SCO	Industrial SCO	29549-001	29549-002
LAB SAMPLE ID						277110001	277110002
SAMPLING DATE						4/28/2011	4/28/2011
SAMPLE DEPTH (ft.)						0	0
Semivolatile Organics by EPA 8270C in µg/kg							
1,2,4-Trichlorobenzene	NS	NS	NS	NS	NS	69.3 U	69.5 U
1,2-Dichlorobenzene	NS	NS	NS	NS	NS	69.3 U	69.5 U
1,3-Dichlorobenzene	NS	NS	NS	NS	NS	69.3 U	69.5 U
1,4-Dichlorobenzene	NS	NS	NS	NS	NS	69.3 U	69.5 U
2,4,5-Trichlorophenol	NS	NS	NS	NS	NS	69.3 U	69.5 U
2,4,6-Trichlorophenol	NS	NS	NS	NS	NS	69.3 U	69.5 U
2,4-Dichlorophenol	NS	NS	NS	NS	NS	69.3 U	69.5 U
2,4-Dimethylphenol	NS	NS	NS	NS	NS	121 U	122 U
2,4-Dinitrophenol	NS	NS	NS	NS	NS	132 U	132 U
2,4-Dinitrotoluene	NS	NS	NS	NS	NS	34.6 U	34.7 U
2,6-Dinitrotoluene	NS	NS	NS	NS	NS	34.6 U	34.7 U
2-Chloronaphthalene	NS	NS	NS	NS	NS	11.4 U	11.5 U
2-Chlorophenol	NS	NS	NS	NS	NS	69.3 U	69.5 U
2-Methyl-4,6-dinitrophenol	NS	NS	NS	NS	NS	69.3 U	69.5 U
2-Methylnaphthalene	NS	NS	NS	NS	NS	6.93 U	31.3 J
2-Nitrophenol	NS	NS	NS	NS	NS	69.3 U	69.5 U
3,3'-Dichlorobenzidine	NS	NS	NS	NS	NS	104 U	104 U
4-Bromophenyl phenyl ether	NS	NS	NS	NS	NS	69.3 U	69.5 U
2-Chloro-3-methylphenol	NS	NS	NS	NS	NS	69.3 U	69.5 U
4-Chloroaniline	NS	NS	NS	NS	NS	69.3 U	69.5 U
4-Chlorophenyl phenyl ether	NS	NS	NS	NS	NS	69.3 U	69.5 U
4-Nitrophenol	NS	NS	NS	NS	NS	114 U	115 U
Acenaphthene	20,000	100,000	100,000	500,000	1,000,000	11.4 U	104
Acenaphthylene	100,000	100,000	100,000	500,000	1,000,000	10.4 U	10.4 U
Anthracene	100,000	100,000	100,000	500,000	1,000,000	16.3 J	275
Benzo(a)anthracene	1,000	1,000	1,000	5,600	11,000	54.4	745
Benzo(a)pyrene	1,000	1,000	1,000	100	1,100	53.3	633
Benzo(b)fluoranthene	1,000	1,000	1,000	5,600	11,000	64.1	904
Benzo(ghi)perylene	100,000	100,000	100,000	500,000	1,000,000	26.7 J	337
Benzo(k)fluoranthene	800	1,000	3,900	56,000	110,000	25.6 J	395
Butyl benzyl phthalate	NS	NS	NS	NS	NS	69.3 U	69.5 U
Carbazole	NS	NS	NS	NS	NS	10.4 U	165
Chrysene	1,000	1,000	3,900	56,000	110,000	45.0	625
Di-n-butylphthalate	NS	NS	NS	NS	NS	69.3 U	69.5 U
Di-n-octylphthalate	NS	NS	NS	NS	NS	69.3 U	69.5 U
Dibenzo(a,h)anthracene	330	330	330	560	1,100	10.4 J	91.0
Dibenzofuran	NS	NS	NS	NS	NS	69.3 U	80.6 J
Diethyl phthalate	NS	NS	NS	NS	NS	69.3 U	69.5 U
Dimethyl phthalate	NS	NS	NS	NS	NS	69.3 U	69.5 U
Diphenylamine	NS	NS	NS	NS	NS	69.3 U	69.5 U
Fluoranthene	100,000	100,000	100,000	500,000	1,000,000	123	1680
Fluorene	30,000	100,000	100,000	500,000	1,000,000	10.4 U	124
Hexachlorobenzene	NS	NS	NS	NS	NS	69.3 U	69.5 U
Hexachlorobutadiene	NS	NS	NS	NS	NS	69.3 U	69.5 U
Hexachlorocyclopentadiene	NS	NS	NS	NS	NS	69.3 U	69.5 U
Hexachloroethane	NS	NS	NS	NS	NS	69.3 U	69.5 U
Indeno(1,2,3-cd)Pyrene	500	500	500	5,600	11,000	29.8 J	310
Isophorone	NS	NS	NS	NS	NS	69.3 U	69.5 U
n-Nitrosodi-n-propylamine	NS	NS	NS	NS	NS	69.3 U	69.5 U
Naphthalene	12,000	100,000	100,000	500,000	1,000,000	10.4 U	83.4
Nitrobenzene	NS	NS	NS	NS	NS	69.3 U	69.5 U
Pentachlorophenol	800	2,400	6,700	6,700	55,000	86.6 U	86.8 U
Phenanthrene	100,000	100,000	100,000	500,000	1,000,000	62.3	1150
Phenol	330	100,000	100,000	500,000	1,000,000	69.3 U	69.5 U
Pyrene	100,000	100,000	100,000	500,000	1,000,000	98.4	1580
Bis(2-chloroethoxy)methane	NS	NS	NS	NS	NS	69.3 U	69.5 U
Bis(2-chloroethyl)ether	NS	NS	NS	NS	NS	69.3 U	69.5 U
Bis(2-chloroisopropyl)ether	NS	NS	NS	NS	NS	69.3 U	69.5 U
Bis(2-Ethylhexyl)phthalate	NS	NS	NS	NS	NS	69.3 U	69.5 U
n,p-Cresols	330	100,000	100,000	500,000	1,000,000	104 U	104 U
n-Notroline	NS	NS	NS	NS	NS	69.3 U	69.5 U
o-Cresol	330	100,000	100,000	500,000	1,000,000	69.3 U	69.5 U
o-Nitroaniline	NS	NS	NS	NS	NS	69.3 U	69.5 U
p-Nitroaniline	NS	NS	NS	NS	NS	104 U	104 U

Notes:

¹Unrestricted Use Soil Cleanup Objectives (SCO) 6 NYCRR Part 375, Environmental Remediation Programs, December 2006

²Resticted Soil Cleanup Objectives (SCO) 6 NYCRR Part 375, Environmental Remediation Programs, December 2006

U - Analyte not detected above the laboratory MDL

J - Estimated value

NS - No standard established

Green highlighting indicates exceedance of Unrestricted Use SCO

Yellow highlighting indicates exceedance of RSCO

Blue highlighting indicates exceedance of UUSCO and RSCO

Appendix C

HFBR Fan Houses Project RESRAD Summary Reports

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

[illegible]

Dose Conversion Factor (and Related) Parameter Summary ...	2
Site-Specific Parameter Summary	4
Summary of Pathway Selections	8
Contaminated Zone and Total Dose Summary	9
Total Dose Components	
Time = 0.000E+00	10
Time = 1.000E+00	11
Time = 5.000E+00	12
Time = 1.000E+01	13
Time = 5.000E+01	14
Time = 1.000E+02	15
Time = 5.000E+02	16
Time = 1.000E+03	17
Dose/Source Ratios Summed Over All Pathways	18
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Soil Concentration Per Nuclide	19

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
AA				

Summary : Fan-House+802-Residential- Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(4,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(5,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(5,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(1,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(4,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(5,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(5,2)
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

	User	Used by RESRAD	Parameter
Menu	Input	(If different from user input)	Name
AA			
R011	Area of contaminated zone (m**2)	---	AREA
R011	Thickness of contaminated zone (m)	---	THICK0
R011	Fraction of contamination that is submerged	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	---	BRDL
R011	Time since placement of material (yr)	---	TI
R011	Times for calculations (yr)	---	T(2)
R011	Times for calculations (yr)	---	T(3)
R011	Times for calculations (yr)	---	T(4)
R011	Times for calculations (yr)	---	T(5)
R011	Times for calculations (yr)	---	T(6)
R011	Times for calculations (yr)	---	T(7)
R011	Times for calculations (yr)	---	T(8)
R011	Times for calculations (yr)	---	T(9)
R011	Times for calculations (yr)	---	T(10)
R012	Initial principal radionuclide (pCi/g): Cs-137	---	S1(1)
R012	Initial principal radionuclide (pCi/g): U-238	---	S1(6)
R012	Concentration in groundwater (pCi/L): Cs-137	---	W1(1)
R012	Concentration in groundwater (pCi/L): U-238	---	W1(6)
R013	Cover depth (m)	---	COVER0
R013	Density of cover material (g/cm**3)	---	DENSCV
R013	Cover depth erosion rate (m/yr)	---	VCV
R013	Density of contaminated zone (g/cm**3)	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	---	VCZ
R013	Contaminated zone total porosity	---	TPCZ
R013	Contaminated zone field capacity	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	---	HCCZ
R013	Contaminated zone b parameter	---	BCZ
R013	Average annual wind speed (m/sec)	---	WIND
R013	Humidity in air (g/m**3)	---	HUMID
R013	Evapotranspiration coefficient	---	EVAPTR
R013	Precipitation (m/yr)	---	PRECIP
R013	Irrigation (m/yr)	---	RI
R013	Irrigation mode	---	IDITCH
R013	Runoff coefficient	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	---	WAREA
R013	Accuracy for water/soil computations	---	EPS
R014	Density of saturated zone (g/cm**3)	---	DENSAQ
R014	Saturated zone total porosity	---	TPSZ
R014	Saturated zone effective porosity	---	EPSZ
R014	Saturated zone field capacity	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	---	HCSZ
R014	Saturated zone hydraulic gradient	---	HGWT
R014	Saturated zone b parameter	---	BSZ
R014	Water table drop rate (m/yr)	---	VWT
R014	Well pump intake depth (m below water table)	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	---	MODEL

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	0.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.660E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.400E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.900E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+03	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.889E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.082E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.618E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.349E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)

Summary : Fan-House+802-Residential- Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
Distribution coefficients for daughter U-234					
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
Inhalation rate (m**3/yr)					
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
Mass loading for inhalation (g/m**3)					
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
Exposure duration					
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
Shielding factor, inhalation					
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
Shielding factor, external gamma					
R017	Shielding factor, external gamma	8.000E-01	7.000E-01	---	SHF1
Fraction of time spent indoors					
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
Fraction of time spent outdoors (on site)					
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
Shape factor flag, external gamma					
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
Radii of shape factor array (used if FS = -1):					
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
Fractions of annular areas within AREA:					
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
Fruits, vegetables and grain consumption (kg/yr)					
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
Leafy vegetable consumption (kg/yr)					
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
Milk consumption (L/yr)					
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
Meat and poultry consumption (kg/yr)					
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
Fish consumption (kg/yr)					
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
Other seafood consumption (kg/yr)					
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
Soil ingestion rate (g/yr)					
R018	Soil ingestion rate (g/yr)	4.380E+01	3.650E+01	---	SOIL

Summary : Fan-House+802-Residential- Bkg-Subtract

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R018	Drinking water intake (L/yr)	7.000E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
3 3 3 3 3 3					
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-05	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
3 3 3 3 3 3					
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
3 3 3 3 3 3					
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
3 3 3 3 3 3					

Summary : Fan-House+802-Residential- Bkg-Subtract

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FL00R1
R021	Bulk density of building foundation (g/cm*3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH20CV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH20FL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Summary : Fan-House+802-Residential- Bkg-Subtract

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
AAAAAAAAAAAAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAAAAAAAAAAAA	
Area:	4000.00 square meters	Cs-137	1.160E+00
Thickness:	5.00 meters	U-238	4.100E-01
Cover Depth:	0.00 meters		

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 1.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

AA

t (years):	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
TDOSE(t):	2.597E+00	2.546E+00	2.358E+00	2.149E+00	1.214E+00	6.174E-01	5.547E-02	5.060E-03
M(t):	1.731E-01	1.698E-01	1.572E-01	1.432E-01	8.092E-02	4.116E-02	3.698E-03	3.373E-04

Maximum TDOSE(t): 2.597E+00 mrem/yr at t = 0.000E+00 years

Summary : Fan-House+802-Residential- Bkg-Subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	2.325E+00	0.8955	7.000E-07	0.0000	0.000E+00	0.0000	1.995E-01	0.0768	0.000E+00	0.0000	0.000E+00	0.0000	1.883E-03	0.0007
U-238	3.728E-02	0.0144	9.241E-04	0.0004	0.000E+00	0.0000	2.391E-02	0.0092	0.000E+00	0.0000	0.000E+00	0.0000	3.611E-03	0.0014
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.363E+00	0.9099	9.248E-04	0.0004	0.000E+00	0.0000	2.234E-01	0.0860	0.000E+00	0.0000	0.000E+00	0.0000	5.494E-03	0.0021

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	3.872E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.572E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.527E+00	0.9731
U-238	3.893E-03	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	2.697E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	6.988E-02	0.0269
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	3.897E-03	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	2.699E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	2.597E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	2.272E+00	0.8921	6.839E-07	0.0000	0.000E+00	0.0000	1.949E-01	0.0765	0.000E+00	0.0000	0.000E+00	0.0000	1.840E-03	0.0007
U-238	3.710E-02	0.0146	9.197E-04	0.0004	0.000E+00	0.0000	2.380E-02	0.0093	0.000E+00	0.0000	0.000E+00	0.0000	3.594E-03	0.0014
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	2.309E+00	0.9067	9.204E-04	0.0004	0.000E+00	0.0000	2.187E-01	0.0859	0.000E+00	0.0000	0.000E+00	0.0000	5.433E-03	0.0021

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	1.144E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.103E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.468E+00	0.9694
U-238	1.169E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	8.354E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	7.794E-02	0.0306
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	1.170E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	8.362E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	2.546E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAAAA													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	2.069E+00	0.8774	6.228E-07	0.0000	0.000E+00	0.0000	1.775E-01	0.0753	0.000E+00	0.0000	0.000E+00	0.0000	1.675E-03	0.0007
U-238	3.641E-02	0.0154	9.025E-04	0.0004	0.000E+00	0.0000	2.335E-02	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	3.526E-03	0.0015
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.105E+00	0.8929	9.032E-04	0.0004	0.000E+00	0.0000	2.008E-01	0.0852	0.000E+00	0.0000	0.000E+00	0.0000	5.202E-03	0.0022

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAAAA													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.838E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.795E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.248E+00	0.9534
U-238	4.252E-02	0.0180	0.000E+00	0.0000	0.000E+00	0.0000	3.082E-03	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	1.098E-01	0.0466
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.255E-02	0.0180	0.000E+00	0.0000	0.000E+00	0.0000	3.084E-03	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	2.358E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	1.840E+00	0.8566	5.540E-07	0.0000	0.000E+00	0.0000	1.579E-01	0.0735	0.000E+00	0.0000	0.000E+00	0.0000	1.490E-03	0.0007
U-238	3.556E-02	0.0165	8.815E-04	0.0004	0.000E+00	0.0000	2.281E-02	0.0106	0.000E+00	0.0000	0.000E+00	0.0000	3.444E-03	0.0016
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	1.876E+00	0.8731	8.821E-04	0.0004	0.000E+00	0.0000	1.807E-01	0.0841	0.000E+00	0.0000	0.000E+00	0.0000	4.935E-03	0.0023

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	6.528E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.777E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.000E+00	0.9308
U-238	8.023E-02	0.0373	0.000E+00	0.0000	0.000E+00	0.0000	5.830E-03	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	1.488E-01	0.0692
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	8.030E-02	0.0374	0.000E+00	0.0000	0.000E+00	0.0000	5.835E-03	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	2.149E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	7.220E-01	0.5948	2.173E-07	0.0000	0.000E+00	0.0000	6.194E-02	0.0510	0.000E+00	0.0000	0.000E+00	0.0000	5.847E-04	0.0005
U-238	2.944E-02	0.0243	7.299E-04	0.0006	0.000E+00	0.0000	1.889E-02	0.0156	0.000E+00	0.0000	0.000E+00	0.0000	2.852E-03	0.0023
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	7.514E-01	0.6190	7.301E-04	0.0006	0.000E+00	0.0000	8.082E-02	0.0666	0.000E+00	0.0000	0.000E+00	0.0000	3.437E-03	0.0028

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	1.241E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	9.117E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.846E-01	0.6464
U-238	3.517E-01	0.2897	0.000E+00	0.0000	0.000E+00	0.0000	2.561E-02	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	4.292E-01	0.3536
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	3.518E-01	0.2898	0.000E+00	0.0000	0.000E+00	0.0000	2.562E-02	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	1.214E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	2.241E-01	0.3630	6.747E-08	0.0000	0.000E+00	0.0000	1.923E-02	0.0311	0.000E+00	0.0000	0.000E+00	0.0000	1.815E-04	0.0003
U-238	2.325E-02	0.0377	5.765E-04	0.0009	0.000E+00	0.0000	1.492E-02	0.0242	0.000E+00	0.0000	0.000E+00	0.0000	2.253E-03	0.0036
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	2.474E-01	0.4007	5.766E-04	0.0009	0.000E+00	0.0000	3.415E-02	0.0553	0.000E+00	0.0000	0.000E+00	0.0000	2.434E-03	0.0039

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	7.730E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	5.684E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.436E-01	0.3946
U-238	3.102E-01	0.5024	0.000E+00	0.0000	0.000E+00	0.0000	2.260E-02	0.0366	0.000E+00	0.0000	0.000E+00	0.0000	3.738E-01	0.6054
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	3.103E-01	0.5025	0.000E+00	0.0000	0.000E+00	0.0000	2.261E-02	0.0366	0.000E+00	0.0000	0.000E+00	0.0000	6.174E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	1.935E-05	0.0003	5.824E-12	0.0000	0.000E+00	0.0000	1.660E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.567E-08	0.0000
U-238	3.519E-03	0.0634	8.736E-05	0.0016	0.000E+00	0.0000	2.260E-03	0.0408	0.000E+00	0.0000	0.000E+00	0.0000	3.413E-04	0.0062
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	3.538E-03	0.0638	8.736E-05	0.0016	0.000E+00	0.0000	2.262E-03	0.0408	0.000E+00	0.0000	0.000E+00	0.0000	3.413E-04	0.0062

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	3.554E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.614E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.106E-05	0.0004
U-238	4.589E-02	0.8274	0.000E+00	0.0000	0.000E+00	0.0000	3.344E-03	0.0603	0.000E+00	0.0000	0.000E+00	0.0000	5.544E-02	0.9996
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.589E-02	0.8274	0.000E+00	0.0000	0.000E+00	0.0000	3.344E-03	0.0603	0.000E+00	0.0000	0.000E+00	0.0000	5.547E-02	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	1.610E-10	0.0000	4.845E-17	0.0000	0.000E+00	0.0000	1.381E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.303E-13	0.0000
U-238	3.328E-04	0.0658	8.261E-06	0.0016	0.000E+00	0.0000	2.147E-04	0.0424	0.000E+00	0.0000	0.000E+00	0.0000	3.230E-05	0.0064
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	3.328E-04	0.0658	8.261E-06	0.0016	0.000E+00	0.0000	2.147E-04	0.0424	0.000E+00	0.0000	0.000E+00	0.0000	3.230E-05	0.0064

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	6.431E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.731E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.756E-10	0.0000
U-238	4.168E-03	0.8238	0.000E+00	0.0000	0.000E+00	0.0000	3.037E-04	0.0600	0.000E+00	0.0000	0.000E+00	0.0000	5.060E-03	1.0000
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.168E-03	0.8238	0.000E+00	0.0000	0.000E+00	0.0000	3.037E-04	0.0600	0.000E+00	0.0000	0.000E+00	0.0000	5.060E-03	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential- Bkg-Subtract

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Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA
Cs-137+D	Cs-137+D	1.000E+00	2.178E+00	2.128E+00	1.938E+00	1.724E+00	6.764E-01	2.100E-01	1.816E-05	1.514E-10
U-238	U-238	5.400E-05	4.085E-06	5.114E-06	9.181E-06	1.416E-05	4.997E-05	4.381E-05	6.481E-06	5.889E-07
U-238+D	U-238+D	9.999E-01	1.704E-01	1.901E-01	2.678E-01	3.628E-01	1.047E+00	9.114E-01	1.350E-01	1.230E-02
U-238+D	U-234	9.999E-01	1.243E-07	4.526E-07	2.949E-06	8.671E-06	1.470E-04	2.565E-04	1.889E-04	3.428E-05
U-238+D	Th-230	9.999E-01	4.086E-13	2.468E-12	2.911E-11	1.016E-10	2.050E-09	6.979E-09	5.740E-08	7.939E-08
U-238+D	Ra-226+D	9.999E-01	2.012E-11	6.175E-11	2.736E-10	4.503E-10	4.578E-09	2.535E-08	8.861E-07	2.788E-06
U-238+D	Pb-210+D	9.999E-01	5.530E-10	1.695E-09	7.426E-09	1.173E-08	6.078E-08	2.429E-07	1.589E-06	3.768E-06
U-238+D	äDSR(j)		1.704E-01	1.901E-01	2.678E-01	3.628E-01	1.047E+00	9.116E-01	1.352E-01	1.234E-02
iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii

The DSR includes contributions from associated (half-life ó 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA
Cs-137	6.886E+00	7.049E+00	7.740E+00	8.701E+00	2.218E+01	7.142E+01	8.262E+05	9.910E+10	
U-238	8.800E+01	7.891E+01	5.602E+01	4.134E+01	1.433E+01	1.645E+01	1.109E+02	1.215E+03	
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
AAAAAAAA	AAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA
Cs-137	1.160E+00	0.000E+00	2.178E+00	6.886E+00	2.178E+00	6.886E+00
U-238	4.100E-01	55.5 ñ 0.1	1.126E+00	1.332E+01	1.705E-01	8.800E+01
iiiiiiii	iiiiiiii	iiiiiiiiiiiiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

Summary : Fan-House+802-Residential- Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-BKG-SUBTRACT.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr									
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	Cs-137	1.000E+00		2.527E+00	2.468E+00	2.248E+00	2.000E+00	7.846E-01	2.436E-01	2.106E-05	1.756E-10	
U-238	U-238	5.400E-05		1.675E-06	2.097E-06	3.764E-06	5.804E-06	2.049E-05	1.796E-05	2.657E-06	2.415E-07	
U-238	U-238	9.999E-01		6.988E-02	7.794E-02	1.098E-01	1.487E-01	4.291E-01	3.737E-01	5.536E-02	5.043E-03	
U-238	äDOSE(j)			6.988E-02	7.794E-02	1.098E-01	1.488E-01	4.292E-01	3.737E-01	5.537E-02	5.043E-03	
U-234	U-238	9.999E-01		5.096E-08	1.856E-07	1.209E-06	3.555E-06	6.029E-05	1.052E-04	7.744E-05	1.406E-05	
Th-230	U-238	9.999E-01		1.675E-13	1.012E-12	1.194E-11	4.167E-11	8.407E-10	2.861E-09	2.353E-08	3.255E-08	
Ra-226	U-238	9.999E-01		8.249E-12	2.532E-11	1.122E-10	1.846E-10	1.877E-09	1.039E-08	3.633E-07	1.143E-06	
Pb-210	U-238	9.999E-01		2.267E-10	6.951E-10	3.045E-09	4.810E-09	2.492E-08	9.960E-08	6.517E-07	1.545E-06	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g									
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	Cs-137	1.000E+00		1.160E+00	1.133E+00	1.032E+00	9.180E-01	3.601E-01	1.118E-01	9.651E-06	8.029E-11	
U-238	U-238	5.400E-05		2.214E-05	2.204E-05	2.162E-05	2.112E-05	1.749E-05	1.381E-05	2.090E-06	1.972E-07	
U-238	U-238	9.999E-01		4.100E-01	4.080E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.652E-03	
U-238	äS(j):			4.100E-01	4.081E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.653E-03	
U-234	U-238	9.999E-01		0.000E+00	1.157E-06	5.676E-06	1.109E-05	4.589E-05	7.248E-05	5.481E-05	1.034E-05	
Th-230	U-238	9.999E-01		0.000E+00	5.215E-12	1.287E-10	5.069E-10	1.119E-08	3.841E-08	3.197E-07	4.425E-07	
Ra-226	U-238	9.999E-01		0.000E+00	7.535E-16	9.325E-14	7.367E-13	8.338E-11	5.905E-10	3.036E-08	9.758E-08	
Pb-210	U-238	9.999E-01		0.000E+00	5.821E-18	3.519E-15	5.404E-14	2.479E-11	2.808E-10	2.607E-08	9.099E-08	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

THF(i) is the thread fraction of the parent nuclide.

RESRAD.EXE execution time = 22.47 seconds

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Time = 1.000E+00	11
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Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1 DCF's for external ground radiation, (mrem/yr)/(pCi/g)				
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(1)
A-1	Ba-137m (Source: FGR 12)	3.606E+00	3.606E+00	DCF1(2)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(3)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(4)
A-1	Cs-137 (Source: FGR 12)	7.510E-04	7.510E-04	DCF1(5)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(6)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(7)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(8)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(9)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(10)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(11)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(12)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(13)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(14)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(15)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(16)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(17)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(18)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(19)
B-1 Dose conversion factors for inhalation, mrem/pCi:				
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(2)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(3)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(4)
B-1	U-234	1.320E-01	1.320E-01	DCF2(5)
B-1	U-238	1.180E-01	1.180E-01	DCF2(6)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(7)
D-1 Dose conversion factors for ingestion, mrem/pCi:				
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(1)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(2)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(3)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(4)
D-1	U-234	2.830E-04	2.830E-04	DCF3(5)
D-1	U-238	2.550E-04	2.550E-04	DCF3(6)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(7)
D-34 Food transfer factors:				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(1,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(1,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(4,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(5,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(5,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(1,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(4,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(5,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(5,2)
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)

#####

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R011	Area of contaminated zone (m**2)	4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	5.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	2.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	5.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	5.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	5.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
3 3 3 3 3 3					
R012	Initial principal radionuclide (pCi/g): Cs-137	1.160E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): U-238	4.100E-01	0.000E+00	---	S1(6)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(6)
3 3 3 3 3 3					
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.660E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.400E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.000E+03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	6.230E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	4.600E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.230E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
3 3 3 3 3 3					
R014	Density of saturated zone (g/cm**3)	1.660E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.400E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	2.000E+04	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	4.800E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.900E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.800E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	0.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.660E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.400E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.900E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+03	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.889E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(6)
R016	Unsat. zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsat. zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.082E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCC(3)
R016	Unsat. zone 1 (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.618E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(4)
R016	Unsat. zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.349E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R018	Drinking water intake (L/yr)	3.500E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
3 3 3 3 3 3					
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
3 3 3 3 3 3					
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
3 3 3 3 3 3					
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
3 3 3 3 3 3					

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH20CV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH20FL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions	Initial Soil Concentrations, pCi/g
AAAAAAAAAAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAAAAAAAAAA
Area: 4000.00 square meters	Cs-137 1.160E+00
Thickness: 5.00 meters	U-238 4.100E-01
Cover Depth: 0.00 meters	

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
AA

t (years):	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
TDOSE(t):	7.161E-01	7.037E-01	6.577E-01	6.073E-01	4.036E-01	2.305E-01	2.413E-02	2.195E-03
M(t):	4.774E-02	4.691E-02	4.384E-02	4.049E-02	2.691E-02	1.537E-02	1.608E-03	1.463E-04

Maximum TDOSE(t): 7.161E-01 mrem/yr at t = 0.000E+00 years

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	7.012E-01	0.9793	1.991E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.813E-04	0.0007
U-238	1.124E-02	0.0157	2.629E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.227E-04	0.0013
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.125E-01	0.9950	2.631E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.404E-03	0.0020

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.936E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.017E-01	0.9799
U-238	1.946E-03	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.437E-02	0.0201
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.948E-03	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.161E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.850E-01	0.9734	1.945E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.701E-04	0.0007
U-238	1.119E-02	0.0159	2.616E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.184E-04	0.0013
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	6.962E-01	0.9893	2.618E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.388E-03	0.0020

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	5.722E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.855E-01	0.9741
U-238	5.844E-03	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.821E-02	0.0259
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	5.850E-03	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.037E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.238E-01	0.9485	1.771E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.281E-04	0.0007
U-238	1.098E-02	0.0167	2.567E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.012E-04	0.0014
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	6.348E-01	0.9652	2.569E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.329E-03	0.0020

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.919E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.243E-01	0.9492
U-238	2.126E-02	0.0323	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.339E-02	0.0508
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.128E-02	0.0324	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.577E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-Bkgd subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	5.550E-01	0.9137	1.576E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.809E-04	0.0006
U-238	1.072E-02	0.0177	2.507E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.802E-04	0.0014
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	5.657E-01	0.9314	2.509E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.261E-03	0.0021

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.264E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.554E-01	0.9144
U-238	4.012E-02	0.0661	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.197E-02	0.0856
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.015E-02	0.0661	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.073E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	2.177E-01	0.5394	6.182E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.494E-04	0.0004
U-238	8.877E-03	0.0220	2.076E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.288E-04	0.0018
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.266E-01	0.5614	2.077E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.782E-04	0.0022

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.203E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.179E-01	0.5400
U-238	1.759E-01	0.4357	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.857E-01	0.4600
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.759E-01	0.4359	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.036E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-Bkgd subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.759E-02	0.2932	1.919E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.639E-05	0.0002
U-238	7.011E-03	0.0304	1.640E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.757E-04	0.0025
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.460E-02	0.3236	1.640E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.221E-04	0.0027

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.865E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.767E-02	0.2936
U-238	1.551E-01	0.6728	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.628E-01	0.7064
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.551E-01	0.6730	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.305E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-Bkgd subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	5.834E-06	0.0002	1.657E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.004E-09	0.0000
U-238	1.061E-03	0.0440	2.485E-05	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.722E-05	0.0036
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.067E-03	0.0442	2.485E-05	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.723E-05	0.0036

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.777E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.856E-06	0.0002
U-238	2.295E-02	0.9511	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.412E-02	0.9998
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.295E-02	0.9511	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.413E-02	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-Bkgd subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	4.853E-11	0.0000	1.378E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.331E-14	0.0000
U-238	1.003E-04	0.0457	2.350E-06	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.253E-06	0.0038
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.003E-04	0.0457	2.350E-06	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.253E-06	0.0038

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.216E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.889E-11	0.0000
U-238	2.084E-03	0.9495	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.195E-03	1.0000
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.084E-03	0.9495	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.195E-03	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA
Cs-137+D	Cs-137+D	1.000E+00	6.049E-01	5.909E-01	5.382E-01	4.788E-01	1.879E-01	5.834E-02	5.048E-06	4.215E-11
U-238	U-238	5.400E-05	3.943E-07	8.808E-07	2.804E-06	5.158E-06	2.210E-05	1.947E-05	2.878E-06	2.610E-07
U-238+D	U-238+D	9.999E-01	3.506E-02	4.442E-02	8.145E-02	1.267E-01	4.528E-01	3.971E-01	5.874E-02	5.337E-03
U-238+D	U-234	9.999E-01	1.395E-08	7.955E-08	9.017E-07	3.159E-06	6.502E-05	1.140E-04	8.387E-05	1.519E-05
U-238+D	Th-230	9.999E-01	6.038E-14	2.959E-13	3.010E-12	9.832E-12	1.944E-10	6.707E-10	5.473E-09	7.572E-09
U-238+D	Ra-226+D	9.999E-01	9.425E-12	2.873E-11	1.269E-10	2.021E-10	1.453E-09	7.062E-09	1.716E-07	5.245E-07
U-238+D	Pb-210+D	9.999E-01	2.592E-10	7.899E-10	3.472E-09	5.442E-09	2.812E-08	1.111E-07	5.488E-07	1.087E-06
U-238+D	äDSR(j)		3.506E-02	4.442E-02	8.145E-02	1.268E-01	4.528E-01	3.972E-01	5.883E-02	5.353E-03
iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii

The DSR includes contributions from associated (half-life 6 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA
Cs-137	2.480E+01	2.538E+01	2.787E+01	3.133E+01	7.985E+01	2.571E+02	2.972E+06	3.559E+11	
U-238	4.279E+02	3.377E+02	1.842E+02	1.183E+02	3.312E+01	3.777E+01	2.550E+02	2.802E+03	
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
AAAAAAAA	AAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA
Cs-137	1.160E+00	0.000E+00	6.049E-01	2.480E+01	6.049E-01	2.480E+01
U-238	4.100E-01	55.6 ñ 0.1	4.906E-01	3.057E+01	3.506E-02	4.279E+02
iiiiiiii	iiiiiiii	iiiiiiiiiiiiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr									
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03	
AAAAAAAA	AAAAAAAA	AAAAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA
Cs-137	Cs-137	1.000E+00	7.017E-01	6.855E-01	6.243E-01	5.554E-01	2.179E-01	6.767E-02	5.856E-06	4.889E-11		
U-238	U-238	5.400E-05	1.617E-07	3.611E-07	1.150E-06	2.115E-06	9.059E-06	7.984E-06	1.180E-06	1.070E-07		
U-238	U-238	9.999E-01	1.437E-02	1.821E-02	3.339E-02	5.197E-02	1.856E-01	1.628E-01	2.408E-02	2.188E-03		
U-238	äDOSE(j)		1.437E-02	1.821E-02	3.339E-02	5.197E-02	1.856E-01	1.628E-01	2.408E-02	2.188E-03		
U-234	U-238	9.999E-01	5.718E-09	3.262E-08	3.697E-07	1.295E-06	2.666E-05	4.675E-05	3.439E-05	6.229E-06		
Th-230	U-238	9.999E-01	2.476E-14	1.213E-13	1.234E-12	4.031E-12	7.971E-11	2.750E-10	2.244E-09	3.104E-09		
Ra-226	U-238	9.999E-01	3.864E-12	1.178E-11	5.201E-11	8.286E-11	5.956E-10	2.895E-09	7.035E-08	2.151E-07		
Pb-210	U-238	9.999E-01	1.063E-10	3.239E-10	1.424E-09	2.231E-09	1.153E-08	4.555E-08	2.250E-07	4.458E-07		
iiiiiiii	iiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g									
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03	
AAAAAAAA	AAAAAAAA	AAAAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA
Cs-137	Cs-137	1.000E+00	1.160E+00	1.133E+00	1.032E+00	9.180E-01	3.601E-01	1.118E-01	9.651E-06	8.029E-11		
U-238	U-238	5.400E-05	2.214E-05	2.204E-05	2.162E-05	2.112E-05	1.749E-05	1.381E-05	2.090E-06	1.972E-07		
U-238	U-238	9.999E-01	4.100E-01	4.080E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.652E-03		
U-238	äS(j):		4.100E-01	4.081E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.653E-03		
U-234	U-238	9.999E-01	0.000E+00	1.157E-06	5.676E-06	1.109E-05	4.589E-05	7.248E-05	5.481E-05	1.034E-05		
Th-230	U-238	9.999E-01	0.000E+00	5.215E-12	1.287E-10	5.069E-10	1.119E-08	3.841E-08	3.197E-07	4.425E-07		
Ra-226	U-238	9.999E-01	0.000E+00	7.535E-16	9.325E-14	7.367E-13	8.338E-11	5.905E-10	3.036E-08	9.758E-08		
Pb-210	U-238	9.999E-01	0.000E+00	5.821E-18	3.519E-15	5.404E-14	2.479E-11	2.808E-10	2.607E-08	9.099E-08		
iiiiiiii	iiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 18.13 seconds

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1 DCF's for external ground radiation, (mrem/yr)/(pCi/g)				
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(1)
A-1	Ba-137m (Source: FGR 12)	3.606E+00	3.606E+00	DCF1(2)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(3)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(4)
A-1	Cs-137 (Source: FGR 12)	7.510E-04	7.510E-04	DCF1(5)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(6)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(7)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(8)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(9)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(10)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(11)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(12)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(13)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(14)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(15)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(16)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(17)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(18)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(19)
B-1 Dose conversion factors for inhalation, mrem/pCi:				
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(2)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(3)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(4)
B-1	U-234	1.320E-01	1.320E-01	DCF2(5)
B-1	U-238	1.180E-01	1.180E-01	DCF2(6)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(7)
D-1 Dose conversion factors for ingestion, mrem/pCi:				
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(1)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(2)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(3)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(4)
D-1	U-234	2.830E-04	2.830E-04	DCF3(5)
D-1	U-238	2.550E-04	2.550E-04	DCF3(6)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(7)
D-34 Food transfer factors:				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(1,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(1,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(4,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(5,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(5,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(1,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(4,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(5,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(5,2)
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)

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#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

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Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R011	Area of contaminated zone (m**2)	4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	5.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	2.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	5.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	5.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	5.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
3 3 3 3 3 3					
R012	Initial principal radionuclide (pCi/g): Cs-137	1.160E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Ra-226	3.320E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): U-238	4.100E-01	0.000E+00	---	S1(6)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(6)
3 3 3 3 3 3					
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.660E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.400E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.000E+03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	6.230E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	4.600E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.230E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
3 3 3 3 3 3					
R014	Density of saturated zone (g/cm**3)	1.660E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.400E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	2.000E+04	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	4.800E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.900E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Well pump intake depth (m below water table)	1.800E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	0.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.660E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.400E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.900E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+03	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.889E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCC(3)
R016	Unsat. zone 1 (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.618E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(6)
R016	Unsat. zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsat. zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.082E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(4)
R016	Unsat. zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.349E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
Distribution coefficients for daughter U-234					
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
Inhalation rate (m**3/yr)					
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
Fractions of annular areas within AREA:					
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
Fruits, vegetables and grain consumption (kg/yr)					
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	4.380E+01	3.650E+01	---	SOIL

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Drinking water intake (L/yr)	7.000E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-05	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH20CV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH20FL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
AAAAAAAAAAAAAAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAAAAAAAAAAAAAA	
Area:	4000.00 square meters	Cs-137	1.160E+00
Thickness:	5.00 meters	Ra-226	3.320E-01
Cover Depth:	0.00 meters	U-238	4.100E-01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
AA
t (years): 0.000E+00 1.000E+00 5.000E+00 1.000E+01 5.000E+01 1.000E+02 5.000E+02 1.000E+03
TDOSE(t): 6.400E+00 6.415E+00 6.461E+00 6.507E+00 6.615E+00 6.247E+00 4.625E+00 3.443E+00
M(t): 4.267E-01 4.276E-01 4.307E-01 4.338E-01 4.410E-01 4.165E-01 3.083E-01 2.296E-01
Maximum TDOSE(t): 6.615E+00 mrem/yr at t = 48.43 ± 0.10 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.843E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	7.490E-01	0.1132	2.255E-07	0.0000	0.000E+00	0.0000	6.426E-02	0.0097	0.000E+00	0.0000	0.000E+00	0.0000	6.066E-04	0.0001
Ra-226	2.162E+00	0.3268	1.645E-04	0.0000	0.000E+00	0.0000	3.078E+00	0.4653	0.000E+00	0.0000	0.000E+00	0.0000	7.399E-02	0.0112
U-238	2.966E-02	0.0045	7.354E-04	0.0001	0.000E+00	0.0000	1.903E-02	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	2.873E-03	0.0004
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	2.940E+00	0.4445	9.001E-04	0.0001	0.000E+00	0.0000	3.161E+00	0.4779	0.000E+00	0.0000	0.000E+00	0.0000	7.747E-02	0.0117

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.843E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	1.247E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.162E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.140E-01	0.1231
Ra-226	6.293E-02	0.0095	0.000E+00	0.0000	0.000E+00	0.0000	4.586E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	5.382E+00	0.8136
U-238	3.420E-01	0.0517	0.000E+00	0.0000	0.000E+00	0.0000	2.490E-02	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	4.192E-01	0.0634
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	4.050E-01	0.0612	0.000E+00	0.0000	0.000E+00	0.0000	2.950E-02	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	6.615E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential-NO Bkg-Subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	2.325E+00	0.3633	7.000E-07	0.0000	0.000E+00	0.0000	1.995E-01	0.0312	0.000E+00	0.0000	0.000E+00	0.0000	1.883E-03	0.0003
Ra-226	2.224E+00	0.3475	5.686E-05	0.0000	0.000E+00	0.0000	1.564E+00	0.2444	0.000E+00	0.0000	0.000E+00	0.0000	1.562E-02	0.0024
U-238	3.728E-02	0.0058	9.241E-04	0.0001	0.000E+00	0.0000	2.391E-02	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	3.611E-03	0.0006
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	4.587E+00	0.7166	9.817E-04	0.0002	0.000E+00	0.0000	1.787E+00	0.2793	0.000E+00	0.0000	0.000E+00	0.0000	2.112E-02	0.0033

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.872E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.572E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.527E+00	0.3948
Ra-226	2.395E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.536E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.804E+00	0.5943
U-238	3.893E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	2.697E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.988E-02	0.0109
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.921E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	2.715E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.400E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential-NO Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-NO-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	2.272E+00	0.3541	6.839E-07	0.0000	0.000E+00	0.0000	1.949E-01	0.0304	0.000E+00	0.0000	0.000E+00	0.0000	1.840E-03	0.0003
Ra-226	2.223E+00	0.3465	6.127E-05	0.0000	0.000E+00	0.0000	1.627E+00	0.2537	0.000E+00	0.0000	0.000E+00	0.0000	1.800E-02	0.0028
U-238	3.710E-02	0.0058	9.197E-04	0.0001	0.000E+00	0.0000	2.380E-02	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	3.594E-03	0.0006
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.531E+00	0.7064	9.817E-04	0.0002	0.000E+00	0.0000	1.846E+00	0.2878	0.000E+00	0.0000	0.000E+00	0.0000	2.343E-02	0.0037

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.144E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.103E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.468E+00	0.3848
Ra-226	1.585E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.102E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.868E+00	0.6030
U-238	1.169E-02	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	8.354E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	7.794E-02	0.0122
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.186E-02	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	8.472E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	6.415E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential-NO Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-NO-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	2.069E+00	0.3202	6.228E-07	0.0000	0.000E+00	0.0000	1.775E-01	0.0275	0.000E+00	0.0000	0.000E+00	0.0000	1.675E-03	0.0003
Ra-226	2.218E+00	0.3432	7.750E-05	0.0000	0.000E+00	0.0000	1.857E+00	0.2874	0.000E+00	0.0000	0.000E+00	0.0000	2.678E-02	0.0041
U-238	3.641E-02	0.0056	9.025E-04	0.0001	0.000E+00	0.0000	2.335E-02	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	3.526E-03	0.0005
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	4.323E+00	0.6690	9.807E-04	0.0002	0.000E+00	0.0000	2.058E+00	0.3185	0.000E+00	0.0000	0.000E+00	0.0000	3.198E-02	0.0049

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.838E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.795E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.248E+00	0.3479
Ra-226	1.858E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	1.339E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.103E+00	0.6351
U-238	4.252E-02	0.0066	0.000E+00	0.0000	0.000E+00	0.0000	3.082E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	1.098E-01	0.0170
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	4.441E-02	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	3.218E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	6.461E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.840E+00	0.2828	5.540E-07	0.0000	0.000E+00	0.0000	1.579E-01	0.0243	0.000E+00	0.0000	0.000E+00	0.0000	1.490E-03	0.0002
Ra-226	2.211E+00	0.3398	9.501E-05	0.0000	0.000E+00	0.0000	2.104E+00	0.3234	0.000E+00	0.0000	0.000E+00	0.0000	3.625E-02	0.0056
U-238	3.556E-02	0.0055	8.815E-04	0.0001	0.000E+00	0.0000	2.281E-02	0.0035	0.000E+00	0.0000	0.000E+00	0.0000	3.444E-03	0.0005
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.087E+00	0.6281	9.771E-04	0.0002	0.000E+00	0.0000	2.285E+00	0.3512	0.000E+00	0.0000	0.000E+00	0.0000	4.119E-02	0.0063

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.528E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.777E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.000E+00	0.3073
Ra-226	6.078E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	4.407E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	4.358E+00	0.6698
U-238	8.023E-02	0.0123	0.000E+00	0.0000	0.000E+00	0.0000	5.830E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	1.488E-01	0.0229
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	8.638E-02	0.0133	0.000E+00	0.0000	0.000E+00	0.0000	6.276E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	6.507E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	7.220E-01	0.1091	2.173E-07	0.0000	0.000E+00	0.0000	6.194E-02	0.0094	0.000E+00	0.0000	0.000E+00	0.0000	5.847E-04	0.0001
Ra-226	2.160E+00	0.3265	1.658E-04	0.0000	0.000E+00	0.0000	3.096E+00	0.4681	0.000E+00	0.0000	0.000E+00	0.0000	7.472E-02	0.0113
U-238	2.944E-02	0.0045	7.299E-04	0.0001	0.000E+00	0.0000	1.889E-02	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	2.852E-03	0.0004
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.911E+00	0.4401	8.959E-04	0.0001	0.000E+00	0.0000	3.177E+00	0.4803	0.000E+00	0.0000	0.000E+00	0.0000	7.815E-02	0.0118

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.241E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.117E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.846E-01	0.1186
Ra-226	6.518E-02	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	4.750E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	5.401E+00	0.8165
U-238	3.517E-01	0.0532	0.000E+00	0.0000	0.000E+00	0.0000	2.561E-02	0.0039	0.000E+00	0.0000	0.000E+00	0.0000	4.292E-01	0.0649
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	4.170E-01	0.0630	0.000E+00	0.0000	0.000E+00	0.0000	3.037E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	6.615E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential-NO Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-NO-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	2.241E-01	0.0359	6.747E-08	0.0000	0.000E+00	0.0000	1.923E-02	0.0031	0.000E+00	0.0000	0.000E+00	0.0000	1.815E-04	0.0000
Ra-226	2.097E+00	0.3356	1.834E-04	0.0000	0.000E+00	0.0000	3.326E+00	0.5323	0.000E+00	0.0000	0.000E+00	0.0000	8.462E-02	0.0135
U-238	2.325E-02	0.0037	5.765E-04	0.0001	0.000E+00	0.0000	1.492E-02	0.0024	0.000E+00	0.0000	0.000E+00	0.0000	2.253E-03	0.0004
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.344E+00	0.3752	7.600E-04	0.0001	0.000E+00	0.0000	3.360E+00	0.5378	0.000E+00	0.0000	0.000E+00	0.0000	8.705E-02	0.0139

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	7.730E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.684E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.436E-01	0.0390
Ra-226	1.145E-01	0.0183	0.000E+00	0.0000	0.000E+00	0.0000	8.350E-03	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	5.630E+00	0.9012
U-238	3.102E-01	0.0497	0.000E+00	0.0000	0.000E+00	0.0000	2.260E-02	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	3.738E-01	0.0598
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.248E-01	0.0680	0.000E+00	0.0000	0.000E+00	0.0000	3.096E-02	0.0050	0.000E+00	0.0000	0.000E+00	0.0000	6.247E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential-NO Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-NO-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.935E-05	0.0000	5.824E-12	0.0000	0.000E+00	0.0000	1.660E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.567E-08	0.0000
Ra-226	1.653E+00	0.3573	1.492E-04	0.0000	0.000E+00	0.0000	2.688E+00	0.5813	0.000E+00	0.0000	0.000E+00	0.0000	6.921E-02	0.0150
U-238	3.519E-03	0.0008	8.736E-05	0.0000	0.000E+00	0.0000	2.260E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	3.413E-04	0.0001
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.656E+00	0.3581	2.366E-04	0.0001	0.000E+00	0.0000	2.690E+00	0.5817	0.000E+00	0.0000	0.000E+00	0.0000	6.955E-02	0.0150

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.554E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.614E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.106E-05	0.0000
Ra-226	1.483E-01	0.0321	0.000E+00	0.0000	0.000E+00	0.0000	1.082E-02	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	4.569E+00	0.9880
U-238	4.589E-02	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	3.344E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	5.544E-02	0.0120
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.942E-01	0.0420	0.000E+00	0.0000	0.000E+00	0.0000	1.416E-02	0.0031	0.000E+00	0.0000	0.000E+00	0.0000	4.625E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fan-House+802-Residential-NO Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-NO-BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.610E-10	0.0000	4.845E-17	0.0000	0.000E+00	0.0000	1.381E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.303E-13	0.0000
Ra-226	1.227E+00	0.3564	1.108E-04	0.0000	0.000E+00	0.0000	1.996E+00	0.5797	0.000E+00	0.0000	0.000E+00	0.0000	5.140E-02	0.0149
U-238	3.328E-04	0.0001	8.261E-06	0.0000	0.000E+00	0.0000	2.147E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	3.230E-05	0.0000
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.228E+00	0.3565	1.191E-04	0.0000	0.000E+00	0.0000	1.997E+00	0.5798	0.000E+00	0.0000	0.000E+00	0.0000	5.143E-02	0.0149

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.431E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.731E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.756E-10	0.0000
Ra-226	1.522E-01	0.0442	0.000E+00	0.0000	0.000E+00	0.0000	1.110E-02	0.0032	0.000E+00	0.0000	0.000E+00	0.0000	3.438E+00	0.9985
U-238	4.168E-03	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	3.037E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	5.060E-03	0.0015
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.563E-01	0.0454	0.000E+00	0.0000	0.000E+00	0.0000	1.140E-02	0.0033	0.000E+00	0.0000	0.000E+00	0.0000	3.443E+00	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA
Cs-137+D	Cs-137+D	1.000E+00	2.178E+00	2.128E+00	1.938E+00	1.724E+00	6.764E-01	2.100E-01	1.816E-05	1.514E-10
Ra-226+D	Ra-226+D	1.000E+00	1.134E+01	1.133E+01	1.130E+01	1.127E+01	1.101E+01	1.068E+01	8.425E+00	6.261E+00
Ra-226+D	Pb-210+D	1.000E+00	1.190E-01	3.203E-01	1.056E+00	1.857E+00	5.262E+00	6.274E+00	5.337E+00	4.095E+00
Ra-226+D	äDSR(j)		1.146E+01	1.165E+01	1.236E+01	1.313E+01	1.627E+01	1.696E+01	1.376E+01	1.036E+01
U-238	U-238	5.400E-05	4.085E-06	5.114E-06	9.181E-06	1.416E-05	4.997E-05	4.381E-05	6.481E-06	5.889E-07
U-238+D	U-238+D	9.999E-01	1.704E-01	1.901E-01	2.678E-01	3.628E-01	1.047E+00	9.114E-01	1.350E-01	1.230E-02
U-238+D	U-234	9.999E-01	1.243E-07	4.526E-07	2.949E-06	8.671E-06	1.470E-04	2.565E-04	1.889E-04	3.428E-05
U-238+D	Th-230	9.999E-01	4.086E-13	2.468E-12	2.911E-11	1.016E-10	2.050E-09	6.979E-09	5.740E-08	7.939E-08
U-238+D	Ra-226+D	9.999E-01	2.012E-11	6.175E-11	2.736E-10	4.503E-10	4.578E-09	2.535E-08	8.861E-07	2.788E-06
U-238+D	Pb-210+D	9.999E-01	5.530E-10	1.695E-09	7.426E-09	1.173E-08	6.078E-08	2.429E-07	1.589E-06	3.768E-06
U-238+D	äDSR(j)		1.704E-01	1.901E-01	2.678E-01	3.628E-01	1.047E+00	9.116E-01	1.352E-01	1.234E-02
iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii	iiiiiiiiii

The DSR includes contributions from associated (half-life ó 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

Nuclide									
(i)	t= 0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03	
AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	
Cs-137	6.886E+00	7.049E+00	7.740E+00	8.701E+00	2.218E+01	7.142E+01	8.262E+05	9.910E+10	
Ra-226	1.309E+00	1.287E+00	1.214E+00	1.143E+00	9.221E-01	8.846E-01	1.090E+00	1.448E+00	
U-238	8.800E+01	7.891E+01	5.602E+01	4.134E+01	1.433E+01	1.645E+01	1.109E+02	1.215E+03	
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 48.43 ñ 0.10 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
AAAAAAAA	AAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA
Cs-137	1.160E+00	0.000E+00	2.178E+00	6.886E+00	7.018E-01	2.137E+01
Ra-226	3.320E-01	101.3 ñ 0.2	1.696E+01	8.845E-01	1.621E+01	9.254E-01
U-238	4.100E-01	55.5 ñ 0.1	1.126E+00	1.332E+01	1.022E+00	1.467E+01
iiiiiiii	iiiiiiii	iiiiiiiiiiiiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

Summary : Fan-House+802-Residential-NO Bkg-Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-RES-NO-BKG-SUBTRACT.RAD

Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr								
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAA	AAAAAAA	AAAAAAAAA	AAAAAAAAA	AAAAAAAAA	AAAAAAAAA	AAAAAAAAA	AAAAAAAAA	AAAAAAAAA	AAAAAAAAA	AAAAAAAAA	
Cs-137	Cs-137	1.000E+00	2.527E+00	2.468E+00	2.248E+00	2.000E+00	7.846E-01	2.436E-01	2.106E-05	1.756E-10	
Ra-226	Ra-226	1.000E+00	3.764E+00	3.762E+00	3.753E+00	3.742E+00	3.654E+00	3.547E+00	2.797E+00	2.079E+00	
Ra-226	U-238	9.999E-01	8.249E-12	2.532E-11	1.122E-10	1.846E-10	1.877E-09	1.039E-08	3.633E-07	1.143E-06	
Ra-226	äDOSE(j)		3.764E+00	3.762E+00	3.753E+00	3.742E+00	3.654E+00	3.547E+00	2.797E+00	2.079E+00	
Pb-210	Ra-226	1.000E+00	3.951E-02	1.063E-01	3.505E-01	6.166E-01	1.747E+00	2.083E+00	1.772E+00	1.360E+00	
Pb-210	U-238	9.999E-01	2.267E-10	6.951E-10	3.045E-09	4.810E-09	2.492E-08	9.960E-08	6.517E-07	1.545E-06	
Pb-210	äDOSE(j)		3.951E-02	1.063E-01	3.505E-01	6.166E-01	1.747E+00	2.083E+00	1.772E+00	1.360E+00	
U-238	U-238	5.400E-05	1.675E-06	2.097E-06	3.764E-06	5.804E-06	2.049E-05	1.796E-05	2.657E-06	2.415E-07	
U-238	U-238	9.999E-01	6.988E-02	7.794E-02	1.098E-01	1.487E-01	4.291E-01	3.737E-01	5.536E-02	5.043E-03	
U-238	äDOSE(j)		6.988E-02	7.794E-02	1.098E-01	1.488E-01	4.292E-01	3.737E-01	5.537E-02	5.043E-03	
U-234	U-238	9.999E-01	5.096E-08	1.856E-07	1.209E-06	3.555E-06	6.029E-05	1.052E-04	7.744E-05	1.406E-05	
Th-230	U-238	9.999E-01	1.675E-13	1.012E-12	1.194E-11	4.167E-11	8.407E-10	2.861E-09	2.353E-08	3.255E-08	

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j, t), pCi/g								
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	
Cs-137	Cs-137	1.000E+00	1.160E+00	1.133E+00	1.032E+00	9.180E-01	3.601E-01	1.118E-01	9.651E-06	8.029E-11	
Ra-226	Ra-226	1.000E+00	3.320E-01	3.318E-01	3.310E-01	3.300E-01	3.223E-01	3.128E-01	2.466E-01	1.831E-01	
Ra-226	U-238	9.999E-01	0.000E+00	7.535E-16	9.325E-14	7.367E-13	8.338E-11	5.905E-10	3.036E-08	9.758E-08	
Ra-226	äS(j):		3.320E-01	3.318E-01	3.310E-01	3.300E-01	3.223E-01	3.128E-01	2.466E-01	1.831E-01	
Pb-210	Ra-226	1.000E+00	0.000E+00	1.015E-02	4.762E-02	8.808E-02	2.531E-01	2.971E-01	2.449E-01	1.819E-01	
Pb-210	U-238	9.999E-01	0.000E+00	5.821E-18	3.519E-15	5.404E-14	2.479E-11	2.808E-10	2.607E-08	9.099E-08	
Pb-210	äS(j):		0.000E+00	1.015E-02	4.762E-02	8.808E-02	2.531E-01	2.971E-01	2.449E-01	1.819E-01	
U-238	U-238	5.400E-05	2.214E-05	2.204E-05	2.162E-05	2.112E-05	1.749E-05	1.381E-05	2.090E-06	1.972E-07	
U-238	U-238	9.999E-01	4.100E-01	4.080E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.652E-03	
U-238	äS(j):		4.100E-01	4.081E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.653E-03	
U-234	U-238	9.999E-01	0.000E+00	1.157E-06	5.676E-06	1.109E-05	4.589E-05	7.248E-05	5.481E-05	1.034E-05	
Th-230	U-238	9.999E-01	0.000E+00	5.215E-12	1.287E-10	5.069E-10	1.119E-08	3.841E-08	3.197E-07	4.425E-07	

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 24.16 seconds

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Time = 0.000E+00	10
Time = 1.000E+00	11
Time = 5.000E+00	12
Time = 1.000E+01	13
Time = 5.000E+01	14
Time = 1.000E+02	15
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Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1 DCF's for external ground radiation, (mrem/yr)/(pCi/g)				
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(1)
A-1	Ba-137m (Source: FGR 12)	3.606E+00	3.606E+00	DCF1(2)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(3)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(4)
A-1	Cs-137 (Source: FGR 12)	7.510E-04	7.510E-04	DCF1(5)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(6)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(7)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(8)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(9)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(10)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(11)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(12)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(13)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(14)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(15)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(16)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(17)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(18)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(19)
B-1 Dose conversion factors for inhalation, mrem/pCi:				
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(2)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(3)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(4)
B-1	U-234	1.320E-01	1.320E-01	DCF2(5)
B-1	U-238	1.180E-01	1.180E-01	DCF2(6)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(7)
D-1 Dose conversion factors for ingestion, mrem/pCi:				
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(1)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(2)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(3)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(4)
D-1	U-234	2.830E-04	2.830E-04	DCF3(5)
D-1	U-238	2.550E-04	2.550E-04	DCF3(6)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(7)
D-34 Food transfer factors:				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(1,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(1,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

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Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(4,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(5,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(5,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(1,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(4,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(5,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(5,2)
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)

 #For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R011	Area of contaminated zone (m**2)	4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	5.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	2.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	5.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	5.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	5.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
3 3 3 3 3 3					
R012	Initial principal radionuclide (pCi/g): Cs-137	1.160E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Ra-226	3.320E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): U-238	4.100E-01	0.000E+00	---	S1(6)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(6)
3 3 3 3 3 3					
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.660E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.400E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.000E+03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	6.230E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	4.600E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.230E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
3 3 3 3 3 3					
R014	Density of saturated zone (g/cm**3)	1.660E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.400E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	2.000E+04	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	4.800E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.900E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R014	Well pump intake depth (m below water table)	1.800E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
3 3 3 3 3 3					
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	0.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.660E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.400E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.900E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+03	1.000E+01	---	HCUZ(1)
3 3 3 3 3 3					
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.800E+02	4.600E+03	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.889E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
3 3 3 3 3 3					
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	5.000E+02	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.618E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
3 3 3 3 3 3					
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
3 3 3 3 3 3					
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.082E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
3 3 3 3 3 3					
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.349E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	1.700E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.721E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R018	Drinking water intake (L/yr)	3.500E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
3 3 3 3 3 3					
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
3 3 3 3 3 3					
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
3 3 3 3 3 3					
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
3 3 3 3 3 3					

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH20CV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH20FL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions	Initial Soil Concentrations, pCi/g
Area: 4000.00 square meters	Cs-137 1.160E+00
Thickness: 5.00 meters	Ra-226 3.320E-01
Cover Depth: 0.00 meters	U-238 4.100E-01

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 1.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
TDOSE(t):	1.391E+00	1.379E+00	1.334E+00	1.286E+00	1.107E+00	9.417E-01	6.143E-01	4.615E-01
M(t):	9.271E-02	9.191E-02	8.894E-02	8.576E-02	7.377E-02	6.278E-02	4.095E-02	3.077E-02

Maximum TDOSE(t): 1.391E+00 mrem/yr at t = 0.000E+00 years

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	7.012E-01	0.5042	1.991E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.813E-04	0.0003
Ra-226	6.706E-01	0.4822	1.617E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.992E-03	0.0029
U-238	1.124E-02	0.0081	2.629E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.227E-04	0.0007
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.383E+00	0.9945	2.792E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.396E-03	0.0039

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.936E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.017E-01	0.5046
Ra-226	1.197E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.746E-01	0.4851
U-238	1.946E-03	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.437E-02	0.0103
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.960E-03	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.391E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.850E-01	0.4969	1.945E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.701E-04	0.0003
Ra-226	6.702E-01	0.4862	1.743E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.600E-03	0.0033
U-238	1.119E-02	0.0081	2.616E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.184E-04	0.0007
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.366E+00	0.9912	2.792E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.989E-03	0.0043

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	5.722E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.855E-01	0.4972
Ra-226	7.926E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.749E-01	0.4896
U-238	5.844E-03	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.821E-02	0.0132
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	5.929E-03	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.379E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA
Cs-137	6.238E-01	0.4676	1.771E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.281E-04	0.0003
Ra-226	6.687E-01	0.5012	2.205E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.843E-03	0.0051
U-238	1.098E-02	0.0082	2.567E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.012E-04	0.0007
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.303E+00	0.9770	2.789E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.173E-03	0.0061

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA
Cs-137	1.919E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.243E-01	0.4679
Ra-226	9.292E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.765E-01	0.5070
U-238	2.126E-02	0.0159	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.339E-02	0.0250
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.221E-02	0.0166	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.334E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	5.550E-01	0.4314	1.576E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.809E-04	0.0003
Ra-226	6.667E-01	0.5183	2.703E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.264E-03	0.0072
U-238	1.072E-02	0.0083	2.507E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.802E-04	0.0007
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.232E+00	0.9580	2.779E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.053E-02	0.0082

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.264E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.554E-01	0.4317
Ra-226	3.039E-03	0.0024	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.791E-01	0.5279
U-238	4.012E-02	0.0312	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.197E-02	0.0404
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.319E-02	0.0336	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.286E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	2.177E-01	0.1967	6.182E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.494E-04	0.0001
Ra-226	6.512E-01	0.5885	4.716E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.909E-02	0.0173
U-238	8.877E-03	0.0080	2.076E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.288E-04	0.0007
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	8.778E-01	0.7933	2.548E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.997E-02	0.0180

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.203E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.179E-01	0.1969
Ra-226	3.259E-02	0.0295	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.030E-01	0.6353
U-238	1.759E-01	0.1589	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.857E-01	0.1678
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.085E-01	0.1884	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.107E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.759E-02	0.0718	1.919E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.639E-05	0.0000
Ra-226	6.322E-01	0.6714	5.217E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.162E-02	0.0230
U-238	7.011E-03	0.0074	1.640E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.757E-04	0.0006
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.068E-01	0.7506	2.162E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.225E-02	0.0236

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.865E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.767E-02	0.0719
Ra-226	5.726E-02	0.0608	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.111E-01	0.7552
U-238	1.551E-01	0.1647	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.628E-01	0.1729
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.124E-01	0.2256	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.417E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	5.834E-06	0.0000	1.657E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.004E-09	0.0000
Ra-226	4.983E-01	0.8112	4.245E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.769E-02	0.0288
U-238	1.061E-03	0.0017	2.485E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.722E-05	0.0001
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	4.994E-01	0.8129	6.730E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.777E-02	0.0289

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
Cs-137	1.777E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.856E-06	0.0000
Ra-226	7.415E-02	0.1207	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.902E-01	0.9607
U-238	2.295E-02	0.0374	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.412E-02	0.0393
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	9.710E-02	0.1581	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.143E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\FANHOUSE+802-IND-NO BKG-SUBTRACT.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	4.853E-11	0.0000	1.378E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.331E-14	0.0000
Ra-226	3.701E-01	0.8019	3.153E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.314E-02	0.0285
U-238	1.003E-04	0.0002	2.350E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.253E-06	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.702E-01	0.8021	3.388E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.314E-02	0.0285

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.216E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.889E-11	0.0000
Ra-226	7.608E-02	0.1648	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.593E-01	0.9952
U-238	2.084E-03	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.195E-03	0.0048
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.816E-02	0.1694	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.615E-01	1.0000

*Sum of all water independent and dependent pathways.

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i, tmin)	G(i, tmin) (pCi/g)	DSR(i, tmax)	G(i, tmax) (pCi/g)
AAAAAAAA	AAAAAAAAAA	AAAAAAAAAAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA	AAAAAAAAAA
Cs-137	1.160E+00	0.000E+00	6.049E-01	2.480E+01	6.049E-01	2.480E+01
Ra-226	3.320E-01	91.4 ± 0.2	2.143E+00	7.000E+00	2.032E+00	7.382E+00
U-238	4.100E-01	55.6 ± 0.1	4.906E-01	3.057E+01	3.506E-02	4.279E+02
iiiiiiii	iiiiiiiiii	iiiiiiiiiiiiiiiiiii	iiiiiiiiiii	iiiiiiiiiii	iiiiiiiiiii	iiiiiiiiiii

Summary : Fanhouse+802-Industrial-No Bkgd Subtract

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Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr								
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	Cs-137	1.000E+00		7.017E-01	6.855E-01	6.243E-01	5.554E-01	2.179E-01	6.767E-02	5.856E-06	4.889E-11
Ra-226	Ra-226	1.000E+00		6.743E-01	6.739E-01	6.723E-01	6.703E-01	6.546E-01	6.355E-01	5.015E-01	3.731E-01
Ra-226	U-238	9.999E-01		3.864E-12	1.178E-11	5.201E-11	8.286E-11	5.956E-10	2.895E-09	7.035E-08	2.151E-07
Ra-226	äDOSE(j)			6.743E-01	6.739E-01	6.723E-01	6.703E-01	6.546E-01	6.355E-01	5.015E-01	3.731E-01
Pb-210	Ra-226	1.000E+00		3.292E-04	1.017E-03	4.158E-03	8.739E-03	4.833E-02	7.560E-02	8.864E-02	8.619E-02
Pb-210	U-238	9.999E-01		1.063E-10	3.239E-10	1.424E-09	2.231E-09	1.153E-08	4.555E-08	2.250E-07	4.458E-07
Pb-210	äDOSE(j)			3.292E-04	1.017E-03	4.158E-03	8.739E-03	4.833E-02	7.560E-02	8.864E-02	8.619E-02
U-238	U-238	5.400E-05		1.617E-07	3.611E-07	1.150E-06	2.115E-06	9.059E-06	7.984E-06	1.180E-06	1.070E-07
U-238	U-238	9.999E-01		1.437E-02	1.821E-02	3.339E-02	5.197E-02	1.856E-01	1.628E-01	2.408E-02	2.188E-03
U-238	äDOSE(j)			1.437E-02	1.821E-02	3.339E-02	5.197E-02	1.856E-01	1.628E-01	2.408E-02	2.188E-03
U-234	U-238	9.999E-01		5.718E-09	3.262E-08	3.697E-07	1.295E-06	2.666E-05	4.675E-05	3.439E-05	6.229E-06
Th-230	U-238	9.999E-01		2.476E-14	1.213E-13	1.234E-12	4.031E-12	7.971E-11	2.750E-10	2.244E-09	3.104E-09
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g								
			t=	0.000E+00	1.000E+00	5.000E+00	1.000E+01	5.000E+01	1.000E+02	5.000E+02	1.000E+03
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	Cs-137	1.000E+00		1.160E+00	1.133E+00	1.032E+00	9.180E-01	3.601E-01	1.118E-01	9.651E-06	8.029E-11
Ra-226	Ra-226	1.000E+00		3.320E-01	3.318E-01	3.310E-01	3.300E-01	3.223E-01	3.128E-01	2.466E-01	1.831E-01
Ra-226	U-238	9.999E-01		0.000E+00	7.535E-16	9.325E-14	7.367E-13	8.338E-11	5.905E-10	3.036E-08	9.758E-08
Ra-226	äS(j):			3.320E-01	3.318E-01	3.310E-01	3.300E-01	3.223E-01	3.128E-01	2.466E-01	1.831E-01
Pb-210	Ra-226	1.000E+00		0.000E+00	1.015E-02	4.762E-02	8.808E-02	2.531E-01	2.971E-01	2.449E-01	1.819E-01
Pb-210	U-238	9.999E-01		0.000E+00	5.821E-18	3.519E-15	5.404E-14	2.479E-11	2.808E-10	2.607E-08	9.099E-08
Pb-210	äS(j):			0.000E+00	1.015E-02	4.762E-02	8.808E-02	2.531E-01	2.971E-01	2.449E-01	1.819E-01
U-238	U-238	5.400E-05		2.214E-05	2.204E-05	2.162E-05	2.112E-05	1.749E-05	1.381E-05	2.090E-06	1.972E-07
U-238	U-238	9.999E-01		4.100E-01	4.080E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.652E-03
U-238	äS(j):			4.100E-01	4.081E-01	4.004E-01	3.911E-01	3.238E-01	2.557E-01	3.870E-02	3.653E-03
U-234	U-238	9.999E-01		0.000E+00	1.157E-06	5.676E-06	1.109E-05	4.589E-05	7.248E-05	5.481E-05	1.034E-05
Th-230	U-238	9.999E-01		0.000E+00	5.215E-12	1.287E-10	5.069E-10	1.119E-08	3.841E-08	3.197E-07	4.425E-07
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 19.30 seconds

Appendix D

HFBR Fan Houses Project ORISE IVS Report

July 26, 2011

Ms. Terri Kneitel
U.S. Department of Energy
Brookhaven Site Office
53 Bell Ave., Building 464
Upton, NY 11973

**SUBJECT: DOE CONTRACT NO. DE-AC05-06OR23100
FINAL REPORT- INDEPENDENT VERIFICATION SURVEY OF THE
HIGH FLUX BEAM REACTOR, FAN HOUSE BUILDINGS 704 AND 802
BROOKHAVEN NATIONAL LABORATORY, UPTON, NEW YORK
DCN: 5098-SR-06-1**

Dear Ms. Kneitel:

The Oak Ridge Institute for Science and Education's (ORISE) Independent Environmental Assessment and Verification (IEAV) Program has revised the final verification survey report for the 802 Fan House to include the 704 Fan House at Brookhaven National Laboratory. You may contact me via my information provided below, or Phyllis Weaver at 865.576.5321, should you have any questions or require additional information.

Sincerely,



Evan M. Harpenau
Assistant Project Manager/Health Physicist
Independent Environmental Assessment
and Verification

EMH:bf

Enclosure

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FINAL REPORT – INDEPENDENT VERIFICATION SURVEY OF THE HIGH FLUX BEAM REACTOR, FAN HOUSE BUILDINGS 704 AND 802 BROOKHAVEN NATIONAL LABORATORY, UPTON, NEW YORK

E. M. Harpenau

Prepared for the
U.S. Department of Energy

ORISE

Oak Ridge Institute for Science and Education

Approved for public release; further dissemination unlimited.



The Oak Ridge Institute for Science and Education (ORISE) is a U.S. Department of Energy institute focusing on scientific initiatives to research health risks from occupational hazards, assess environmental cleanup, respond to radiation medical emergencies, support national security and emergency preparedness, and educate the next generation of scientists. ORISE is managed by Oak Ridge Associated Universities.

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**FINAL REPORT- INDEPENDENT VERIFICATION SURVEY
OF THE HIGH FLUX BEAM REACTOR,
FAN HOUSE BUILDINGS 704 AND 802
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

Prepared by

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Prepared for the
U.S. Department of Energy

FINAL REPORT



July 2011

This report is based on work performed by the Oak Ridge Institute for Science and Education under contract number DE-AC05-06OR23100 with the U.S. Department of Energy

**FINAL REPORT- INDEPENDENT VERIFICATION SURVEY
OF THE HIGH FLUX BEAM REACTOR
FAN HOUSE BUILDINGS 704 AND 802
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

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ABBREVIATIONS AND ACRONYMS

AEC	Atomic Energy Commission
BAO	Brookhaven Area Office
BKG	background
BNL	Brookhaven National Laboratory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
CO	cleanup objective
CPM	counts per minute
DOE	U.S. Department of Energy
DPM	disintegrations per minute
EPA	U.S. Environmental Protection Agency
FIPS	Federal Information Processing Standard
FSS	final status survey
GPS	Global Positioning System
HFBR	High Flux Beam Reactor
IAG	Interagency Agreement
IEAV	Independent Environmental Assessment and Verification
ISM	Integrated Safety Management
ITP	Intercomparison Testing Program
IV	independent verification
JHA	Job Hazard Analyses
MAPEP	Mixed Analyte Performance Evaluation Program
MDC	minimum detectable concentration
MeV	million electron volts
Mrem	millirem
NaI	sodium iodide
NIST	National Institute for Standards and Technology
NRIP	NIST Radiochemistry Intercomparison Program
NYSDEC	New York State Department of Environmental Conservation
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RESRAD	RESidual RADioactivity
ROC	Radionuclide of Concern

ABBREVIATIONS AND ACRONYMS

ROD	Record of Decision
SOR	sum-of-ratios
SPCS	State Plane Coordinate System
SU	survey unit
TAP	total absorption peak
Yr	year

**FINAL REPORT - INDEPENDENT VERIFICATION SURVEY
OF THE HIGH FLUX BEAM REACTOR, FAN HOUSE
BUILDINGS 704 AND 802
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

1.0 INTRODUCTION AND SITE HISTORY

The Brookhaven National Laboratory (BNL), located in Upton, Suffolk County, New York, conducts research and development for the U.S. Department of Energy's (DOE) Office of Science (Figure A-1). BNL was originally occupied by the U.S. Army as Camp Upton during both World War I and II. In 1947, the site was transferred to the former Atomic Energy Commission (the current DOE). DOE's Brookhaven Area Office (BAO) oversees activities at the site, including environmental management programs that involve the cleanup and removal of contaminated facilities and soils.

Research operations and processes conducted at the site have produced a variety of radioactive and hazardous wastes that have had an impact on the local site environment. As a result, the BNL site was included on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List on December 21, 1989. In May 1992, DOE entered into an Interagency Agreement (IAG) with the U.S. Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) under CERCLA, Section 120. The IAG established the framework and schedule for characterizing, assessing, and remediating the site in accordance with requirements of CERCLA and the Resource Conservation and Recovery Act (RCRA) (EPA 1997). In April 2009, the Record of Decision (ROD) Area of Concern 31 for the High Flux Beam Reactor (HFBR) was finalized. The HFBR ROD defined eight isolated areas of contamination that were present in 2005 and have since been remediated (BNL 2009). Per final status survey (FSS) requirements, BNL will assess the outside grounds around the HFBR to assure that the previous remediation activities remain successful and that no activity at BNL has since affected these areas.

Based on guidance in a DOE Environmental Management Memorandum, independent verification (IV) shall be performed at all DOE cleanup sites (DOE 2011). At the request of the DOE-BAO, the Oak Ridge Institute for Science and Education's (ORISE) Independent Environmental

Assessment and Verification (IEAV) program performed IV of FSS activities associated with the HFBR decommissioning project. The purpose of IV is to confirm that remediation activities are effective in meeting established guidelines and that documentation accurately and adequately describes the final site conditions. By using an independent third party, DOE can provide a level of assurance to the stakeholders that the as-left radiological conditions meet the established cleanup goals and are accurately documented.

2.0 SITE DESCRIPTION

The HFBR Complex is centrally located within the BNL Site between Cornell Avenue, Renaissance Road, and Rutherford Drive. The HFBR Complex occupies approximately 13 acres that formerly housed multiple structures and systems, including the 704 and 802 Fan Houses. Both facilities were located to the southeast of the Brookhaven Graphite Research Reactor (BGRR) and to the northwest of the HFBR (Figure A-1). The 704 Fan House was initially constructed to provide primary and secondary cooling air for the HFBR. The BGRR discharge plenum, the electrical switchgear, and the normal and emergency power batteries for the HFBR were also housed in the 704 Fan House (BNL 2011a). After removal of the 704 building structure, the basement foundation and the concrete pad of the Air By-Pass Filter Facility remained. The 704 footprint was divided into survey units (SUs) 4 and 5 (Figure A-2).

The HFBR 802 Fan House and associated piping once occupied the area located at the north base of the existing stack (Figure A-3). The 802 Fan House provided exhaust flow for Buildings 801, 815, and 830. Building 802 housed the equipment for evaporation of low-level triated water. SU 6 consists of the 802 Fan House footprint. The boundaries of the initial SU 6 were modified post-remediation and before the FSS. The area delineated by the FSS boundary lines was approximately 1,845 m² and it includes the soils and remaining clay off-gas piping that lay beneath an active high-pressure steam line (BNL 2011b).

3.0 OBJECTIVE

The objective of the verification survey was to obtain evidence, by means of measurements and sampling, to confirm that the final radiological conditions meet the established cleanup goals. This objective was achieved via multiple verification components, including document reviews,

instrument scans, and sample analysis, to determine the accuracy and adequacy of FSS documentation.

4.0 PROCEDURES

ORISE conducted verification activities on August 17, 2010 at the 704 Fan House and on May 9, 2011 at the 802 Fan House. ORISE activities included visual inspections of the survey areas, measurement and sampling of remaining soils and concrete, surface measurements of remaining concrete structures and piping, and sampling for removable activity on remaining surfaces associated with the 704 and 802 Fan Houses. Verification activities were conducted in accordance with an ORISE project-specific plan, and the ORISE/IEAV Survey Procedures and Quality Program Manuals (ORISE 2011a and 2008, and ORAU 2011).

4.1 REFERENCE SYSTEM

ORISE used a Global Positioning System (GPS) for documenting measurement and sampling locations, SU or area boundaries, and tracking scan data. The specific geographic coordinate system used was the State Plane Coordinate System (SPCS), New York Long Island Federal Information Processing Standard (FIPS) 3104. Coordinate measurements collected using the GPS were accurate to within one meter.

4.2 SURFACE SCANS

All gamma scans were performed using an unshielded 2 in $\times$ 2 in NaI scintillation detector coupled to a ratemeter-scaler with an audible indicator. The GPS compatible detector enabled real-time gamma count rate and position data capture. Scan data were also recorded on a hard copy of available field survey maps. Gamma scans were performed in all accessible areas in SUs 4, 5, and 6 to include the 704 Fan House foundation walls, floor, the concrete pad, and accessible soils in the 802 Fan House excavated area (Figure A-4, A-5, and A-6).

Alpha-plus-beta scans of the remaining 704 Fan House foundation lower walls and pedestals were performed at locations selected for surface activity measurements. An area of approximately one square meter equal distance around the surface activity measurement location was scanned using gas proportional detectors coupled to ratemeter-scalers with an audible indicator. On the remaining

concrete pad in SU 5, 100% of the accessible area was scanned using a large-area alpha-plus-beta gas proportional detector coupled to a ratemeter-scaler with an audible indicator.

Alpha and beta scans were also performed within a meter inside the opening in each end of the remaining 802 Fan House clay off-gas pipe in SU 6. Alpha and beta scans were performed using alpha scintillation and beta scintillation detectors coupled to ratemeter-scalers with audible indicators.

4.3 SURFACE ACTIVITY MEASUREMENTS

Direct surface activity measurements for alpha-plus-beta were performed on the remaining foundation pedestals of the 704 Fan House using a gas-proportional detector. Surface activity measurements were performed at the 802 Fan House at each opening of the remaining section of the clay pipe using both alpha and beta scintillation detectors. Attention was given to joints, cracks, and penetrations in the concrete surfaces when determining sample locations.

Smears for removable gross alpha and beta contamination were obtained on remaining concrete and clay surface using a 47 mm diameter numbered filter paper disk. Individual smears were placed in a labeled envelope. A second smear was moistened with deionized water which was used to collect a sample to quantify the tritium (H-3) concentration. The smear was then sealed in a labeled liquid scintillation vial. Both gross alpha and beta and H-3 smears were collected from adjacent 100cm² area locations.

Twenty smears for both removable gross alpha and beta activity, and for H-3 concentrations, were collected at judgmentally selected locations on the walls and pedestals of the 704 Fan House foundation (Figure A-7). Two smears for removable gross alpha and beta activity, and two smears for H-3 concentrations, were obtained from judgmentally selected locations inside the 18-inch clay off-gas pipe in SU 6 (Figure A-8). Smear results are presented in Table B-1 for the 704 Fan House and Table B-2 for the 802 Fan House.

4.4 SOIL AND CONCRETE SAMPLING

Visual Sampling Plan (VSP) software was used to generate the statistical basis for the number of soil samples necessary to estimate the mean and to provide the randomly generated sample locations per

EPA guidance (EPA 2002). Twelve random systematic soil samples (0 to 0.15 m) were obtained in SUs 4 and 5, and two judgmental soil samples (S0036 and S0037) were collected from the remediated hot-spot locations identified in SU 5 (Figures A-9 and A-10). Three judgmental concrete samples (S0038 to S0040) were collected from the Air Bypass concrete pad primarily for H-3 analysis (Figure A-10).

The VSP developed for sampling the 802 Fan House SU 6 could not be used as a result of a change in the survey unit's boundary as originally determined by Brookhaven Science Associates (BSA). BSA did not provide ORISE with the revised geospatially-oriented maps prior to arriving on-site. ORISE collected six judgmental soil samples based on observation and professional judgment. Soil samples were obtained with consideration to locations having the greatest potential for contamination to settle. This would include the soil beneath the clay pipe joint connections and at the deepest points of the excavation (Figure A-11). Gamma measurements were also performed at each soil sample location prior to and after each sample was collected to verify that the level of radioactivity did not increase following the removal of soil.

5.0 SOIL CLEANUP OBJECTIVES

The soil cleanup objectives for the radionuclides of concern (ROCs) are provided in Table 1 as specified in the HFBR – ROD (BNL 2009 and 2010). The primary ROCs are Cs-137, Sr-90, and Ra-226. Also listed are potential radionuclides that have been associated with the various processes and projects at BNL during the years of operation. BNL will prepare a residual radioactivity (RESRAD) code calculation to include any of these additional radionuclides that might be identified to determine if the resulting concentration does not exceed the site 15 millirem per year (mrem/yr) dose criteria.

TABLE 1:
RADIONUCLIDES OF CONCERN FOR THE
704 AND 802 FAN HOUSES AT
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

Radionuclide	Operable Unit I ROD (pCi/g)
Cs-137	23
Sr-90	15
Ra-226	5
<i>Estimated Cleanup Values (pCi/g)^a</i>	
H-3	Not Listed ^b
Co-60	1,260
Am-241	34
Pu-238	57
Pu-239/240	35
Eu-152	51
Eu-154	180
U-235	4.6 ^c
U-238	4.7 ^c

^aEach value listed in this section of the table is the estimated cleanup value if the individual radionuclide was the only radionuclide. The demonstration that the site is acceptable would be based on a RESRAD evaluation using all BNL-related radionuclides detected (BNL 2010).

^bThe pCi/g value for tritium for both the 15 millirem total dose criterion and the 4 millirem per year groundwater consumption criterion is very high ($> 1 \text{ E}+15$) because the calculated dose is close to zero. Tritium, if detected, will be included in the RESRAD evaluation following remediation.

^cValues listed for uranium are based on 4 millirem per year from groundwater consumption.

6.0 SAMPLE ANALYSIS AND DATA INTERPRETATION

6.1 SOIL AND CONCRETE ANALYSIS

Samples were returned to the ORISE laboratory in Oak Ridge, TN for radiological analysis and interpretation. Sample analyses were performed in accordance with the ORISE Laboratory Procedures Manual (ORISE 2011b). Soil and concrete samples were analyzed by gamma spectroscopy and reviewed for the primary radionuclides of concern, Cs-137 and Ra-226. The spectra were also reviewed for other identifiable photopeaks. Sr-90 in soil and concrete was quantified by radiochemical separation and counted on a low background proportional counter. Soil sample results are reported in units of picocuries per gram (pCi/g). Analytical results were compared to the cleanup objectives provided in Table 1.

6.2 REMOVABLE ACTIVITY SAMPLES

Smear samples for gross alpha and beta activity were analyzed using a low-background proportional counter. Removable activity is reported in units of disintegrations per minute (dpm)/100 cm².

Surface activity measurement data collected during the field survey were converted from counts per minute (cpm) to units of dpm/100 cm². Tritium concentrations on smears were determined via liquid scintillation analysis. Results for H-3 are reported in pCi/100 cm².

7.0 FINDINGS AND RESULTS

The results of the verification surveys for the 704 and 802 Fan Houses and associated material are discussed below.

7.1 SURFACE SCANS

Gamma scan count rates at the 704 Fan House generally ranged from 3,000 to 7,000 gross cpm for the surface soil, between 2,000 and 4,000 cpm on the concrete pad surfaces, and 3,000 to 5,000 cpm on the walls of the Fan House foundation. The two soil locations near the base of the concrete pad had the highest count rates, measuring 8,000 and 16,000 cpm. Alpha-plus-beta scans of the remaining 704 Fan House foundation lower walls and pedestals ranged from 120 to 460 cpm. On the concrete pad, the alpha-plus-beta scan ranges were from 800 to 1,500 cpm using a large-area detector.

Gamma scan count rates at the 802 Fan House ranged from approximately 5,200 to 13,357 gross cpm with a mean of 8,311 cpm. The highest count rates were observed where soils were near ground level and in close proximity to ongoing remediation activities around the stack. The isolated count rate in excess of 11,200 cpm is the result of the gamma survey inside the clay off-gas pipe. This type of ceramic construction material is known to consist of naturally occurring radioactive material which typically has elevated count rate activity when compared to the count rates of the surrounding soil. The orientation of the excavated soils at the east end of the pipe allowed the ORISE surveyor to scan to a depth of approximately one meter inside the pipe, while the excavated soil at the west pipe opening allowed the surveyor to reach an approximate depth of 0.6 meters. Alpha scans ranged from 0 to 15 cpm at the west opening and 0 to 10 cpm at the east opening. Beta

scans for the west opening of the off-gas pipe ranged from 850 to 1050 cpm and 750 to 900 cpm at the east opening.

7.2 SURFACE ACTIVITY MEASUREMENTS

Alpha-plus-beta surface activity measurements were collected on the remaining 704 concrete structure surfaces. The surface activity measurement data are presented in Table B-1. A material-specific background was not subtracted from the concrete samples in SU 5; however, a gross ambient background was subtracted from the gross count rate and then compared to the direct measurements taken on the concrete surface. Measurements ranged from 26 dpm/100 cm² to 1102 dpm/100 cm².

Two alpha and beta surface activity measurements were collected inside both openings of the off-gas pipe at the 802 Fan House. The detector was moved inside the pipe to the full extension of the detector cable. A material-specific background was not subtracted from the gross count rate. Moreover, the surface measurements were compared to the ceramic block background count rate for a beta detector with a similar efficiency, as listed in Table 5.1 of NUREG-1507 (NRC 1998). This comparison supports the conclusion that the as-left radiological conditions meet the project cleanup goals. The direct measurement data are presented in Table B-2.

7.3 REMOVABLE ACTIVITY AND CONCENTRATIONS

Removable activity for gross alpha and beta results from the 704 Fan House ranged from -0.43 to 1.73 dpm/100 cm² for alpha and -3.64 to 7.80 dpm/100 cm² for beta. H-3 concentrations for smears ranged from -1.9 to 9.0 pCi/100 cm². Results for individual sample locations are provided in Table B-1.

Removable activity results of smears collected inside the clay off-gas pipe from the 802 Fan House were -0.43 and 1.73 dpm/100 cm² for gross alpha and -3.64 to -2.60 dpm/100 cm² for gross beta activity. The removable H-3 concentrations were 6.1 and 1.7 pCi/100 cm². Results for individual sample locations are provided in Table B-2.

7.4 SOIL ANALYSIS

Sample results for the 704 Fan House are provided in Table B-3. Concentrations ranged from 0.01 to 0.17 pCi/g for Cs-137, 0.21 to 0.58 pCi/g for Ra-226, and from 0.03 to 0.55 pCi/g for Sr-90. The two judgmental soil sample concentrations for Cs-137 were 0.16 and 0.37 pCi/g, 0.22 and 0.24 pCi/g for Ra-226, and -0.02 and 0.57 pCi/g for Sr-90.

Sample results for the 802 Fan House are provided in Table B-4. Concentrations for Cs-137 ranged from -0.01 to 0.07 pCi/g, 0.25 to 0.32 pCi/g for Ra-226 and the Sr-90 concentrations ranged from 0.31 to 0.05 pCi/g.

All gamma spectroscopy spectra and results were reviewed to determine if alpha spectroscopy analysis was warranted. In particular, the Am-241 was reviewed for measurable concentrations. Such results would be indicative of a potential issue with Pu-239/240. All Am-241 concentrations were less than the minimum detectable concentration (MDC).

7.5 CONCRETE SAMPLES

Gamma spectroscopy results in the concrete samples ranged from 0.02 to 0.11 pCi/g for Cs-137 and 0.19 to 0.22 pCi/g for Ra-226. Sr-90 concentrations ranged from -0.09 to 3.02 pCi/g. H-3 concentrations ranged from 75.0 to 299.7 pCi/g. Results for each individual sample are provided in Table B-3.

8.0 COMPARISON OF RESULTS WITH GUIDELINES

The analytical results for the primary ROCs were compared to the soil cleanup objectives shown in Table 1. Cs-137, Ra-226, and Sr-90 concentrations were well below the cleanup objectives and many below the analytical MDC. Because there are multiple ROC (n) evaluated, the unity rule sum-of-ratios (SOR) is applicable for soil samples using the following equation:

$$\frac{Conc_{Ra-226}}{CO_{Ra-226}} + \frac{Conc_{Cs-137}}{CO_{Cs-137}} + \frac{Conc_{Sr-90}}{CO_{Sr-90}} + \dots + \frac{Conc_n}{CO_n} \leq 1$$

where the SOR of individual radionuclide concentration divided by the radionuclide cleanup objective must be less than or equal to 1.

The SORs for individual samples were all below 1 for SUs 4, 5, and 6. SORs are listed in Tables B-3 and B-4. Low concentrations of H-3 were measured within the concrete sample matrices. Guideline values were not listed by BNL for residual H-3 in volumetric mass. The DOE Order 5400.5 was used as guidance for comparison of surface activity measurements (DOE 1993).

9.0 CONCLUSION

On August 17, 2010 and May 9, 2011, ORISE conducted verification survey activities including scans, measurements, sampling, and the collection of smears of the remaining soils, concrete, and off-gas pipe associated with the 704 and 802 Fan Houses within the HFBR Complex at BNL. ORISE is of the opinion, based on independent scan and sample results obtained during verification activities at the HFBR 704 and 802 Fan Houses, that these FSS units meet the applicable site cleanup objectives established for as-left radiological conditions.

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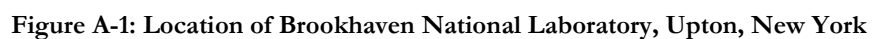
U.S. Environmental Protection Agency (EPA). *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination (OSWER Directive 9200.14-18)*, U.S. Environmental Protection Agency. August 1997.

U.S. Environmental Protection Agency. *Guidance on Choosing a Sampling Design for Environmental Data Collection*. U.S. Environmental Protection Agency. December 2002.

U.S. Nuclear Regulatory Agency (NRC). *Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG 1507. Washington, DC. January 1998.

APPENDIX A

FIGURES



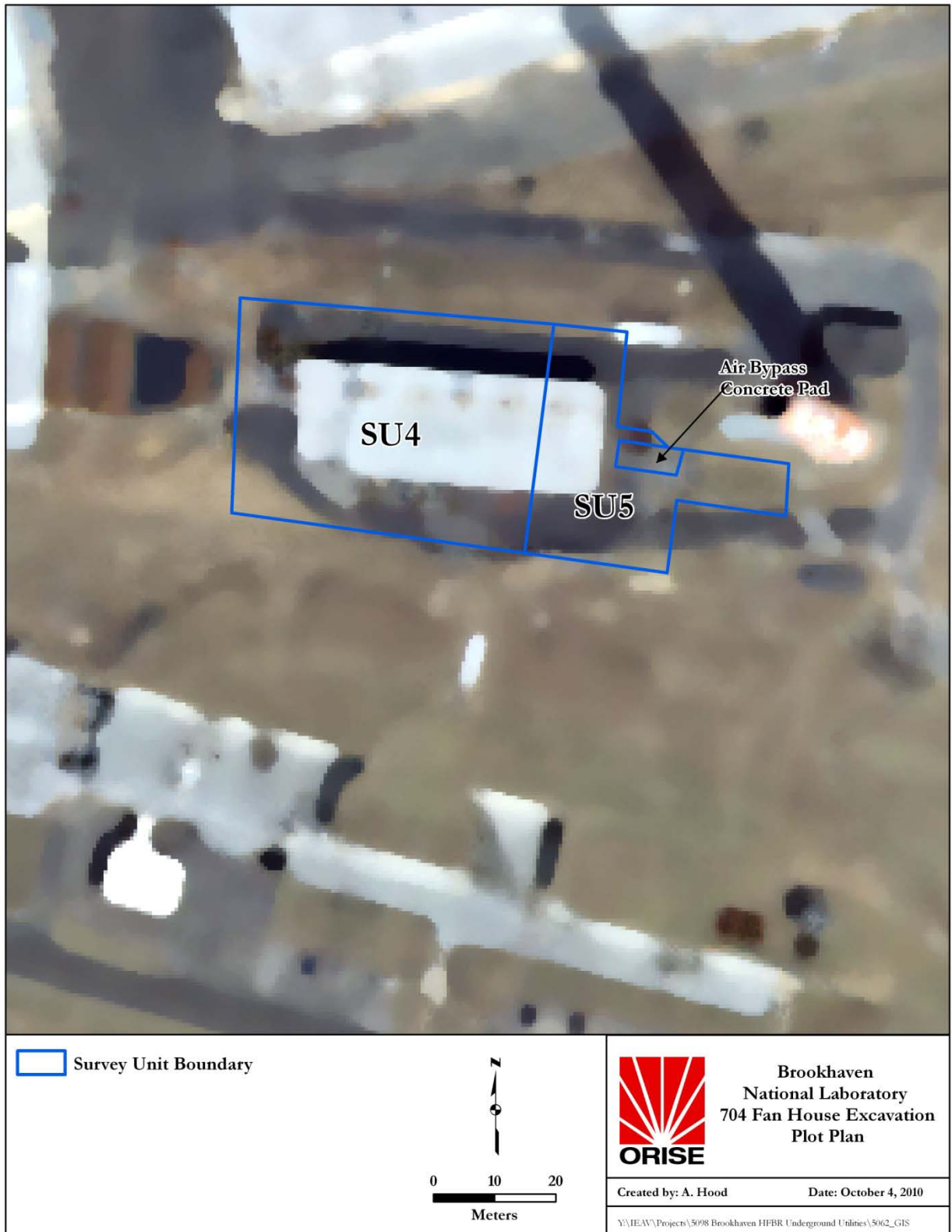


Figure A-2: Plot Plan of the 704 Fan House Survey Area at Brookhaven National Laboratory



Figure A-3: Plot Plan of the 802 Fan House Survey Area at Brookhaven National Laboratory

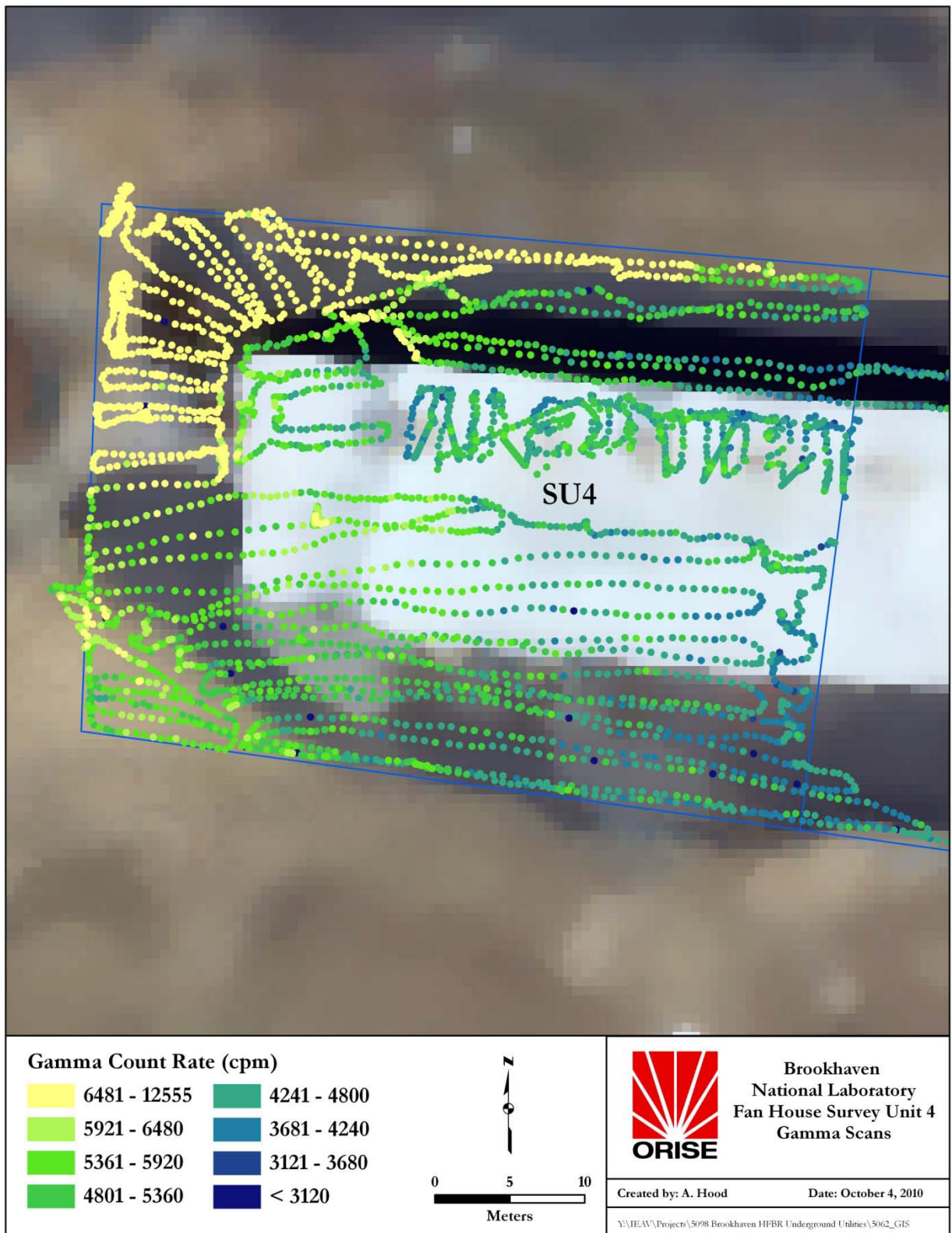


Figure A-4: Gamma Scans of the 704 Fan House Survey Area

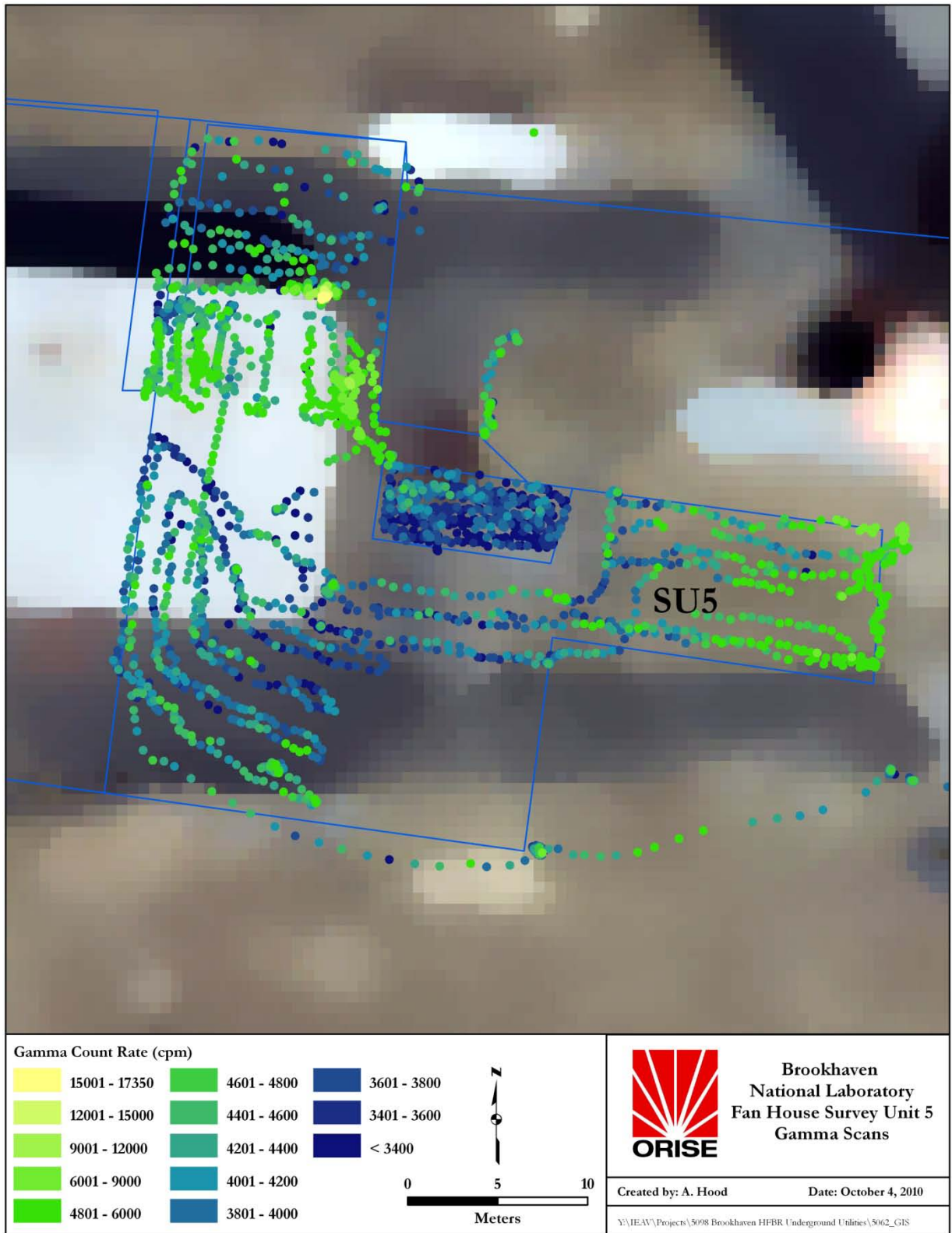


Figure A-5: Gamma Scans of the 704 Fan House and Air By-Pass Concrete Pad Survey Area



Figure A-6: Gamma Scans of the 802 Fan House Survey Area

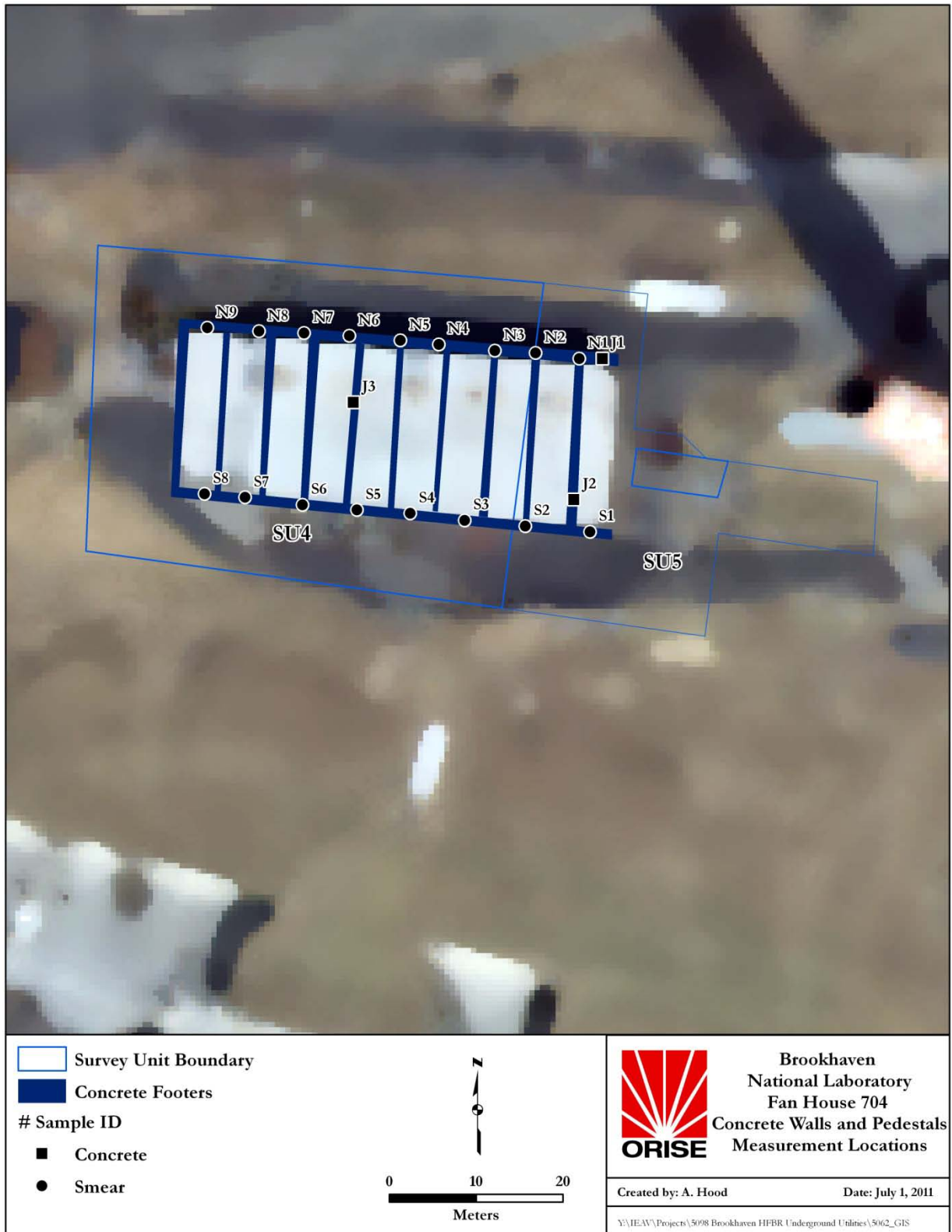


Figure A-7: 704 Fan House Judgmental Locations

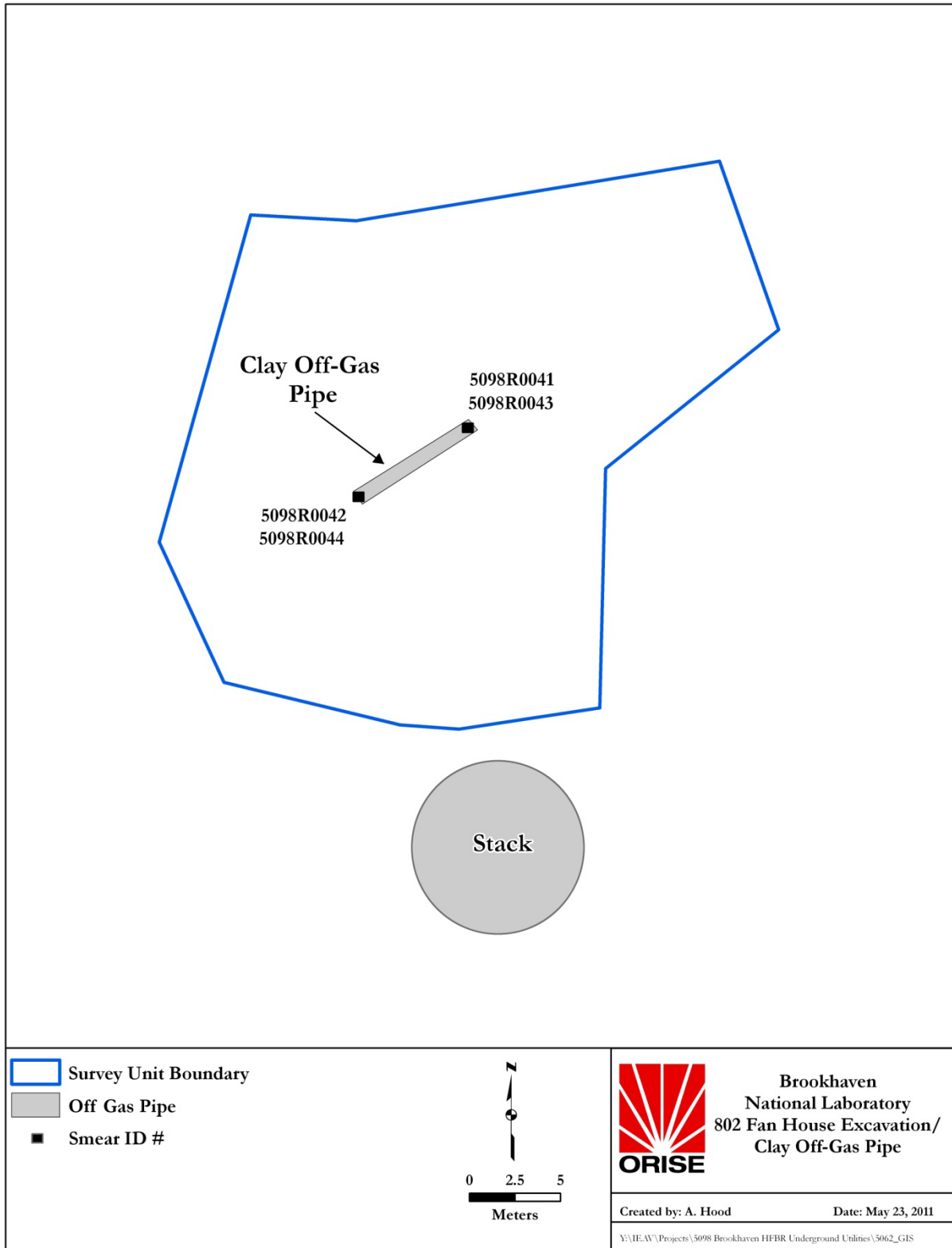


Figure A-8: Clay Off-Gas Pipe Direct Measurement and Smears Locations

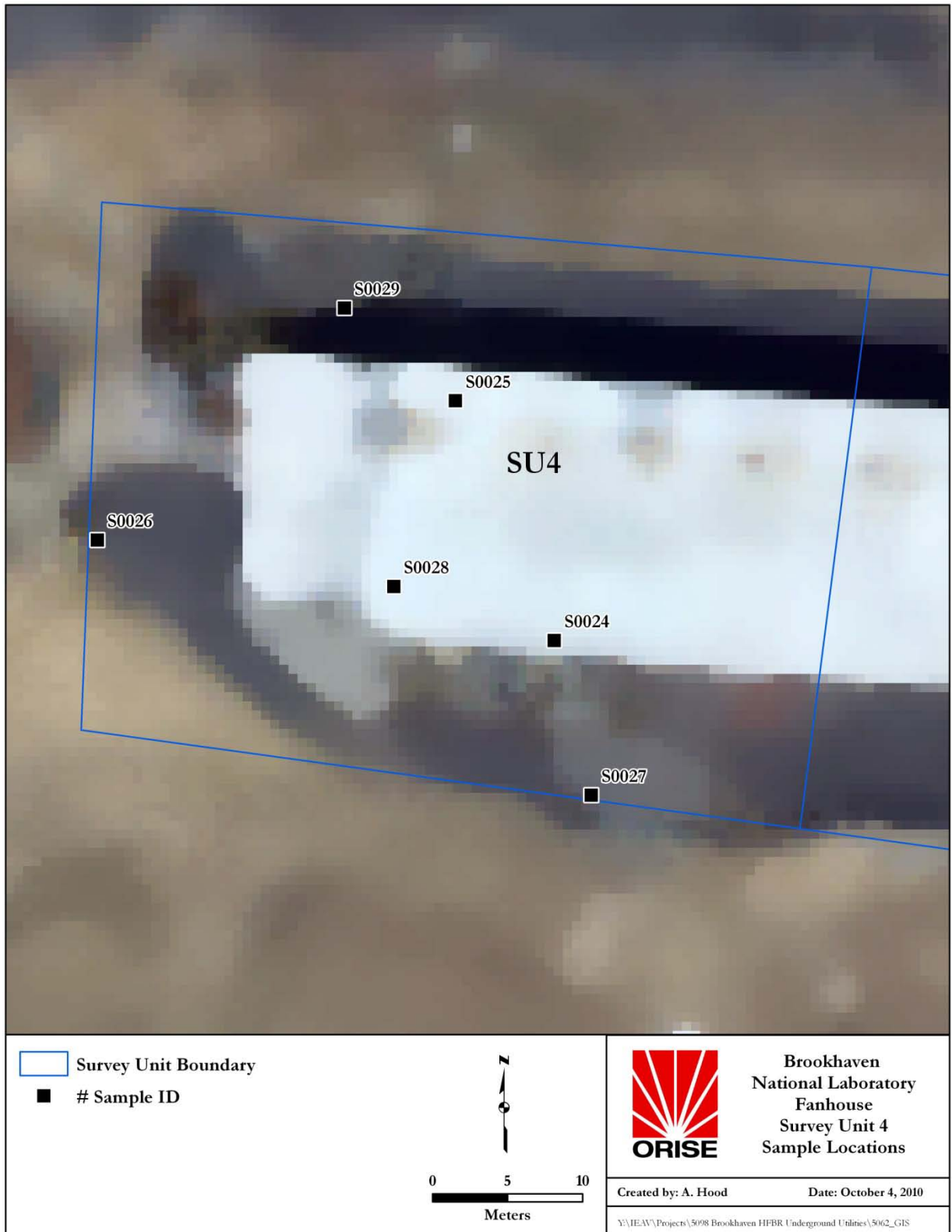


Figure A-9: 704 Fan House Soil Sample Locations

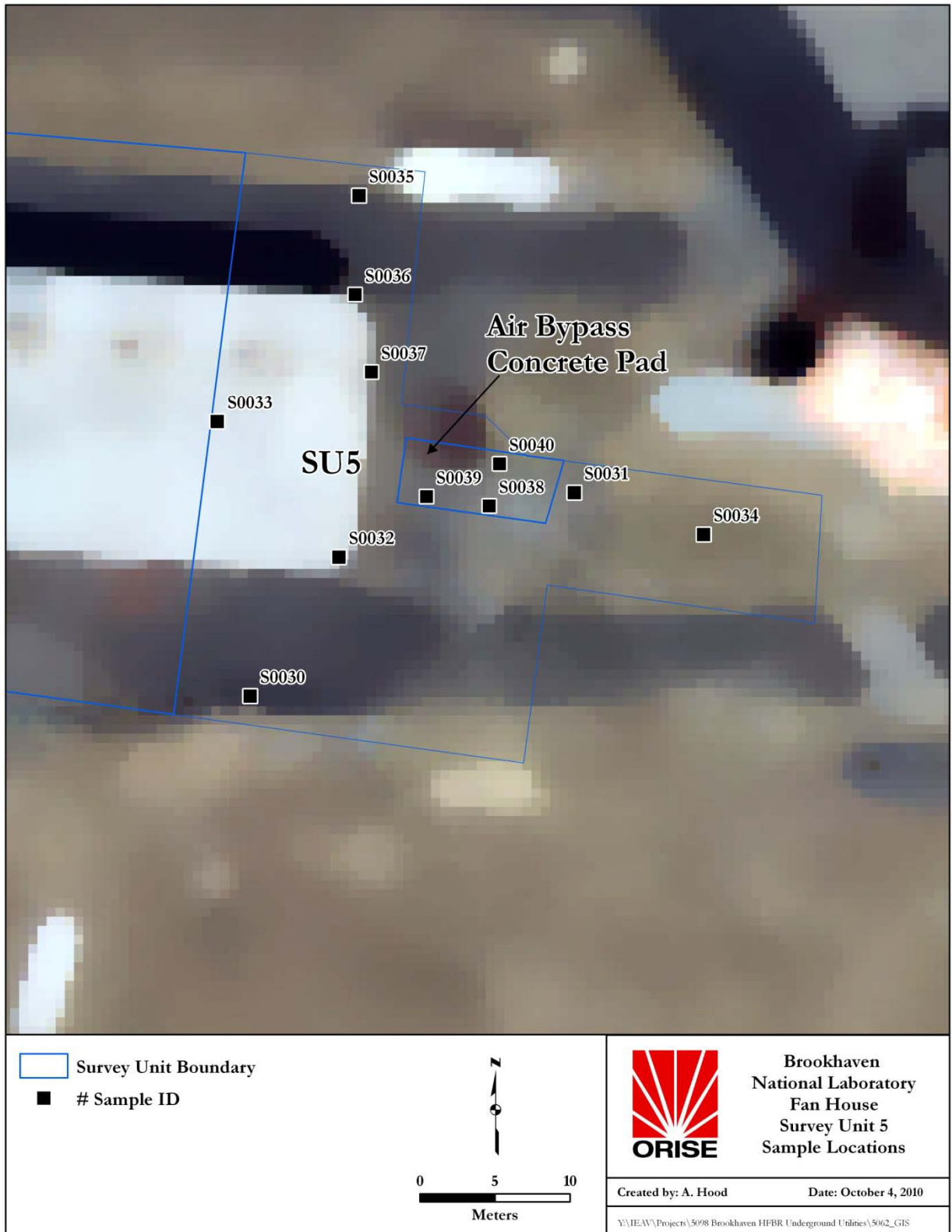


Figure A-10: 704 Fan House Soil and Air By-Pass Concrete Sample Locations

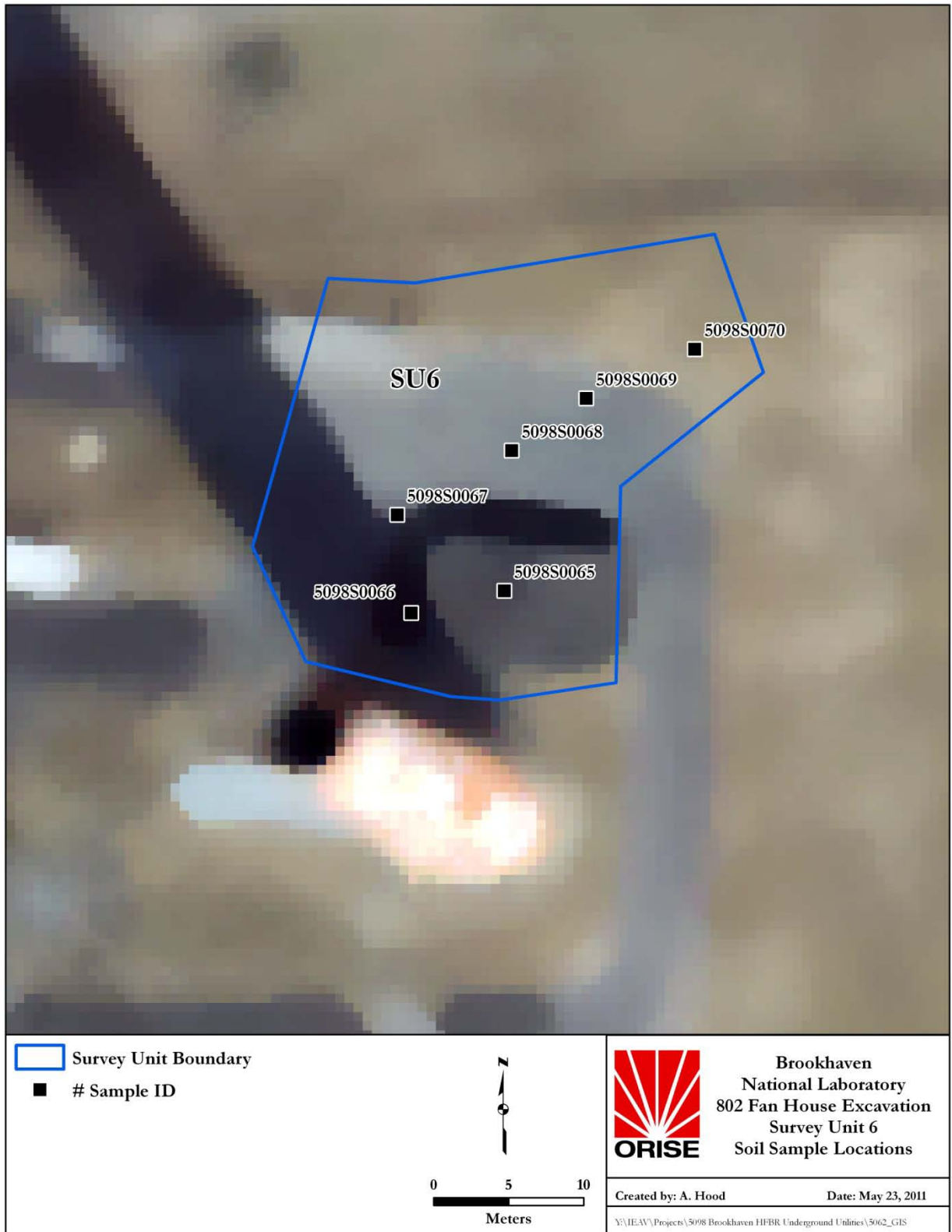


Figure A-11: 802 Fan House Judgmental Soil Sample Locations

APPENDIX B

TABLES

**TABLE B-1:
REMOVABLE ACTIVITY AND CONCENTRATIONS
FOR THE 704 FAN HOUSE CONCRETE STRUCTURE
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

Smear ID ^a	Surface Activity Measurements ^b	Removable Activity		Tritium Activity
	Alpha + Beta			
	Activity (dpm/100 cm ²)	Alpha (dpm/100 cm ²)	Beta (dpm/100 cm ²)	Activity (pCi/100 cm ²)
N1	38	-0.43	-3.64	4.82
N2	88	-0.43	1.56	3.89
N3	73	-0.43	1.56	2.62
N4	129	-0.43	7.80	0.42
N5	244	-0.43	-0.52	1.86
N6	420	-0.43	-1.56	-1.94
N7	170	-0.43	0.52	3.46
N8	135	-0.43	-2.60	5.83
N9	135	-0.43	0.52	2.70
S1	68	-0.43	-2.60	0.51
S2	206	-0.43	4.68	5.66
S3	129	-0.43	-3.64	8.96
S4	79	1.73	1.56	0.51
S5	159	-0.43	-3.64	1.77
S6	26	1.73	-2.60	4.65
S7	170	1.73	-2.60	1.44
S8	88	-0.43	1.56	0.84
J1	1102	-0.43	0.52	4.31
J2	497	-0.43	-1.56	2.70
J3	56	-0.43	3.64	3.46

^aRefer to Figure A-7.

^bStatic activity measurements collected using gas proportional detector.

**TABLE B-2:
REMOVABLE ACTIVITY AND CONCENTRATIONS
FOR THE CLAY OFF-GAS PIPE 802 FAN HOUSE
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

Smear ID ^a	Surface Activity Measurements ^b		Removable Activity		Tritium
	Alpha	Beta			
	Activity (dpm/100 cm ²)	Activity (dpm/100 cm ²)	Gross Alpha (dpm/100 cm ²)	Gross Beta (dpm/100 cm ²)	Activity (pCi/100 cm ²)
5098R0041	64	2,474	-0.43	-3.64	n/a ^c
5098R0042	36	2,560	1.73	-2.60	n/a ^c
5098R0043	—	—	—	—	6.1
5098R0044	—	—	—	—	1.7

^aRefer to Figure A-8.

^bSurface activity measurements collected using alpha and beta scintillation detectors.

^cField is identified as not applicable because smears were individually collected for a specific analytical detection method.

**TABLE B-3:
RADIONUCLIDE CONCENTRATIONS
IN SOIL AND CONCRETE 704 FAN HOUSE
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

Sample ID ^a	Radionuclide Concentration in Samples (pCi/g)				
	Cs-137 ^b	Sr-90 ^c	Ra-226 ^{bd}	H-3	Sum of Ratios (SOR)
SU 4					
5098S0024	0.05 ± 0.01 ^e	0.33 ± 0.43	0.22 ± 0.03	—	0.07
5098S0025	0.17 ± 0.03	0.39 ± 0.41	0.24 ± 0.04	—	0.08
5098S0026	0.07 ± 0.02	0.13 ± 0.40	0.58 ± 0.06	—	0.13
5098S0027	0.07 ± 0.02	0.24 ± 0.42	0.32 ± 0.04	—	0.08
5098S0028	0.02 ± 0.02	0.13 ± 0.41	0.27 ± 0.04	—	0.06
5098S0029	0.09 ± 0.02	0.03 ± 0.38	0.33 ± 0.04	—	0.07
SU 5					
5098S0030	0.04 ± 0.01	0.28 ± 0.41	0.30 ± 0.04	—	0.08
5098S0031	0.06 ± 0.02	0.20 ± 0.39	0.27 ± 0.04	—	0.07
5098S0032	0.06 ± 0.03	0.16 ± 0.37	0.31 ± 0.05	—	0.08
5098S0033	0.01 ± 0.02	0.37 ± 0.44	0.23 ± 0.03	—	0.07
5098S0034	0.02 ± 0.01	0.55 ± 0.52	0.21 ± 0.03	—	0.08
5098S0035	0.04 ± 0.01	0.24 ± 0.52	0.26 ± 0.04	—	0.07
SU 5 Judgmental					
5098S0036	0.16 ± 0.03	0.57 ± 0.58	0.22 ± 0.04	—	0.09
5098S0037	0.37 ± 0.05	-0.02 ± 0.52	0.24 ± 0.03	—	0.06
SU 5 Concrete Samples^f					
5098S0038	0.11 ± 0.03	3.02 ± 0.66	0.19 ± 0.05	75.0 ± 3.0	0.24
5098S0039	0.07 ± 0.07	0.25 ± 0.50	0.22 ± 0.07	299.7 ± 7.0	0.06
5098S0040	0.02 ± 0.07	-0.09 ± 0.45	0.21 ± 0.06	162.1 ± 5.6	0.04

^aRefer to Figure A-9 and A-10.

^bResults derived from gamma spectroscopy analysis.

^cResults derived from radiochemical separation and a low background proportional counter.

^dRadium-226 concentrations were derived from lead-214. Isotopes were assumed to be in equilibrium.

^eUncertainties are at the 95% confidence level based on total propagated uncertainties.

^fSOR excludes H-3 concentrations.

**TABLE B-4:
RADIONUCLIDE CONCENTRATIONS IN SOIL 802 FAN HOUSE
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

Sample ID ^a	Radionuclide Concentration in Soil Samples (pCi/g)			
	Cs-137 ^b	Sr-90 ^c	Ra-226 ^{bd}	Sum of Ratios (SOR)
SU 6				
5098S0065	0.00 ± 0.02 ^c	0.01 ± 0.26	0.26 ± 0.04	0.05
5098S0066	0.04 ± 0.03	0.05 ± 0.24	0.25 ± 0.04	0.06
5098S0067	0.00 ± 0.02	-0.31 ± 0.22	0.26 ± 0.03	0.03
5098S0068	0.01 ± 0.02	-0.22 ± 0.22	0.27 ± 0.04	0.04
5098S0069	-0.01 ± 0.03	-0.05 ± 0.31	0.27 ± 0.04	0.05
5098S0070	0.07 ± 0.02	-0.05 ± 0.24	0.32 ± 0.04	0.06

^aRefer to Figure A-11.

^bResults derived from gamma spectroscopy analysis.

^cResults derived from radiochemical separation and a low background proportional counter.

^dRadium-226 concentrations were derived from lead-214. Isotopes were assumed to be in equilibrium.

^eUncertainties are at the 95% confidence level based on total propagated uncertainties.

APPENDIX C

MAJOR INSTRUMENTATION

The display of a specific product is not to be construed as an endorsement of the product or its manufacturer by the author or his employer.

C.1 SCANNING AND MEASUREMENT INSTRUMENT/DETECTOR COMBINATIONS

Ludlum Scintillation Detector Model 44-10, Crystal: 2-in. x 2-in. (Ludlum Measurements, Inc., Sweetwater, TX)

Coupled to:

Ludlum Ratemeter-Scaler Model 2221 (Ludlum Measurements, Inc., Sweetwater, TX)

Coupled to:

Trimble GeoXH Receiver and Data Logger (Trimble Navigation Limited, Sunnyvale, CA)

Ludlum Gas Proportional Detector Model 43-68, 126cm² physical area
coupled to:

Ludlum Ratemeter-scaler Model 2221

(Ludlum Measurements, Inc., Sweetwater, TX)

Ludlum Gas Proportional Detector Model 43-37, 582cm² physical area
coupled to:

Ludlum Ratemeter-scaler Model 2221

(Ludlum Measurements, Inc., Sweetwater, TX)

Ludlum Beta Scintillation Detector Model 44-142, 1.125-in. diameter magnetically shielded photomultiplier. (Ludlum Measurements, Inc., Sweetwater, TX)

Coupled to:

Ludlum Ratemeter-Scaler Model 2221 (Ludlum Measurements, Inc., Sweetwater, TX)

Ludlum Alpha Scintillation Detector Model 43-92, 1.125-in. diameter magnetically shielded photomultiplier. (Ludlum Measurements, Inc., Sweetwater, TX)

Coupled to:

Ludlum Ratemeter-Scaler Model 2221 (Ludlum Measurements, Inc., Sweetwater, TX)

C.2 LABORATORY ANALYTICAL INSTRUMENTATION

High-Purity Extended Range Intrinsic Detector CANBERRA/Tennelec Model No: ERVDS30-25195 (Canberra, Meriden, CT)

Used in conjunction with:

Lead Shield Model G-11 (Nuclear Lead, Oak Ridge, TN), Apex Gamma Software (Canberra, Meriden, CT) and Multichannel Analyzer with Dell Workstation

High-Purity Extended Range Intrinsic Detector Model No. GMX-45200-5 (AMETEK/ORTEC, Oak Ridge, TN)

Used in conjunction with:

Lead Shield Model SPG-16-K8 (Nuclear Data), Apex Gamma Software (Canberra, Meriden, CT) and Multichannel Analyzer with Dell Workstation

High-Purity Germanium Detector Model GMX-30-P4, 30% Eff. (AMETEK/ORTEC, Oak Ridge, TN)

Used in conjunction with:

Lead Shield Model G-16 (Gamma Products, Palos Hills, IL), Apex Gamma Software (Canberra, Meriden, CT) and Multichannel Analyzer with Dell Workstation

Low background alpha/beta counting system Canberra/Tennelec LB5100W (Canberra, Inc., Meriden, CT)

Liquid Scintillation Counter Model No. Tri-Carb 3100TR (PerkinElmer, Shelton, CT)

Liquid Scintillation Counter Model No. Tri-Carb 2500TR (Packard, Meriden, CT)

APPENDIX D

SURVEY AND ANALYTICAL PROCEDURES

D.1 PROJECT HEALTH AND SAFETY

The survey and sampling procedures were evaluated to ensure that any hazards inherent to the procedures themselves were addressed in current job hazard analyses (JHAs). All survey and laboratory activities were conducted in accordance with ORISE health and safety and radiation protection procedures.

Pre-survey activities included an overview of potential health and safety issues. BNL representatives provided site-specific safety awareness training for ORISE personnel involved with the survey effort. In-process and verification surveys were performed according to the ORISE generic health and safety plan, site-specific Integrated Safety Management (ISM) pre-job hazard checklist, and safety procedures discussed during the on-site training.

D.2 QUALITY ASSURANCE

Analytical and field survey activities were conducted in accordance with procedures from the following ORAU and ORISE documents:

- Survey Procedures Manual (ORISE 2008)
- Laboratory Procedures Manual (ORISE 2011b)
- Quality Program Manual (ORAU 2011)

The procedures contained in these manuals were developed to meet the requirements of 10 CFR 830 Subpart A, *Quality Assurance Requirements*, Department of Energy Order 414.1C, *Quality Assurance*, and the U.S. Nuclear Regulatory Commission, *Quality Assurance Manual for the Office of Nuclear Material Safety and Safeguards*, and contain measures to assess processes during their performance.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.
- Participation in Mixed Analyte Performance Evaluation Program (MAPEP), National Institute for Standards and Technology (NIST) Radiochemistry Intercomparison Program (NRIP), and Intercomparison Testing Program (ITP) Laboratory Quality Assurance Programs.

- Training and certification of all individuals performing procedures.
- Periodic internal and external audits.

D.3 CALIBRATION

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to NIST, when such standards/sources were available. In cases where they were not available, standards of an industry-recognized organization were used.

D.4 SURVEY PROCEDURES

D.4.1 SURFACE SCANS

D.4.1.1 Gamma

Scans for elevated gamma radiation were performed by passing the detector slowly over the surface. The distance between the detector and surface was maintained as close to the surface as possible. NaI scintillation detectors were coupled to GPS units that enabled real-time recording of position in one-second intervals. Identification of elevated radiation levels was based on increases in the audible signal from the instrument. Positioning data files were downloaded from field data loggers for plotting using commercially available software (http://trl.trimble.com/docushare/dsweb/Get/Document-261826/GeoExpl2005_100A_GSG_ENG.pdf).

The scan minimum detectable concentrations (MDCs) for the NaI scintillation detector for the contaminants of concern in surface soil were obtained directly from NUREG-1507¹ when available or estimated using the calculation approach described in NUREG-1507. A typical NaI 2-in x 2-in detector MDC is 6.4 pCi/g for cesium-137. Audible increases in the activity rate are investigated by ORISE. It is standard procedure for ORISE staff to pause and investigate any locations where gamma radiation is distinguishable from background levels.

D.4.1.2 Beta

Beta surface scan minimum detectable concentrations (MDCs) were estimated using the calculational approach described in NUREG-1507. The scan MDC is a function of many variables,

¹NUREG-1507. Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions. U.S. Nuclear Regulatory Commission. Washington, DC; June 1998.

including the background level. Additional parameters selected for the calculation of scan MDCs included a two-second observation interval, a specified level of performance at the first scanning stage of 95% true positive rate and 25% false positive rate, which yields a d' value of 2.32 (NUREG-1507, Table 6.1), and a surveyor efficiency of 0.5. The scanning instrument total efficiency (ϵ_{total}) for the hand-held scintillation detector was approximately 0.32.

The construction material-specific background levels ranged from 750 to 1050 cpm for the scintillation detector. To illustrate an example for a hand-held scintillation detector using a ceramic background of 1050 cpm, the minimum detectable count rate (MDCR) and scan MDC can be calculated using the following relationships:

$$\begin{aligned} s_i &= d'(b_i)^{1/2} ; \\ \text{MDCR} &= s_i \times (60/i); \text{ and} \\ \text{MDCR}_{\text{surveyor}} &= \text{MDCR}/(p)^{1/2} \end{aligned}$$

Where:

s_i = the minimum detectable number of source counts

d' = the specified level of performance of 2.32

b_i = the number of background count in the observation interval

MDCR = minimum detectable count rate

i = observation interval

p = surveyor efficiency of 0.5

The equations are combined and the variables are then calculated as follows:

$$\begin{aligned} b_i &= (1050 \text{ cpm})(2 \text{ s})(1 \text{ min}/60 \text{ s}) = 35 \text{ counts}, \\ \text{MDCR} &= (2.32)(35 \text{ counts})^{1/2} [(60 \text{ s}/\text{min})/(2 \text{ s})] = 411.8 \text{ cpm}, \\ \text{MDCR}_{\text{surveyor}} &= 411.8/(0.5)^{1/2} = 292 \text{ cpm} \end{aligned}$$

The scan MDC is calculated assuming a total efficiency (ϵ_{total}) of 0.32:

$$\text{ScanMDC} = \frac{\text{MDCR}_{\text{surveyor}}}{(\epsilon_{total})} \text{ dpm}/100 \text{ cm}^2$$

For the given background, the estimated scan MDC was 913 dpm/100 cm² for the hand-held scintillation detector.

D.4.1.3 Alpha

Determination of the alpha scan sensitivity is a probability-based determination. That is, at a given scan speed and with the associated low alpha background count rates, what is the probability of the surveyor pausing to investigate. Based on the instrumentation and scan speeds, the alpha scan MDC was approximately 300 dpm/100 cm².

Surface scans were also performed using either large surface area (550 cm²) gas proportional floor monitors or small area (126 cm²) hand-held detectors (both with a 0.8 mg/cm² window) were used to scan the floors, walls, and other structural surfaces. Identification of elevated radiation levels is based on increases in the audible signal from the recording and/or indicating instrument.

D.4.2 SURFACE ACTIVITY MEASUREMENTS

Measurements of total alpha and total beta surface activity levels were performed using hand-held scintillation detectors coupled to portable ratemeter-scalers. Count rates (cpm), which were integrated over one minute with the detector held in a static position, were converted to activity levels (dpm/100 cm²) by dividing the count rate by the total static efficiency ($\epsilon_i \times \epsilon_s$) and correcting for the physical area of the detector.

The *a priori* MDC for surface activity measurements was calculated using the following equation:

$$MDC = \frac{3 + (4.65\sqrt{B})}{Tx\epsilon_{Tot} \times G}$$

Where:

B	=	background (total counts) in time interval, T
T	=	count time (min) used for field instruments
ϵ_{Tot}	=	total efficiency = $\epsilon_i \times \epsilon_s$
ϵ_i	=	instrument efficiency
ϵ_s	=	source efficiency
G	=	geometry (physical detector area cm ² /100)

The *a priori* alpha static MDC was approximately 87 dpm/100 cm² using the total efficiency of 0.11 and an instrument background of 2 cpm. The physical surface area assessed by the scintillation detector used was 100 cm². The *a priori* beta static MDC was approximately 300 dpm/100 cm² using the total efficiency of 0.32 and the nominal instrument background of 398 cpm. The physical surface

area assessed by the detector used was 100 cm².

D.4.3 REMOVABLE ACTIVITY MEASUREMENTS

Smear samples for removable gross alpha and gross beta contamination were obtained from each measurement location. Removable activity samples were collected using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear and approximately 100 cm² of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded. Wet smears were used for determining removable H-3 activity and the smear placed into a liquid scintillation vial.

D.4.3 SOIL SAMPLING

Approximately 0.5 to 1 kilogram of soil was collected at each sample location. Collected samples were placed in plastic bags, sealed, and labeled in accordance with ORISE survey procedures.

D.5 RADIOLOGICAL ANALYSIS

D.5.1 GROSS ALPHA/BETA

Smears were counted on a low-background gas proportional system for gross alpha and beta activity. The MDCs of the procedure were 9 dpm/100 cm² and 15 dpm/100 cm² for a 2-minute count time for gross alpha and gross beta, respectively.

D.5.2 LIQUID SCINTILLATION

Smears were counted for five minutes in a liquid scintillation analyzer for low-energy betas to determine the H-3 activity. The typical MDC for H-3 is 34 dpm/100 cm².

D.5.3 STRONTIUM-90

Soil samples were dissolved by a combination of potassium hydrogen fluoride and pyrosulfate fusions. The fusion cake was dissolved and strontium was coprecipitated on lead sulfate. The strontium was separated from residual calcium and lead by precipitating strontium sulfate from ethylenediaminetetraacetic acid at a pH of 4.0. Strontium was separated from barium by complexing the strontium in diethylenetriaminepentaacetic acid while precipitating barium as barium carbonate. The strontium was ultimately converted to strontium carbonate and counted on a low-background gas proportional counter. The typical MDC of the procedure is 0.4 pCi/g for a one hour count time.

D.5.4 GAMMA SPECTROSCOPY

Samples of soil were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in a 0.5-liter or other appropriate size Marinelli container. Concrete samples were crushed as necessary prior to being sealed in an appropriate size Marinelli container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. Net material weights were determined and the samples counted using intrinsic germanium detectors coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. All total absorption peaks (TAPs) associated with the radionuclides of concern were reviewed for consistency of activity. Total absorption peaks used for determining the activities of radionuclides of concern and the typical associated MDCs for a one-hour count time were:

Radionuclide ^a	TAP (MeV)	MDC (pCi/g)
Cs-137	0.662	0.05
Ra-226 (from Pb-214)	0.351	0.08

^aSpectra were also reviewed for other identifiable TAPs.

D.5.5 DETECTION LIMITS

Detection limits, referred to as MDC, were based on 3 plus 4.65 times the standard deviation of the background (BKG) count [$3 + (4.65 (\text{BKG})^{1/2})$]. Because of variations in background levels, measurement efficiencies, and contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument.

D.5.6 UNCERTAINTIES

The uncertainties associated with the analytical data presented in the tables of this report represent the total propagated uncertainties for those data. These uncertainties were calculated based on both the gross sample count levels and the associated background count level.

Appendix E

Overburden Soil Data

Relog 2608271.
ASL Prefix No. 2574211.

Page 1 of 1

BROOKHAVEN
NATIONAL LABORATORY

Carrier/Waybill # _____
P.O. # _____

Chain of Custody No. 30049

Requires EDD ☒

DQL _____

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: Andy Lockwood		Name: PA Grosse		Name: GEL	
Life: No: _____ Ext: _____		Contact: Chris Amato		Address: 2090 Savage Rd	
Acct. No: 65070/65074 Dept: ERP		Phone: 631.365-5202		City: Charleston St: SC Zip: 29407	
Email Reports To: _____		Email/Fax: Christopher@pugross.com		Contact: Anna Skarski	
1 lockwood@BNI.gov		Sampler: Chris Amato		Phone: 843-556-8171	
2 beinder@BNI.gov		Project Manager: _____		Email/Fax: hunk@sel.com	
Project Name: Fan House D:O		Field Engineer: _____		Field Engineer: Kent Heckman	

Comments:

Sample Information										Additional Sample Information				Analysis Requested													
UID	Smp	Col	Site ID/Bldg/Life #	Depth/RWP	Date	Time	Mark	Name/Description	Cont Vol/Units	Cont Type	# of Cont	Preservative	Alpha	Tritium	Gamma	Sr-90	524.2	624	Nuclides	PCBs	Metals	SVOCs	VOCs				
001	EC		bld. 704		7/28/16	13:50	S	Overburden Composite	8oz	AG	3	None								X	X	X	X	X			
002	EC		bld. 704		7/28/16	14:06	S	over burden composite (stump/rod)	8oz	AG	3	None								X	X	X	X	X			
																		</									

1 Relinquished By/Date/Time		2 Relinquished By/Date/Time		3 Relinquished By/Date/Time	
Print: Chris Amato 7/28/16		Print: _____		Print: _____	
Signature: _____ 15:00		Signature: _____		Signature: _____	
1 Received By/Date/Time		2 Received By/Date/Time		3 Received By/Date/Time	
Print: Brittany Dillings 7-29-16		Print: _____		Print: _____	
Signature: _____ 845		Signature: _____		Signature: _____	

Contractor Lab Sample Disposal:	
☐ Return To Client	☒ Disposal by Lab
☐ Archive For _____ Months	
Data Package: ☒ Full ☐ Summary	
Turn-Around Time Required:	
☐ Rush (1 Day)	☐ 14 Days ☐ 30 Days
☒ 7 Days	☐ Other ()



SAMPLE RECEIPT & REVIEW FORM

Client: <u>BRYL</u>		SDG/AR/COC/Work Order: <u>2574211</u>	
Received By: <u>BD</u>		Date Received: <u>7-29-10</u>	
Suspected Hazard Information	Yes ☐ No ☒	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.	
COC/Samples marked as radioactive?	☐ Yes ☒ No	Maximum Counts Observed*: <u>CPM 20</u>	
Classified Radioactive II or III by RSO?	☐ Yes ☒ No		
COC/Samples marked containing PCBs?	☐ Yes ☒ No		
Shipped as a DOT Hazardous?	☐ Yes ☒ No	Hazard Class Shipped: UN#:	
Samples identified as Foreign Soil?	☐ Yes ☒ No		

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	☒	☐	☐	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?	☒	☐	☐	Preservation Method: <u>WC</u> <u>Ice bags</u> Blue ice Dry ice None Other (describe)
2a	Daily check performed and passed on IR temperature gun?	☒	☐	☐	Temperature Device Serial #: <u>4150482</u> Secondary Temperature Device Serial # (If Applicable):
3	Chain of custody documents included with shipment?	☒	☐	☐	
4	Sample containers intact and sealed?	☒	☐	☐	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5	Samples requiring chemical preservation at proper pH?	☐	☒	☐	Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?	☐	☒	☐	Sample ID's and containers affected:
7	Are Encore containers present?	☐	☐	☒	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	☒	☐	☐	ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	☒	☐	☐	Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	☒	☐	☐	Sample ID's affected:
11	Number of containers received match number indicated on COC?	☒	☐	☐	Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	☒	☐	☐	
13	Carrier and tracking number.	☒	☐	☐	Circle Applicable: <u>FedEx Air</u> FedEx Ground UPS Field Services Courier Other <u>9800 5395 2431</u>

Comments (Use Continuation Form if needed):

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462

Report Date: September 23, 2010

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services--Full

Client Sample ID: 30049-001
Sample ID: 260827001
Matrix: S
Collect Date: 28-JUL-10 13:50
Receive Date: 29-JUL-10 08:45
Collector: Client
Moisture: 3.31%

Project: BRKL00500
Client ID: BRKL005
COC: 30049
Samp Recv.:
Client Desc.: Bld. 704
Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
<i>7471 Cold Vapor Hg in Solid "Dry Weight Corrected"</i>											
Mercury	Hh	0.322	0.00358	0.200	mg/kg	1	JXL1	09/22/10	0741	1025812	1
Metals Analysis-ICP											
<i>6010 TAL Metals Soil "Dry Weight Corrected"</i>											
Barium		5.09	0.101	0.503	mg/kg	1	HSC	09/17/10	1415	1025365	2
Cadmium	U	ND	0.101	0.503	mg/kg	1					
Chromium		2.55	0.151	0.503	mg/kg	1					
Silver	U	ND	0.101	0.503	mg/kg	1					
Metals Analysis-ICP-MS											
<i>3050/6020 Arsenic "Dry Weight Corrected"</i>											
Arsenic	J	0.714	0.207	1.03	mg/kg	2	RMJ	09/18/10	1257	1025367	3
Lead		7.83	0.103	0.414	mg/kg	2					
Selenium	U	ND	0.517	1.03	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	AXG2	09/17/10	0700	1025364
SW846 3050B	ICP-MS 3050BS PREP	AXG2	09/17/10	0700	1025366
SW846 7471A Prep	EPA 7471A Mercury Prep Soil	TXB3	09/21/10	1351	1025810

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	
3	SW846 3050B/6020	

GEL LABORATORIES LLC

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462

Report Date: September 23, 2010

Contact: Upton, New York 11973--5000
Project: Mr. John Burke
Hazardous & Radiochemical Analytical Services--Full

Client Sample ID: 30049-002
Sample ID: 260827002
Matrix: S
Collect Date: 28-JUL-10 14:00
Receive Date: 29-JUL-10 08:45
Collector: Client
Moisture: 3.92%

Project: BRKL00500
Client ID: BRKL005
COC: 30049
Samp Recv.:
Client Desc.: Bld. 704
Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
<i>7471 Cold Vapor Hg in Solid "Dry Weight Corrected"</i>											
Mercury	Hh	0.0265	0.00376	0.200	mg/kg	1	JXL1	09/22/10	0750	1025812	1
Metals Analysis-ICP											
<i>6010 TAL Metals Soil "Dry Weight Corrected"</i>											
Barium		11.3	0.0993	0.497	mg/kg	1	HSC	09/17/10	1441	1025365	2
Cadmium	J	0.167	0.0993	0.497	mg/kg	1					
Chromium		5.86	0.149	0.497	mg/kg	1					
Silver	U	ND	0.0993	0.497	mg/kg	1					
Metals Analysis-ICP-MS											
<i>3050/6020 Arsenic "Dry Weight Corrected"</i>											
Arsenic		1.28	0.207	1.03	mg/kg	2	RMJ	09/18/10	1330	1025367	3
Lead		10.3	0.103	0.414	mg/kg	2					
Selenium	U	ND	0.517	1.03	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	AXG2	09/17/10	0700	1025364
SW846 3050B	ICP-MS 3050BS PREP	AXG2	09/17/10	0700	1025366
SW846 7471A Prep	EPA 7471A Mercury Prep Soil	TXB3	09/21/10	1351	1025810

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	
3	SW846 3050B/6020	

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: September 23, 2010

Page 1 of 3

Brookhaven National Laboratory

Building 462

Upton, New York

Contact: Mr. John Burke

Workorder: 260827

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1025367										
QC1202217497	260827001	DUP									
Arsenic		J	0.714	J	0.625	mg/kg	13.3 ^	(+/-0.987)	RMJ	09/18/10	13:04
Lead			7.83		7.61	mg/kg	2.83	(0%-20%)			
Selenium		U	ND	U	ND	mg/kg	N/A				
QC1202217496	LCS										
Arsenic	4.85				4.90	mg/kg		101 (80%-120%)		09/18/10	12:51
Lead	4.85				5.11	mg/kg		105 (80%-120%)			
Selenium	4.85				4.70	mg/kg		96.8 (80%-120%)			
QC1202217495	MB										
Arsenic				U	ND	mg/kg				09/18/10	12:44
Lead				U	ND	mg/kg					
Selenium				U	ND	mg/kg					
QC1202217498	260827001	MS									
Arsenic	5.01	J	0.714		5.88	mg/kg		103 (75%-125%)		09/18/10	13:10
Lead	5.01		7.83		13.4	mg/kg		112 (75%-125%)			
Selenium	5.01	U	ND		4.88	mg/kg		96.1 (75%-125%)			
QC1202217688	260827001	MSD									
Arsenic	4.84	J	0.714		5.62	mg/kg	4.45	101 (0%-20%)		09/18/10	13:17
Lead	4.84		7.83	N	20.8	mg/kg	42.9*	268* (0%-20%)			
Selenium	4.84	U	ND		4.62	mg/kg	5.44	94.1 (0%-20%)			
QC1202217499	260827001	SDILT									
Arsenic		J	3.45	U	ND	ug/L	N/A	(0%-10%)		09/18/10	13:24
Lead			37.9		7.64	ug/L	.872	(0%-10%)			
Selenium		U	ND	U	ND	ug/L	N/A	(0%-10%)			
Metals Analysis-ICP											
Batch	1025365										
QC1202217492	260827001	DUP									
Barium			5.09		4.68	mg/kg	8.38	(0%-20%)	HSC	09/17/10	14:20
Cadmium		U	ND	U	ND	mg/kg	N/A				
Chromium			2.55		1.97	mg/kg	25.6*^	(+/-0.481)			
Silver		U	ND	U	ND	mg/kg	N/A				
QC1202217491	LCS										
Barium	48.9				48.9	mg/kg		100 (80%-120%)		09/17/10	14:09
Cadmium	48.9				49.3	mg/kg		101 (80%-120%)			
Chromium	48.9				48.0	mg/kg		98.2 (80%-120%)			
Silver	48.9				48.2	mg/kg		98.4 (80%-120%)			
QC1202217490	MB										
Barium				U	ND	mg/kg				09/17/10	14:03
Cadmium				U	ND	mg/kg					
Chromium				U	ND	mg/kg					

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2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Workorder: 260827

Page 2 of 3

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1025365										
Silver			U	ND	mg/kg						
QC1202217493	260827001	MS									
Barium	51.1		5.09	57.8	mg/kg		103	(75%-125%)	HSC	09/17/10	14:27
Cadmium	51.1	U	ND	51.0	mg/kg		99.6	(75%-125%)			
Chromium	51.1		2.55	53.6	mg/kg		99.9	(75%-125%)			
Silver	51.1	U	ND	51.3	mg/kg		100	(75%-125%)			
QC1202217687	260827001	MSD									
Barium	50.6		5.09	57.0	mg/kg	1.47	102	(0%-20%)		09/17/10	14:31
Cadmium	50.6	U	ND	49.1	mg/kg	3.73	96.9	(0%-20%)			
Chromium	50.6		2.55	53.2	mg/kg	0.774	100	(0%-20%)			
Silver	50.6	U	ND	49.8	mg/kg	2.86	98.5	(0%-20%)			
QC1202217494	260827001	SDILT									
Barium			50.6	9.50	ug/L	6.17		(0%-10%)		09/17/10	14:35
Cadmium		U	ND	ND	ug/L	N/A		(0%-10%)			
Chromium			25.3	4.75	ug/L	6.18		(0%-10%)			
Silver		U	ND	ND	ug/L	N/A		(0%-10%)			
Metals Analysis-Mercury											
Batch	1025812										
QC1202218557	260827001	DUP									
Mercury		Hh	0.322	Hh	0.261	mg/kg	21.0 ^	(+/-0.200)	JXL1	09/22/10	07:43
QC1202218556	LCS										
Mercury	0.102			0.111	mg/kg		109	(80%-120%)		09/22/10	07:39
QC1202218555	MB										
Mercury			U	ND	mg/kg					09/22/10	07:38
QC1202218558	260827001	MS									
Mercury	0.111	Hh	0.322	HNh	0.362	mg/kg		36.1 * (80%-120%)		09/22/10	07:44
QC1202218560	260827001	MSD									
Mercury	0.118	Hh	0.322	HNh	0.365	mg/kg	0.829	36.4 * (0%-20%)		09/22/10	07:46
QC1202218559	260827001	SDILT									
Mercury		Hh	6.11	Hh	1.24	ug/L	1.32			09/22/10	07:48

Notes:

The Qualifiers in this report are defined as follows:

- ** Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- DL Failed required detection limit.
- E Metals--%difference of sample and SD is >10%. Sample concentration must meet flagging criteria

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Workorder: 260827

Page 3 of 3

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
F	Estimated Value										
H	Analytical holding time was exceeded										
H	Holding time exceeded										
J	Estimated value; the result was greater than the MDA but less than the required detection limit.										
J	Value is estimated										
JN	Presumptive evidence of the analyte at an estimated quantity.										
M	Matrix Related Failure										
N	Metals--The Matrix spike sample recovery is not within specified control limits										
N/A	RPD or %Recovery limits do not apply.										
ND	Analyte concentration is not detected above the detection limit										
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.										
R	Sample results are rejected										
R	The data are unusable (radionuclide may or may not be present).										
U	Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.										
U	Undetected; sample result < MDA										
UI	Uncertain identification for gamma spectroscopy.										
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Y	QC Samples were not spiked with this compound										
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.										
h	Preparation or preservation holding time was exceeded										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

ASL Prefix No. 2574211.

Page 1 of 1

BROOKHAVEN
NATIONAL LABORATORY

Carrier/Waybill # _____

P.O.# _____

Chain of Custody No.

30049

Requires EDD ☒

DOL _____

SAMPLING CHAIN OF CUSTODY

Analysis Requested

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: Andy Lockwood		Name: Pat Grosse		Name: Gel	
Life: No. Ext.		Contact: Chris Amick		Address: 2090 Savage Rd	
Acct. No: 65070/65074 Dept: ERP		Phone: 631.365-5202		City: Charleston St: SC Zip: 29407	
Email Reports To:		Email/Fax: Christopher@Puzgrosse.com		Contact: Anna Strassari	
1 lockwood@BNL.gov		Sampler: Chris Amick		Phone: 843-556-8171	
2 helinder@BNL.gov				Email/Fax: www.gel.com	
Project Name:		Project Manager:		Field Engineer:	
Fan House Pin		Andy Lockwood		Kent Heckman	

Comments:

[illegible]

1 Relinquished By/Date/Time	2 Relinquished By/Date/Time	3 Relinquished By/Date/Time
Print Chris Amato 7/28/10	Print	Print
Signature  15:00	Signature	Signature
1 Received By/Date/Time	2 Received By/Date/Time	3 Received By/Date/Time
Print Brittany Dillinas 7-29-10	Print	Print
Signature  8:46	Signature	Signature

Contractor Lab Sample Disposal:

☐ Return To Client ☒ Disposal by Lab

☐ Archive For _____ Months

Data Package: ☒ Full ☐ Summary

Turn-Around Time Required:

☒ Rush (1 Day) ☐ 14 Days ☐ 30 Days

☒ 7 Days ☐ Other ()

Client: <u>BRL</u>		SDG/AR/COC/Work Order: <u>2574211</u>	
Received By: <u>BD</u>		Date Received: <u>7-29-10</u>	
Suspected Hazard Information	Yes	No	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.
COC/Samples marked as radioactive?		☒	Maximum Counts Observed*: <u>CPM 20</u>
Classified Radioactive II or III by RSO?		☒	
COC/Samples marked containing PCBs?		☒	
Shipped as a DOT Hazardous?		☒	Hazard Class Shipped: UN#:
Samples identified as Foreign Soil?		☒	

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	☒			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?	☒			Preservation Method: <u>WC</u> <u>Ice bags</u> Blue ice Dry ice None Other (describe)
2a	Daily check performed and passed on IR temperature gun?	☒			Temperature Device Serial #: <u>4150482</u> Secondary Temperature Device Serial # (If Applicable):
3	Chain of custody documents included with shipment?	☒			
4	Sample containers intact and sealed?	☒			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5	Samples requiring chemical preservation at proper pH?		☒		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		☒		Sample ID's and containers affected:
7	Are Encore containers present?			☒	(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	☒			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	☒			Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	☒			Sample ID's affected:
11	Number of containers received match number indicated on COC?	☒			Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	☒			
13	Carrier and tracking number.	☒			Circle Applicable: <u>FedEx Air</u> FedEx Ground UPS Field Services Courier Other <u>9800 5395 2431</u>

Comments (Use Continuation Form if needed):

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 5, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-001
Sample ID: 257421001
Matrix: S
Collect Date: 28-JUL-10 13:50
Receive Date: 29-JUL-10 08:45
Collector: Client
Moisture: 3.31%

Project: BRKL00500
Client ID: BRKL005
COC: 30049
Samp Recv.:
Client Desc.: Bld. 704
Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
<i>TCLP Hg in Solid "As Received"</i>											
Mercury	U	ND	0.00066	0.002	mg/L	1	JXL1	08/03/10	1010	1008757	1
Metals Analysis-ICP											
<i>TCLP ICP Metals for Solid "As Received"</i>											
Arsenic	U	ND	0.050	0.300	mg/L	1	HSC	08/02/10	1502	1008384	2
Barium		0.117	0.010	0.050	mg/L	1					
Cadmium	U	ND	0.010	0.050	mg/L	1					
Chromium	U	ND	0.010	0.050	mg/L	1					
Lead	U	ND	0.033	0.100	mg/L	1					
Selenium	U	ND	0.050	0.300	mg/L	1					
Silver	U	ND	0.010	0.050	mg/L	1					
Semi-Volatile-GC/MS											
<i>3550/8270C TCL BNA Soil "Dry Weight Corrected"</i>											
1,2,4-Trichlorobenzene	U	ND	68.8	344	ug/kg	1	JLD1	07/31/10	1449	1008243	3
1,2-Dichlorobenzene	U	ND	68.8	344	ug/kg	1					
1,3-Dichlorobenzene	U	ND	68.8	344	ug/kg	1					
1,4-Dichlorobenzene	U	ND	68.8	344	ug/kg	1					
2,4,5-Trichlorophenol	U	ND	68.8	344	ug/kg	1					
2,4,6-Trichlorophenol	U	ND	68.8	344	ug/kg	1					
2,4-Dichlorophenol	U	ND	68.8	344	ug/kg	1					
2,4-Dimethylphenol	U	ND	120	344	ug/kg	1					
2,4-Dinitrophenol	U	ND	131	688	ug/kg	1					
2,4-Dinitrotoluene	U	ND	34.4	344	ug/kg	1					
2,6-Dinitrotoluene	U	ND	34.4	344	ug/kg	1					
2-Chloronaphthalene	U	ND	11.4	34.4	ug/kg	1					
2-Chlorophenol	U	ND	68.8	344	ug/kg	1					
2-Methyl-4,6-dinitrophenol	U	ND	68.8	344	ug/kg	1					
2-Methylnaphthalene	U	ND	6.88	34.4	ug/kg	1					
2-Nitrophenol	U	ND	68.8	344	ug/kg	1					
3,3'-Dichlorobenzidine	U	ND	103	344	ug/kg	1					
4-Bromophenylphenylether	U	ND	68.8	344	ug/kg	1					
4-Chloro-3-methylphenol	U	ND	68.8	344	ug/kg	1					
4-Chloroaniline	U	ND	68.8	344	ug/kg	1					
4-Chlorophenylphenylether	U	ND	68.8	344	ug/kg	1					
4-Nitrophenol	U	ND	114	344	ug/kg	1					
Acenaphthene	J	13.8	11.4	34.4	ug/kg	1					

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 5, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-001
Sample ID: 257421001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatile-GC/MS											
<i>3550/8270C TCL BNA Soil "Dry Weight Corrected"</i>											
Acenaphthylene	U	ND	10.3	34.4	ug/kg	1					
Anthracene		52.3	6.88	34.4	ug/kg	1					
Benzo(a)anthracene		417	10.3	34.4	ug/kg	1					
Benzo(a)pyrene		449	10.3	34.4	ug/kg	1					
Benzo(b)fluoranthene		620	10.3	34.4	ug/kg	1					
Benzo(ghi)perylene		292	10.3	34.4	ug/kg	1					
Benzo(k)fluoranthene		204	10.3	34.4	ug/kg	1					
Butylbenzylphthalate	U	ND	68.8	344	ug/kg	1					
Carbazole	J	20.0	10.3	34.4	ug/kg	1					
Chrysene		410	10.3	34.4	ug/kg	1					
Di-n-butylphthalate	U	ND	68.8	344	ug/kg	1					
Di-n-octylphthalate	U	ND	68.8	344	ug/kg	1					
Dibenzo(a,h)anthracene		63.3	10.3	34.4	ug/kg	1					
Dibenzofuran	U	ND	68.8	344	ug/kg	1					
Diethylphthalate	U	ND	68.8	344	ug/kg	1					
Dimethylphthalate	U	ND	68.8	344	ug/kg	1					
Diphenylamine	U	ND	68.8	344	ug/kg	1					
Fluoranthene		808	10.3	34.4	ug/kg	1					
Fluorene	J	12.4	10.3	34.4	ug/kg	1					
Hexachlorobenzene	U	ND	68.8	344	ug/kg	1					
Hexachlorobutadiene	U	ND	68.8	344	ug/kg	1					
Hexachlorocyclopentadiene	U	ND	68.8	344	ug/kg	1					
Hexachloroethane	U	ND	68.8	344	ug/kg	1					
Indeno(1,2,3-cd)pyrene		266	10.3	34.4	ug/kg	1					
Isophorone	U	ND	68.8	344	ug/kg	1					
N-Nitrosodipropylamine	U	ND	68.8	344	ug/kg	1					
Naphthalene	U	ND	10.3	34.4	ug/kg	1					
Nitrobenzene	U	ND	68.8	344	ug/kg	1					
Pentachlorophenol	U	ND	86.0	344	ug/kg	1					
Phenanthrene		233	10.3	34.4	ug/kg	1					
Phenol	U	ND	68.8	344	ug/kg	1					
Pyrene		740	10.3	34.4	ug/kg	1					
bis(2-Chloroethoxy)methane	U	ND	68.8	344	ug/kg	1					
bis(2-Chloroethyl) ether	U	ND	68.8	344	ug/kg	1					
bis(2-Chloroisopropyl)ether	U	ND	68.8	344	ug/kg	1					
bis(2-Ethylhexyl)phthalate	U	ND	68.8	344	ug/kg	1					
m,p-Cresols	U	ND	103	344	ug/kg	1					
m-Nitroaniline	U	ND	68.8	344	ug/kg	1					
o-Cresol	U	ND	68.8	344	ug/kg	1					
o-Nitroaniline	U	ND	68.8	344	ug/kg	1					
p-Nitroaniline	U	ND	103	344	ug/kg	1					

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Report Date: August 5, 2010

Client Sample ID: 30049-001
Sample ID: 257421001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatiles-PCB											
<i>8082/3550B PCB soil-Fed "Dry Weight Corrected"</i>											
Aroclor-1016	U	ND	11.5	34.5	ug/kg	10	YS1	08/02/10	1535	1008234	4
Aroclor-1221	U	ND	11.5	34.5	ug/kg	10					
Aroclor-1232	U	ND	11.5	34.5	ug/kg	10					
Aroclor-1242	U	ND	11.5	34.5	ug/kg	10					
Aroclor-1248	U	ND	11.5	34.5	ug/kg	10					
Aroclor-1254	U	ND	11.5	34.5	ug/kg	10					
Aroclor-1260	U	ND	11.5	34.5	ug/kg	10					
Semi-Volatiles-Pesticide											
<i>8081A/3550B Pesticide Soil "Dry Weight Corrected"</i>											
4,4'-DDD	U	ND	0.343	1.37	ug/kg	1	MXS2	08/03/10	1819	1008251	6
4,4'-DDE	U	ND	0.343	1.37	ug/kg	1					
Aldrin	U	ND	0.172	0.686	ug/kg	1					
Chlordane (tech.)	U	ND	1.72	8.58	ug/kg	1					
Dieldrin	U	ND	0.343	1.37	ug/kg	1					
Endosulfan I	U	ND	0.172	0.686	ug/kg	1					
Endosulfan II	U	ND	0.343	1.37	ug/kg	1					
Endosulfan sulfate	U	ND	0.343	1.37	ug/kg	1					
Endrin	U	ND	0.343	1.37	ug/kg	1					
Endrin aldehyde	U	ND	0.343	1.37	ug/kg	1					
Endrin ketone	U	ND	0.343	1.37	ug/kg	1					
Heptachlor	U	ND	0.172	0.686	ug/kg	1					
Heptachlor epoxide	U	ND	0.214	0.686	ug/kg	1					
Methoxychlor	U	ND	1.72	6.86	ug/kg	1					
Toxaphene	U	ND	5.71	17.2	ug/kg	1					
alpha-BHC	U	ND	0.172	0.686	ug/kg	1					
beta-BHC	U	ND	0.172	0.686	ug/kg	1					
delta-BHC	U	ND	0.172	0.686	ug/kg	1					
gamma-BHC (Lindane)	U	ND	0.172	0.686	ug/kg	1					
4,4'-DDT	J	0.799	0.343	1.37	ug/kg	1	MXS2	08/03/10	1819	1008251	7
Volatile Organics											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
1,1,1-Trichloroethane	U	ND	0.310	1.03	ug/kg	1	KXO1	08/04/10	0503	1009557	8
1,1,2,2-Tetrachloroethane	U	ND	0.310	1.03	ug/kg	1					
1,1,2-Trichloroethane	U	ND	0.310	1.03	ug/kg	1					
1,1-Dichloroethane	U	ND	0.310	1.03	ug/kg	1					
1,1-Dichloroethylene	U	ND	0.310	1.03	ug/kg	1					
1,2-Dichloroethane	U	ND	0.310	1.03	ug/kg	1					
1,2-Dichloroethylene (total)	U	ND	0.310	1.03	ug/kg	1					
1,2-Dichloropropane	U	ND	0.310	1.03	ug/kg	1					
2-Butanone	U	ND	1.55	5.17	ug/kg	1					

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Report Date: August 5, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-001
Sample ID: 257421001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Volatile Organics											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
2-Hexanone	U	ND	1.55	5.17	ug/kg	1					
4-Methyl-2-pentanone	U	ND	1.29	5.17	ug/kg	1					
Acetone	U	ND	1.72	5.17	ug/kg	1					
Benzene	U	ND	0.310	1.03	ug/kg	1					
Bromodichloromethane	U	ND	0.310	1.03	ug/kg	1					
Bromoform	U	ND	0.310	1.03	ug/kg	1					
Bromomethane	U	ND	0.310	1.03	ug/kg	1					
Carbon disulfide	U	ND	1.29	5.17	ug/kg	1					
Carbon tetrachloride	U	ND	0.310	1.03	ug/kg	1					
Chlorobenzene	U	ND	0.310	1.03	ug/kg	1					
Chloroethane	U	ND	0.310	1.03	ug/kg	1					
Chloroform	U	ND	0.310	1.03	ug/kg	1					
Chloromethane	U	ND	0.310	1.03	ug/kg	1					
Dibromochloromethane	U	ND	0.310	1.03	ug/kg	1					
Ethylbenzene	U	ND	0.310	1.03	ug/kg	1					
Methylene chloride	J	2.31	2.07	5.17	ug/kg	1					
Styrene	U	ND	0.310	1.03	ug/kg	1					
Tetrachloroethylene	U	ND	0.310	1.03	ug/kg	1					
Toluene	U	ND	0.310	1.03	ug/kg	1					
Trichloroethylene	U	ND	0.341	1.03	ug/kg	1					
Vinyl chloride	U	ND	0.310	1.03	ug/kg	1					
Xylenes (total)	U	ND	0.310	1.03	ug/kg	1					
cis-1,3-Dichloropropylene	U	ND	0.310	1.03	ug/kg	1					
trans-1,3-Dichloropropylene	U	ND	0.310	1.03	ug/kg	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 1311	SW846 1311 TCLP Leaching	EXF1	07/29/10	1600	1007896
SW846 3010A	ICP-TRACE TCLP by SW846 3010A	AXG2	08/02/10	0630	1008383
SW846 3550B	3550B BNA Soil Prep-8270 Analysis	MXS4	07/30/10	2220	1008241
SW846 3550B	3550B PCB Prep Soil	AXV1	07/30/10	1958	1008233
SW846 3550B	3550B Pesticide/PCB Prep Soil	MXS4	07/30/10	1920	1008250
SW846 5035	5035/8260B Prep	KXO1	08/03/10	2300	1009556
SW846 7470A Prep	EPA 7470A Mercury Prep TCLP Liquid	TXB3	08/02/10	1150	1008755

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	

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Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-001
Sample ID: 257421001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
2	SW846	3010/6010B									
3	SW846	8270C									
4	SW846	8082									
5	SW846	8082									
6	SW846	8081A									
7	SW846	8081A									
8	SW846	8260B									

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
2-Fluorobiphenyl	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1040 ug/kg	1720	60.5	(25%-109%)
Nitrobenzene-d5	3550/8270C TCL BNA Soil "Dry Weight Corrected"	947 ug/kg	1720	55.0	(31%-105%)
p-Terphenyl-d14	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1330 ug/kg	1720	77.4	(13%-150%)
2,4,6-Tribromophenol	3550/8270C TCL BNA Soil "Dry Weight Corrected"	2110 ug/kg	3440	61.3	(37%-106%)
2-Fluorophenol	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1840 ug/kg	3440	53.4	(29%-99%)
Phenol-d5	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1810 ug/kg	3440	52.7	(33%-98%)
4cmx	8082/3550B PCB soil-Fed "Dry Weight Corrected"	4.49 ug/kg	6.89	65.1	(32%-120%)
Decachlorobiphenyl	8082/3550B PCB soil-Fed "Dry Weight Corrected"	6.59 ug/kg	6.89	95.6	(30%-116%)
4cmx	8081A/3550B Pesticide Soil "Dry Weight Corrected"	25.6 ug/kg	34.3	74.6	(32%-120%)
Decachlorobiphenyl	8081A/3550B Pesticide Soil "Dry Weight Corrected"	23.4 ug/kg	34.3	68.3	(30%-116%)
1,2-Dichloroethane-d4	5035/8260B TCL in Solid "Dry Weight Corrected"	50.2 ug/kg	50.0	97.1	(66%-134%)
Bromofluorobenzene	5035/8260B TCL in Solid "Dry Weight Corrected"	55.8 ug/kg	50.0	108	(65%-130%)
Toluene-d8	5035/8260B TCL in Solid "Dry Weight Corrected"	50.8 ug/kg	50.0	98.3	(71%-128%)

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Report Date: August 5, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-002
Sample ID: 257421002
Matrix: S
Collect Date: 28-JUL-10 14:00
Receive Date: 29-JUL-10 08:45
Collector: Client
Moisture: 3.92%

Project: BRKL00500
Client ID: BRKL005
COC: 30049
Samp Recv.:
Client Desc.: Bld. 704
Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
<i>TCLP Hg in Solid "As Received"</i>											
Mercury	U	ND	0.00066	0.002	mg/L	1	JXL1	08/03/10	1020	1008757	1
Metals Analysis-ICP											
<i>TCLP ICP Metals for Solid "As Received"</i>											
Arsenic	U	ND	0.050	0.300	mg/L	1	HSC	08/02/10	1456	1008384	2
Barium		0.218	0.010	0.050	mg/L	1					
Cadmium	U	ND	0.010	0.050	mg/L	1					
Chromium	U	ND	0.010	0.050	mg/L	1					
Lead	U	ND	0.033	0.100	mg/L	1					
Selenium	U	ND	0.050	0.300	mg/L	1					
Silver	U	ND	0.010	0.050	mg/L	1					
Semi-Volatile-GC/MS											
<i>3550/8270C TCL BNA Soil "Dry Weight Corrected"</i>											
1,2,4-Trichlorobenzene	U	ND	69.0	345	ug/kg	1	JLD1	07/31/10	1604	1008243	3
1,2-Dichlorobenzene	U	ND	69.0	345	ug/kg	1					
1,3-Dichlorobenzene	U	ND	69.0	345	ug/kg	1					
1,4-Dichlorobenzene	U	ND	69.0	345	ug/kg	1					
2,4,5-Trichlorophenol	U	ND	69.0	345	ug/kg	1					
2,4,6-Trichlorophenol	U	ND	69.0	345	ug/kg	1					
2,4-Dichlorophenol	U	ND	69.0	345	ug/kg	1					
2,4-Dimethylphenol	U	ND	121	345	ug/kg	1					
2,4-Dinitrophenol	U	ND	131	690	ug/kg	1					
2,4-Dinitrotoluene	U	ND	34.5	345	ug/kg	1					
2,6-Dinitrotoluene	U	ND	34.5	345	ug/kg	1					
2-Chloronaphthalene	U	ND	11.4	34.5	ug/kg	1					
2-Chlorophenol	U	ND	69.0	345	ug/kg	1					
2-Methyl-4,6-dinitrophenol	U	ND	69.0	345	ug/kg	1					
2-Methylnaphthalene	U	ND	6.90	34.5	ug/kg	1					
2-Nitrophenol	U	ND	69.0	345	ug/kg	1					
3,3'-Dichlorobenzidine	U	ND	104	345	ug/kg	1					
4-Bromophenylphenylether	U	ND	69.0	345	ug/kg	1					
4-Chloro-3-methylphenol	U	ND	69.0	345	ug/kg	1					
4-Chloroaniline	U	ND	69.0	345	ug/kg	1					
4-Chlorophenylphenylether	U	ND	69.0	345	ug/kg	1					
4-Nitrophenol	U	ND	114	345	ug/kg	1					
Acenaphthene	U	ND	11.4	34.5	ug/kg	1					

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Report Date: August 5, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-002
Sample ID: 257421002

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatile-GC/MS											
<i>3550/8270C TCL BNA Soil "Dry Weight Corrected"</i>											
Acenaphthylene	U	ND	10.4	34.5	ug/kg	1					
Anthracene	U	ND	6.90	34.5	ug/kg	1					
Benzo(a)anthracene		46.9	10.4	34.5	ug/kg	1					
Benzo(a)pyrene		41.8	10.4	34.5	ug/kg	1					
Benzo(b)fluoranthene		61.1	10.4	34.5	ug/kg	1					
Benzo(ghi)perylene		40.7	10.4	34.5	ug/kg	1					
Benzo(k)fluoranthene	J	24.8	10.4	34.5	ug/kg	1					
Butylbenzylphthalate	U	ND	69.0	345	ug/kg	1					
Carbazole	U	ND	10.4	34.5	ug/kg	1					
Chrysene		41.1	10.4	34.5	ug/kg	1					
Di-n-butylphthalate	J	183	69.0	345	ug/kg	1					
Di-n-octylphthalate	U	ND	69.0	345	ug/kg	1					
Dibenzo(a,h)anthracene	J	17.9	10.4	34.5	ug/kg	1					
Dibenzofuran	U	ND	69.0	345	ug/kg	1					
Diethylphthalate	U	ND	69.0	345	ug/kg	1					
Dimethylphthalate	U	ND	69.0	345	ug/kg	1					
Diphenylamine	U	ND	69.0	345	ug/kg	1					
Fluoranthene		52.1	10.4	34.5	ug/kg	1					
Fluorene	U	ND	10.4	34.5	ug/kg	1					
Hexachlorobenzene	U	ND	69.0	345	ug/kg	1					
Hexachlorobutadiene	U	ND	69.0	345	ug/kg	1					
Hexachlorocyclopentadiene	U	ND	69.0	345	ug/kg	1					
Hexachloroethane	U	ND	69.0	345	ug/kg	1					
Indeno(1,2,3-cd)pyrene		38.3	10.4	34.5	ug/kg	1					
Isophorone	U	ND	69.0	345	ug/kg	1					
N-Nitrosodipropylamine	U	ND	69.0	345	ug/kg	1					
Naphthalene	U	ND	10.4	34.5	ug/kg	1					
Nitrobenzene	U	ND	69.0	345	ug/kg	1					
Pentachlorophenol	U	ND	86.3	345	ug/kg	1					
Phenanthrene	J	11.4	10.4	34.5	ug/kg	1					
Phenol	U	ND	69.0	345	ug/kg	1					
Pyrene		44.5	10.4	34.5	ug/kg	1					
bis(2-Chloroethoxy)methane	U	ND	69.0	345	ug/kg	1					
bis(2-Chloroethyl) ether	U	ND	69.0	345	ug/kg	1					
bis(2-Chloroisopropyl)ether	U	ND	69.0	345	ug/kg	1					
bis(2-Ethylhexyl)phthalate	U	ND	69.0	345	ug/kg	1					
m,p-Cresols	U	ND	104	345	ug/kg	1					
m-Nitroaniline	U	ND	69.0	345	ug/kg	1					
o-Cresol	U	ND	69.0	345	ug/kg	1					
o-Nitroaniline	U	ND	69.0	345	ug/kg	1					
p-Nitroaniline	U	ND	104	345	ug/kg	1					

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Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
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Client Sample ID: 30049-002
Sample ID: 257421002

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatiles-PCB											
<i>8082/3550B PCB soil-Fed "Dry Weight Corrected"</i>											
Aroclor-1016	U	ND	1.15	3.46	ug/kg	1	YS1	08/02/10	1613	1008234	4
Aroclor-1221	U	ND	1.15	3.46	ug/kg	1					
Aroclor-1232	U	ND	1.15	3.46	ug/kg	1					
Aroclor-1242	U	ND	1.15	3.46	ug/kg	1					
Aroclor-1248	U	ND	1.15	3.46	ug/kg	1					
Aroclor-1254	U	ND	1.15	3.46	ug/kg	1					
Aroclor-1260	U	ND	1.15	3.46	ug/kg	1					
Semi-Volatiles-Pesticide											
<i>8081A/3550B Pesticide Soil "Dry Weight Corrected"</i>											
4,4'-DDD	U	ND	0.346	1.38	ug/kg	1	MXS2	08/03/10	1833	1008251	6
4,4'-DDE	J	0.707	0.346	1.38	ug/kg	1					
4,4'-DDT	J	1.13	0.346	1.38	ug/kg	1					
Aldrin	U	ND	0.173	0.692	ug/kg	1					
Chlordane (tech.)	U	ND	1.73	8.64	ug/kg	1					
Dieldrin	U	ND	0.346	1.38	ug/kg	1					
Endosulfan I	U	ND	0.173	0.692	ug/kg	1					
Endosulfan II	U	ND	0.346	1.38	ug/kg	1					
Endosulfan sulfate	U	ND	0.346	1.38	ug/kg	1					
Endrin	U	ND	0.346	1.38	ug/kg	1					
Endrin aldehyde	U	ND	0.346	1.38	ug/kg	1					
Endrin ketone	U	ND	0.346	1.38	ug/kg	1					
Heptachlor	U	ND	0.173	0.692	ug/kg	1					
Heptachlor epoxide	U	ND	0.216	0.692	ug/kg	1					
Methoxychlor	U	ND	1.73	6.92	ug/kg	1					
Toxaphene	U	ND	5.76	17.3	ug/kg	1					
alpha-BHC	U	ND	0.173	0.692	ug/kg	1					
beta-BHC	U	ND	0.173	0.692	ug/kg	1					
delta-BHC	U	ND	0.173	0.692	ug/kg	1					
gamma-BHC (Lindane)	U	ND	0.173	0.692	ug/kg	1					
Volatile Organics											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
1,1,1-Trichloroethane	U	ND	0.312	1.04	ug/kg	1	KXO1	08/04/10	0532	1009557	7
1,1,2,2-Tetrachloroethane	U	ND	0.312	1.04	ug/kg	1					
1,1,2-Trichloroethane	U	ND	0.312	1.04	ug/kg	1					
1,1-Dichloroethane	U	ND	0.312	1.04	ug/kg	1					
1,1-Dichloroethylene	U	ND	0.312	1.04	ug/kg	1					
1,2-Dichloroethane	U	ND	0.312	1.04	ug/kg	1					
1,2-Dichloroethylene (total)	U	ND	0.312	1.04	ug/kg	1					
1,2-Dichloropropane	U	ND	0.312	1.04	ug/kg	1					
2-Butanone	U	ND	1.56	5.20	ug/kg	1					

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Report Date: August 5, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-002
Sample ID: 257421002

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Volatile Organics											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
2-Hexanone	U	ND	1.56	5.20	ug/kg	1					
4-Methyl-2-pentanone	U	ND	1.30	5.20	ug/kg	1					
Acetone	U	ND	1.73	5.20	ug/kg	1					
Benzene	U	ND	0.312	1.04	ug/kg	1					
Bromodichloromethane	U	ND	0.312	1.04	ug/kg	1					
Bromoform	U	ND	0.312	1.04	ug/kg	1					
Bromomethane	U	ND	0.312	1.04	ug/kg	1					
Carbon disulfide	U	ND	1.30	5.20	ug/kg	1					
Carbon tetrachloride	U	ND	0.312	1.04	ug/kg	1					
Chlorobenzene	U	ND	0.312	1.04	ug/kg	1					
Chloroethane	U	ND	0.312	1.04	ug/kg	1					
Chloroform	U	ND	0.312	1.04	ug/kg	1					
Chloromethane	U	ND	0.312	1.04	ug/kg	1					
Dibromochloromethane	U	ND	0.312	1.04	ug/kg	1					
Ethylbenzene	U	ND	0.312	1.04	ug/kg	1					
Methylene chloride	J	3.42	2.08	5.20	ug/kg	1					
Styrene	U	ND	0.312	1.04	ug/kg	1					
Tetrachloroethylene	U	ND	0.312	1.04	ug/kg	1					
Toluene	U	ND	0.312	1.04	ug/kg	1					
Trichloroethylene	U	ND	0.343	1.04	ug/kg	1					
Vinyl chloride	U	ND	0.312	1.04	ug/kg	1					
Xylenes (total)	U	ND	0.312	1.04	ug/kg	1					
cis-1,3-Dichloropropylene	U	ND	0.312	1.04	ug/kg	1					
trans-1,3-Dichloropropylene	U	ND	0.312	1.04	ug/kg	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 1311	SW846 1311 TCLP Leaching	EXF1	07/29/10	1600	1007896
SW846 3010A	ICP-TRACE TCLP by SW846 3010A	AXG2	08/02/10	0630	1008383
SW846 3550B	3550B BNA Soil Prep-8270 Analysis	MXS4	07/30/10	2220	1008241
SW846 3550B	3550B PCB Prep Soil	AXV1	07/30/10	1958	1008233
SW846 3550B	3550B Pesticide/PCB Prep Soil	MXS4	07/30/10	1920	1008250
SW846 5035	5035/8260B Prep	KXO1	08/03/10	2303	1009556
SW846 7470A Prep	EPA 7470A Mercury Prep TCLP Liquid	TXB3	08/02/10	1150	1008755

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 5, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30049-002
Sample ID: 257421002

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
2	SW846	3010/6010B									
3	SW846	8270C									
4	SW846	8082									
5	SW846	8082									
6	SW846	8081A									
7	SW846	8260B									

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
2-Fluorobiphenyl	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1150 ug/kg	1730	66.7	(25%-109%)
Nitrobenzene-d5	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1070 ug/kg	1730	62.0	(31%-105%)
p-Terphenyl-d14	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1390 ug/kg	1730	80.3	(13%-150%)
2,4,6-Tribromophenol	3550/8270C TCL BNA Soil "Dry Weight Corrected"	2440 ug/kg	3450	70.7	(37%-106%)
2-Fluorophenol	3550/8270C TCL BNA Soil "Dry Weight Corrected"	2080 ug/kg	3450	60.2	(29%-99%)
Phenol-d5	3550/8270C TCL BNA Soil "Dry Weight Corrected"	2020 ug/kg	3450	58.5	(33%-98%)
4cmx	8082/3550B PCB soil-Fed "Dry Weight Corrected"	4.67 ug/kg	6.92	67.4	(32%-120%)
Decachlorobiphenyl	8082/3550B PCB soil-Fed "Dry Weight Corrected"	5.26 ug/kg	6.92	75.9	(30%-116%)
4cmx	8081A/3550B Pesticide Soil "Dry Weight Corrected"	25.9 ug/kg	34.6	74.9	(32%-120%)
Decachlorobiphenyl	8081A/3550B Pesticide Soil "Dry Weight Corrected"	22.7 ug/kg	34.6	65.7	(30%-116%)
1,2-Dichloroethane-d4	5035/8260B TCL in Solid "Dry Weight Corrected"	47.9 ug/kg	50.0	92.0	(66%-134%)
Bromofluorobenzene	5035/8260B TCL in Solid "Dry Weight Corrected"	58.2 ug/kg	50.0	112	(65%-130%)
Toluene-d8	5035/8260B TCL in Solid "Dry Weight Corrected"	52.2 ug/kg	50.0	100	(71%-128%)

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QC Summary

Report Date: August 5, 2010

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Brookhaven National Laboratory

Building 462

Upton, New York

Contact: Mr. John Burke

Workorder: 257421

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1008384										
QC1202175807	257421001	DUP									
Arsenic		U	ND	U	ND	mg/L	N/A		HSC	08/02/10	15:08
Barium			0.117		0.119	mg/L	1.65 ^	(+/-0.050)			
Cadmium		U	ND	U	ND	mg/L	N/A				
Chromium		U	ND	U	ND	mg/L	N/A				
Lead		U	ND	U	ND	mg/L	N/A				
Selenium		U	ND	U	ND	mg/L	N/A				
Silver		U	ND	U	ND	mg/L	N/A				
QC1202175806	LCS										
Arsenic	5.00				4.89	mg/L		97.8 (80%-120%)		08/02/10	14:50
Barium	5.00				5.15	mg/L		103 (80%-120%)			
Cadmium	5.00				5.04	mg/L		101 (80%-120%)			
Chromium	5.00				5.06	mg/L		101 (80%-120%)			
Lead	5.00				5.10	mg/L		102 (80%-120%)			
Selenium	5.00				4.73	mg/L		94.6 (80%-120%)			
Silver	5.00				4.88	mg/L		97.5 (80%-120%)			
QC1202175805	MB										
Arsenic				U	ND	mg/L				08/02/10	14:36
Barium				U	ND	mg/L					
Cadmium				U	ND	mg/L					
Chromium				U	ND	mg/L					
Lead				U	ND	mg/L					
Selenium				U	ND	mg/L					
Silver				J	0.012	mg/L					
QC1202174602	257421001	MS									
Arsenic	5.26	U	ND		5.10	mg/L		96.9 (75%-125%)		08/02/10	15:14
Barium	10.5		0.117		10.1	mg/L		94.4 (75%-125%)			
Cadmium	1.05	U	ND		1.02	mg/L		97.3 (75%-125%)			
Chromium	5.26	U	ND		5.03	mg/L		95.5 (75%-125%)			
Lead	5.26	U	ND		5.05	mg/L		95.7 (75%-125%)			
Selenium	1.05	U	ND		1.03	mg/L		94.7 (75%-125%)			
Silver	0.526	U	ND		0.472	mg/L		89.8 (75%-125%)			
QC1202175809	257421001	SDILT									
Arsenic		U	ND	U	ND	ug/L	N/A	(0%-10%)		08/02/10	15:21
Barium			11.7	J	3.19	ug/L	36.4	(0%-10%)			
Cadmium		U	ND	U	ND	ug/L	N/A	(0%-10%)			
Chromium		U	ND	U	ND	ug/L	N/A	(0%-10%)			
Lead		U	ND	U	ND	ug/L	N/A	(0%-10%)			
Selenium		U	ND	U	ND	ug/L	N/A	(0%-10%)			

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Workorder: 257421

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QC Summary

Workorder: 257421

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1008243										
1,2,4-Trichlorobenzene			U	ND	ug/kg					07/31/10	11:40
1,2-Dichlorobenzene			U	ND	ug/kg				JLD1		
1,3-Dichlorobenzene			U	ND	ug/kg						
1,4-Dichlorobenzene			U	ND	ug/kg						
2,4,5-Trichlorophenol			U	ND	ug/kg						
2,4,6-Trichlorophenol			U	ND	ug/kg						
2,4-Dichlorophenol			U	ND	ug/kg						
2,4-Dimethylphenol			U	ND	ug/kg						
2,4-Dinitrophenol			U	ND	ug/kg						
2,4-Dinitrotoluene			U	ND	ug/kg						
2,6-Dinitrotoluene			U	ND	ug/kg						
2-Chloronaphthalene			U	ND	ug/kg						
2-Chlorophenol			U	ND	ug/kg						
2-Methyl-4,6-dinitrophenol			U	ND	ug/kg						
2-Methylnaphthalene			U	ND	ug/kg						
2-Nitrophenol			U	ND	ug/kg						
3,3'-Dichlorobenzidine			U	ND	ug/kg						
4-Bromophenylphenylether			U	ND	ug/kg						
4-Chloro-3-methylphenol			U	ND	ug/kg						
4-Chloroaniline			U	ND	ug/kg						
4-Chlorophenylphenylether			U	ND	ug/kg						
4-Nitrophenol			U	ND	ug/kg						
Acenaphthene			U	ND	ug/kg						
Acenaphthylene			U	ND	ug/kg						
Anthracene			U	ND	ug/kg						
Benzo(a)anthracene			U	ND	ug/kg						
Benzo(a)pyrene			U	ND	ug/kg						
Benzo(b)fluoranthene			U	ND	ug/kg						
Benzo(ghi)perylene			U	ND	ug/kg						
Benzo(k)fluoranthene			U	ND	ug/kg						
Butylbenzylphthalate			U	ND	ug/kg						
Carbazole			U	ND	ug/kg						
Chrysene			U	ND	ug/kg						
Di-n-butylphthalate			U	ND	ug/kg						
Di-n-octylphthalate			U	ND	ug/kg						
Dibenzo(a,h)anthracene			U	ND	ug/kg						
Dibenzofuran			U	ND	ug/kg						
Diethylphthalate			U	ND	ug/kg						
Dimethylphthalate			U	ND	ug/kg						
Diphenylamine			U	ND	ug/kg						
Fluoranthene			U	ND	ug/kg						
			U	ND							

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QC Summary

Workorder: 257421

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1008243										
Fluorene					ug/kg						
Hexachlorobenzene			U	ND	ug/kg				JLD1	07/31/10	11:40
Hexachlorobutadiene			U	ND	ug/kg						
Hexachlorocyclopentadiene			U	ND	ug/kg						
Hexachloroethane			U	ND	ug/kg						
Indeno(1,2,3-cd)pyrene			U	ND	ug/kg						
Isophorone			U	ND	ug/kg						
N-Nitrosodipropylamine			U	ND	ug/kg						
Naphthalene			U	ND	ug/kg						
Nitrobenzene			U	ND	ug/kg						
Pentachlorophenol			U	ND	ug/kg						
Phenanthrene			U	ND	ug/kg						
Phenol			U	ND	ug/kg						
Pyrene			U	ND	ug/kg						
bis(2-Chloroethoxy)methane			U	ND	ug/kg						
bis(2-Chloroethyl) ether			U	ND	ug/kg						
bis(2-Chloroisopropyl)ether			U	ND	ug/kg						
bis(2-Ethylhexyl)phthalate			U	ND	ug/kg						
m,p-Cresols			U	ND	ug/kg						
m-Nitroaniline			U	ND	ug/kg						
o-Cresol			U	ND	ug/kg						
o-Nitroaniline			U	ND	ug/kg						
p-Nitroaniline			U	ND	ug/kg						
**2,4,6-Tribromophenol	3330			2390	ug/kg		71.8	(37%-106%)			
**2-Fluorobiphenyl	1670			1230	ug/kg		73.7	(25%-109%)			
**2-Fluorophenol	3330			2200	ug/kg		66.1	(29%-99%)			
**Nitrobenzene-d5	1670			1130	ug/kg		67.8	(31%-105%)			
**Phenol-d5	3330			2160	ug/kg		64.7	(33%-98%)			
**p-Terphenyl-d14	1670			1410	ug/kg		84.4	(13%-150%)			
QC1202175477 257421001 MS											
1,2,4-Trichlorobenzene	1720	U	ND	1160	ug/kg		67.7	(28%-99%)		07/31/10	15:13
1,4-Dichlorobenzene	1720	U	ND	1160	ug/kg		67.3	(27%-96%)			
2,4-Dinitrotoluene	1720	U	ND	1540	ug/kg		89.8	(33%-107%)			
2-Chlorophenol	1720	U	ND	1250	ug/kg		73	(29%-96%)			
4-Chloro-3-methylphenol	1720	U	ND	1220	ug/kg		71	(29%-110%)			
4-Nitrophenol	1720	U	ND	1510	ug/kg		87.8	(15%-110%)			
Acenaphthene	1720	J	13.8	1270	ug/kg		73.3	(17%-109%)			
N-Nitrosodipropylamine	1720	U	ND	1090	ug/kg		63.4	(29%-102%)			
Pentachlorophenol	1720	U	ND	821	ug/kg		47.8	(23%-110%)			
Phenol	1720	U	ND	1060	ug/kg		61.7	(33%-94%)			
Pyrene	1720		740	2580	ug/kg		107	(24%-118%)			
**2,4,6-Tribromophenol	3430		2110	2690	ug/kg		78.3	(37%-106%)			

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QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1008243										
**2-Fluorobiphenyl	1720		1040	1210	ug/kg		70.5	(25%-109%)	JLD1	07/31/10	15:13
**2-Fluorophenol	3430		1840	2130	ug/kg		62.1	(29%-99%)			
**Nitrobenzene-d5	1720		947	994	ug/kg		57.9	(31%-105%)			
**Phenol-d5	3430		1810	2160	ug/kg		62.9	(33%-98%)			
**p-Terphenyl-d14	1720		1330	1610	ug/kg		93.6	(13%-150%)			
QC1202175478 257421001 MSD											
1,2,4-Trichlorobenzene	1720	U	ND	1140	ug/kg	1.51	66.6	(0%-30%)		07/31/10	15:39
1,4-Dichlorobenzene	1720	U	ND	1140	ug/kg	0.916	66.6	(0%-30%)			
2,4-Dinitrotoluene	1720	U	ND	1330	ug/kg	15.1	77.1	(0%-30%)			
2-Chlorophenol	1720	U	ND	1170	ug/kg	7.22	67.9	(0%-30%)			
4-Chloro-3-methylphenol	1720	U	ND	1060	ug/kg	13.8	61.8	(0%-30%)			
4-Nitrophenol	1720	U	ND	1250	ug/kg	18.4	72.9	(0%-30%)			
Acenaphthene	1720	J	13.8	1140	ug/kg	11.1	65.4	(0%-30%)			
N-Nitrosodipropylamine	1720	U	ND	1030	ug/kg	5.97	59.7	(0%-30%)			
Pentachlorophenol	1720	U	ND	687	ug/kg	17.9	39.9	(0%-30%)			
Phenol	1720	U	ND	976	ug/kg	8.18	56.8	(0%-30%)			
Pyrene	1720		740	1910	ug/kg	30.0	67.8	(0%-30%)			
**2,4,6-Tribromophenol	3440		2110	2280	ug/kg		66.3	(37%-106%)			
**2-Fluorobiphenyl	1720		1040	1130	ug/kg		65.4	(25%-109%)			
**2-Fluorophenol	3440		1840	2040	ug/kg		59.4	(29%-99%)			
**Nitrobenzene-d5	1720		947	971	ug/kg		56.5	(31%-105%)			
**Phenol-d5	3440		1810	2010	ug/kg		58.3	(33%-98%)			
**p-Terphenyl-d14	1720		1330	1320	ug/kg		76.7	(13%-150%)			
Semi-Volatiles-PCB											
Batch	1008234										
QC1202175447 LCS											
Aroclor-1016	33.3			23.4	ug/kg		70.2	(39%-102%)	YS1	08/02/10	15:22
Aroclor-1260	33.3			24.7	ug/kg		74.1	(45%-118%)			
**4cmx	6.67			4.67	ug/kg		70	(32%-120%)			
**Decachlorobiphenyl	6.67			4.71	ug/kg		70.6	(30%-116%)			
QC1202175446 MB											
Aroclor-1016				U	ND	ug/kg				08/02/10	15:10
Aroclor-1221				U	ND	ug/kg					
Aroclor-1232				U	ND	ug/kg					
Aroclor-1242				U	ND	ug/kg					
Aroclor-1248				U	ND	ug/kg					
Aroclor-1254				U	ND	ug/kg					
Aroclor-1260				U	ND	ug/kg					
**4cmx	6.67			4.49	ug/kg		67.3	(32%-120%)			
**Decachlorobiphenyl	6.67			4.59	ug/kg		68.9	(30%-116%)			
QC1202175448 257421001 MS											
Aroclor-1016	34.4	U	ND	J	24.4	ug/kg	71	(23%-119%)		08/02/10	15:47
Aroclor-1260	34.4	U	ND	JP	28.4	ug/kg	82.7	(28%-124%)			

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QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-PCB											
Batch	1008234										
**4cmx	6.87	4.49		5.09	ug/kg		74.1	(32%-120%)			
**Decachlorobiphenyl	6.87	6.59		6.84	ug/kg		99.5	(30%-116%)	YS1	08/02/10	15:47
QC1202175449	257421001	MSD									
Aroclor-1016	34.4	U	ND	J	18.4	ug/kg	28.0	53.5	(0%-28%)		08/02/10 16:00
Aroclor-1260	34.4	U	ND	JP	17.0	ug/kg	50.2 *	49.5	(0%-30%)		
**4cmx	6.87	4.49		4.64	ug/kg		67.5	(32%-120%)			
**Decachlorobiphenyl	6.87	6.59		39.5	ug/kg		574 *	(30%-116%)			
Semi-Volatiles-Pesticide											
Batch	1008251										
QC1202175492	LCS										
4,4'-DDD	41.7			37.5	ug/kg		90	(60%-129%)	MXS2	08/03/10	18:06
4,4'-DDE	41.7			37.3	ug/kg		89.6	(59%-122%)			
4,4'-DDT	41.7			39.2	ug/kg		94.1	(50%-142%)			
Aldrin	16.7			12.4	ug/kg		74.2	(51%-124%)			
Chlordane (tech.)			U	ND	ug/kg			(58%-139%)			
Dieldrin	41.7			35.8	ug/kg		85.9	(52%-120%)			
Endosulfan I	16.7			13.8	ug/kg		82.6	(43%-126%)			
Endosulfan II	41.7			33.9	ug/kg		81.3	(50%-126%)			
Endosulfan sulfate	41.7			36.1	ug/kg		86.6	(61%-132%)			
Endrin	41.7			39.9	ug/kg		95.7	(61%-135%)			
Endrin aldehyde	41.7			35.1	ug/kg		84.2	(47%-117%)			
Endrin ketone	41.7			35.9	ug/kg		86.1	(57%-129%)			
Heptachlor	16.7			14.0	ug/kg		83.9	(51%-131%)			
Heptachlor epoxide	16.7			14.0	ug/kg		83.8	(52%-123%)			
Methoxychlor	167			139	ug/kg		83.1	(59%-140%)			
Toxaphene			U	ND	ug/kg			(50%-129%)			
alpha-BHC	16.7			13.9	ug/kg		83.7	(57%-130%)			
beta-BHC	16.7			12.8	ug/kg		76.8	(53%-123%)			
delta-BHC	16.7			13.4	ug/kg		80.1	(56%-130%)			
gamma-BHC (Lindane)	16.7			14.1	ug/kg		84.7	(56%-132%)			
**4cmx	33.3			26.1	ug/kg		78.4	(32%-120%)			
**Decachlorobiphenyl	33.3			26.1	ug/kg		78.2	(30%-116%)			
QC1202175491	MB										
4,4'-DDD			U	ND	ug/kg					08/03/10	17:52
4,4'-DDE			U	ND	ug/kg						
4,4'-DDT			U	ND	ug/kg						
Aldrin			U	ND	ug/kg						
Chlordane (tech.)			U	ND	ug/kg						
Dieldrin			U	ND	ug/kg						
Endosulfan I			U	ND	ug/kg						
Endosulfan II			U	ND	ug/kg						
Endosulfan sulfate			U	ND	ug/kg						

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QC Summary

Workorder: 257421

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1008251										
Endrin			U	ND	ug/kg						
Endrin aldehyde			U	ND	ug/kg				MXS2	08/03/10	17:52
Endrin ketone			U	ND	ug/kg						
Heptachlor			U	ND	ug/kg						
Heptachlor epoxide			U	ND	ug/kg						
Methoxychlor			U	ND	ug/kg						
Toxaphene			U	ND	ug/kg						
alpha-BHC			U	ND	ug/kg						
beta-BHC			U	ND	ug/kg						
delta-BHC			U	ND	ug/kg						
gamma-BHC (Lindane)			U	ND	ug/kg						
**4cmx	33.3			25.4	ug/kg		76.1	(32%-120%)			
**Decachlorobiphenyl	33.3			25.3	ug/kg		75.8	(30%-116%)			
QC1202175493	257421002	MS									
4,4'-DDD	43.3	U	ND	40.8	ug/kg		94.3	(34%-131%)		08/03/10	18:47
4,4'-DDE	43.3	J	0.707	37.6	ug/kg		85.3	(36%-127%)			
4,4'-DDT	43.3	J	1.13	32.1	ug/kg		71.5	(30%-147%)			
Aldrin	17.3	U	ND	13.8	ug/kg		79.6	(40%-120%)			
Chlordane (tech.)		U	ND	U	ND			(50%-150%)			
Dieldrin	43.3	U	ND	35.9	ug/kg		82.9	(32%-126%)			
Endosulfan I	17.3	U	ND	12.8	ug/kg		74.1	(31%-118%)			
Endosulfan II	43.3	U	ND	33.1	ug/kg		76.6	(25%-128%)			
Endosulfan sulfate	43.3	U	ND	34.3	ug/kg		79.3	(32%-127%)			
Endrin	43.3	U	ND	40.9	ug/kg		94.5	(37%-137%)			
Endrin aldehyde	43.3	U	ND	30.2	ug/kg		69.8	(30%-120%)			
Endrin ketone	43.3	U	ND	34.6	ug/kg		80	(35%-130%)			
Heptachlor	17.3	U	ND	14.0	ug/kg		80.7	(33%-128%)			
Heptachlor epoxide	17.3	U	ND	13.9	ug/kg		80.6	(30%-128%)			
Methoxychlor	173	U	ND	125	ug/kg		72	(32%-144%)			
Toxaphene		U	ND	U	ND			(50%-150%)			
alpha-BHC	17.3	U	ND	13.8	ug/kg		79.8	(36%-122%)			
beta-BHC	17.3	U	ND	12.3	ug/kg		70.9	(33%-129%)			
delta-BHC	17.3	U	ND	13.3	ug/kg		76.8	(32%-125%)			
gamma-BHC (Lindane)	17.3	U	ND	14.0	ug/kg		80.8	(37%-126%)			
**4cmx	34.6		25.9	25.7	ug/kg		74.3	(32%-120%)			
**Decachlorobiphenyl	34.6		22.7	22.7	ug/kg		65.5	(30%-116%)			
QC1202175494	257421002	MSD									
4,4'-DDD	43.3	U	ND	40.5	ug/kg	0.674	93.7	(0%-25%)		08/03/10	19:00
4,4'-DDE	43.3	J	0.707	35.3	ug/kg	6.49	79.8	(0%-31%)			
4,4'-DDT	43.3	J	1.13	24.3	ug/kg	27.7*	53.5	(0%-27%)			
Aldrin	17.3	U	ND	13.0	ug/kg	5.45	75.4	(0%-31%)			
Chlordane (tech.)		U	ND	U	ND	N/A		(0%-30%)			

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QC Summary

Workorder: 257421

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time		
Semi-Volatiles-Pesticide													
Batch	1008251												
Dieldrin	43.3	U	ND	33.3	ug/kg	7.61	76.9	(0%-31%)	MXS2	08/03/10 19:00			
Endosulfan I	17.3	U	ND	11.7	ug/kg	9.37	67.5	(0%-29%)					
Endosulfan II	43.3	U	ND	30.7	ug/kg	7.74	70.9	(0%-31%)					
Endosulfan sulfate	43.3	U	ND	32.0	ug/kg	6.90	74	(0%-30%)					
Endrin	43.3	U	ND	37.9	ug/kg	7.45	87.7	(0%-27%)					
Endrin aldehyde	43.3	U	ND	28.3	ug/kg	6.42	65.5	(0%-30%)					
Endrin ketone	43.3	U	ND	31.4	ug/kg	9.62	72.6	(0%-26%)					
Heptachlor	17.3	U	ND	12.9	ug/kg	8.20	74.3	(0%-33%)					
Heptachlor epoxide	17.3	U	ND	12.9	ug/kg	7.90	74.5	(0%-32%)					
Methoxychlor	173	U	ND	105	ug/kg	17.6	60.4	(0%-31%)					
Toxaphene		U	ND	U	ug/kg	N/A		(0%-30%)					
alpha-BHC	17.3	U	ND	13.1	ug/kg	5.21	75.8	(0%-32%)					
beta-BHC	17.3	U	ND	11.4	ug/kg	7.69	65.6	(0%-30%)					
delta-BHC	17.3	U	ND	12.2	ug/kg	8.83	70.4	(0%-29%)					
gamma-BHC (Lindane)	17.3	U	ND	13.1	ug/kg	6.50	75.7	(0%-29%)					
**4cmx	34.6		25.9	24.4	ug/kg		70.5	(32%-120%)					
**Decachlorobiphenyl	34.6		22.7	22.5	ug/kg		65.1	(30%-116%)					
Volatile-GC/MS													
Batch	1009557												
QC1202178835	LCS												
1,1-Dichloroethylene	50.0			47.9	ug/kg		95.8	(71%-129%)	KXO1	08/03/10 22:47			
Benzene	50.0			48.3	ug/kg		96.6	(74%-120%)					
Chlorobenzene	50.0			50.2	ug/kg		100	(76%-120%)					
Toluene	50.0			48.4	ug/kg		96.8	(74%-120%)					
Trichloroethylene	50.0			48.9	ug/kg		97.8	(77%-124%)					
**1,2-Dichloroethane-d4	50.0			48.7	ug/L		97.4	(66%-134%)					
**Bromofluorobenzene	50.0			48.9	ug/L		97.8	(65%-130%)					
**Toluene-d8	50.0			48.6	ug/L		97.3	(71%-128%)					
QC1202178832	MB												
1,1,1-Trichloroethane			U	ND	ug/kg				08/04/10 01:12				
1,1,2,2-Tetrachloroethane			U	ND	ug/kg								
1,1,2-Trichloroethane			U	ND	ug/kg								
1,1-Dichloroethane			U	ND	ug/kg								
1,1-Dichloroethylene			U	ND	ug/kg								
1,2-Dichloroethane			U	ND	ug/kg								
1,2-Dichloroethylene (total)			U	ND	ug/kg								
1,2-Dichloropropane			U	ND	ug/kg								
2-Butanone			U	ND	ug/kg								
2-Hexanone			U	ND	ug/kg								
4-Methyl-2-pentanone			U	ND	ug/kg								
Acetone			U	ND	ug/kg								
Benzene			U	ND	ug/kg								

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QC Summary

Workorder: 257421

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Volatile-GC/MS											
Batch	1009557										
Bromodichloromethane			U	ND	ug/kg						
Bromoform			U	ND	ug/kg				KXO1	08/04/10	01:12
Bromomethane			U	ND	ug/kg						
Carbon disulfide			U	ND	ug/kg						
Carbon tetrachloride			U	ND	ug/kg						
Chlorobenzene			U	ND	ug/kg						
Chloroethane			U	ND	ug/kg						
Chloroform			U	ND	ug/kg						
Chloromethane			U	ND	ug/kg						
Dibromochloromethane			U	ND	ug/kg						
Ethylbenzene			U	ND	ug/kg						
Methylene chloride			U	ND	ug/kg						
Styrene			U	ND	ug/kg						
Tetrachloroethylene			U	ND	ug/kg						
Toluene			U	ND	ug/kg						
Trichloroethylene			U	ND	ug/kg						
Vinyl chloride			U	ND	ug/kg						
Xylenes (total)			U	ND	ug/kg						
cis-1,3-Dichloropropylene			U	ND	ug/kg						
trans-1,3-Dichloropropylene			U	ND	ug/kg						
**1,2-Dichloroethane-d4	50.0			50.0	ug/L		100	(66%-134%)			
**Bromofluorobenzene	50.0			50.2	ug/L		100	(65%-130%)			
**Toluene-d8	50.0			49.6	ug/L		99.2	(71%-128%)			
QC1202178833 257421001 PS											
1,1-Dichloroethylene	50.0	U	ND	45.8	ug/L		91.6	(55%-128%)		08/04/10	08:55
Benzene	50.0	U	ND	45.3	ug/L		90.5	(58%-120%)			
Chlorobenzene	50.0	U	ND	43.1	ug/L		86.1	(50%-130%)			
Toluene	50.0	U	ND	43.0	ug/L		86	(54%-119%)			
Trichloroethylene	50.0	U	ND	45.9	ug/L		91.8	(54%-130%)			
**1,2-Dichloroethane-d4	50.0		48.5	49.9	ug/L		99.9	(66%-134%)			
**Bromofluorobenzene	50.0		53.9	52.2	ug/L		104	(65%-130%)			
**Toluene-d8	50.0		49.1	49.2	ug/L		98.5	(71%-128%)			
QC1202178834 257421001 PSD											
1,1-Dichloroethylene	50.0	U	ND	45.8	ug/L	0.0218	91.6	(0%-20%)		08/04/10	09:24
Benzene	50.0	U	ND	45.6	ug/L	0.836	91.3	(0%-20%)			
Chlorobenzene	50.0	U	ND	42.4	ug/L	1.59	84.8	(0%-24%)			
Toluene	50.0	U	ND	43.1	ug/L	0.279	86.3	(0%-23%)			
Trichloroethylene	50.0	U	ND	45.2	ug/L	1.47	90.5	(0%-23%)			
**1,2-Dichloroethane-d4	50.0		48.5	49.4	ug/L		98.9	(66%-134%)			
**Bromofluorobenzene	50.0		53.9	54.3	ug/L		109	(65%-130%)			
**Toluene-d8	50.0		49.1	49.2	ug/L		98.3	(71%-128%)			

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QC Summary

Workorder: 257421

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
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Notes:

The Qualifiers in this report are defined as follows:

- ** Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- DL Failed required detection limit.
- E Metals--%difference of sample and SD is >10%. Sample concentration must meet flagging criteria
- E Organics--Concentration of the target analyte exceeds the instrument calibration range
- F Estimated Value
- H Analytical holding time was exceeded
- H Holding time exceeded
- J Estimated value; the result was greater than the MDA but less than the required detection limit.
- J Value is estimated
- JN Presumptive evidence of the analyte at an estimated quantity.
- JNX Non Calibrated Compound
- M Matrix Related Failure
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, difference is also <70%
- R Sample results are rejected
- R The data are unusable (radionuclide may or may not be present).
- U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.
- U Undetected; sample result < MDA
- UI Uncertain identification for gamma spectroscopy.
- UJ Compound cannot be extracted
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

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QC Summary

Workorder: 257421

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
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N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

259231.1.

BROOKHAVEN
NATIONAL LABORATORY

P.O.# _____

30050

DOL

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: Andy Lockwood		Name: PW Grosser		Name: 6e1	
Life: No. Ext.		Contact: Chris Amato		Address: 2040 Savage Rd	
Acct. No: 05070/65074 Dept: ERP		Phone: 631.365.5202		City: Charleston St SC Zip: 29407	
Email Reports To:		Email/Fax:		Contact: Ann Skreski	
1 lockwood@BNL.gov		Sampler: Chris Amato		Phone: 843.556.8171	
2 Holindei@BNL.gov				Email/Fax: www.6e1.com	
Project Name:		Project Manager:		Field Engineer:	
Ena House D30		Andy Lockwood		Kent Heckman	

Comments:

[illegible]

1 Relinquished By/Date/Time	2 Relinquished By/Date/Time	3 Relinquished By/Date/Time
Print Chris Amato 8/19/10	Print	Print
Signature [Signature] 0945	Signature	Signature
1 Received By/Date/Time	2 Received By/Date/Time	3 Received By/Date/Time
Print Betty Deleo 8/20/10	Print	Print
Signature [Signature] 0855	Signature	Signature

Contractor Lab Sample Disposal:

☐ Return To Client ☒ Disposal by Lab

☐ Archive For _____ Months

Data Package: ☒ Full ☐ Summary

Turn-Around Time Required:

☒ Rush (1 Day) ☐ 14 Days ☐ 30 Days

☒ 7 Days ☐ Other ()

SAMPLE RECEIPT & REVIEW FORM

Client: <u>BPKL</u>		SDG/AR/COC/Work Order: <u>2592311</u>		<u>30050</u>
Received By: <u>BD</u>		Date Received: <u>8-20-10</u>		
Suspected Hazard Information	Yes	No	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.	
COC/Samples marked as radioactive?		☒	Maximum Counts Observed*: <u>CPM 20</u>	
Classified Radioactive II or III by RSO?		☒		
COC/Samples marked containing PCBs?		☒		
Shipped as a DOT Hazardous?		☒	Hazard Class Shipped: UN#:	
Samples identified as Foreign Soil?		☒		

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	☒	☒		Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?	☒	☒		Preservation Method: <u>5°C</u> Ice bags Blue ice Dry ice None Other (describe)
2a	Daily check performed and passed on IR temperature gun?	☒	☒		Temperature Device Serial #: <u>41502182</u> Secondary Temperature Device Serial # (If Applicable):
3	Chain of custody documents included with shipment?	☒	☒		
4	Sample containers intact and sealed?	☒	☒		Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5	Samples requiring chemical preservation at proper pH?		☒		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		☒		Sample ID's and containers affected:
7	Are Encore containers present?		☒		(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	☒	☒		ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	☒	☒		Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	☒	☒		Sample ID's affected:
11	Number of containers received match number indicated on COC?	☒	☒		Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	☒	☒		
13	Carrier and tracking number.	☒	☒		Circle Applicable: <u>FedEx Air</u> FedEx Ground UPS Field Services Courier Other <u>9800 5395 4170</u>

Comments (Use Continuation Form if needed):

GEL LABORATORIES LLC

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: September 13, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30050-001
Sample ID: 259812001
Matrix: S
Collect Date: 18-AUG-10 15:45
Receive Date: 20-AUG-10 08:55
Collector: Client
Moisture: .906%

Project: BRKL00500
Client ID: BRKL005
COC: 30050
Samp Recv.:
Client Desc.: Bld. 704
Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
<i>7471 Cold Vapor Hg in Solid "Dry Weight Corrected"</i>											
Mercury	J	0.122	0.00381	0.200	mg/kg	1	JXL1	09/10/10	0745	1020742	1
Metals Analysis-ICP											
<i>6010 TAL Metals Soil "Dry Weight Corrected"</i>											
Barium		14.0	0.0999	0.500	mg/kg	1	CYL1	09/01/10	1615	1020185	2
Cadmium	U	ND	0.0999	0.500	mg/kg	1					
Chromium		7.48	0.150	0.500	mg/kg	1					
Silver	U	ND	0.0999	0.500	mg/kg	1					
Metals Analysis-ICP-MS											
<i>3050/6020 Arsenic "Dry Weight Corrected"</i>											
Arsenic		1.82	0.199	0.995	mg/kg	2	BAJ	09/07/10	0355	1020179	3
Lead		22.7	0.0995	0.398	mg/kg	2					
Selenium	U	ND	0.498	0.995	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	AXG2	09/01/10	0900	1020184
SW846 3050B	ICP-MS 3050BS PREP	AXG2	09/01/10	0730	1020177
SW846 7471A Prep	EPA 7471A Mercury Prep Soil	TXB3	09/09/10	1445	1020741

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	
3	SW846 3050B/6020	

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QC Summary

Report Date: September 13, 2010

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Brookhaven National Laboratory

Building 462

Upton, New York

Contact: Mr. John Burke

Workorder: 259812

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1020179										
QC1202204851	259812001	DUP									
Arsenic			1.82	1.80	mg/kg	1.23 ^		(+/-0.922)	BAJ	09/07/10	04:01
Lead			22.7	23.5	mg/kg	3.20		(0%-20%)			
Selenium		U	ND	ND	mg/kg	N/A					
QC1202204850	LCS										
Arsenic	4.82			4.33	mg/kg		89.9	(80%-120%)		09/07/10	03:49
Lead	4.82			4.96	mg/kg		103	(80%-120%)			
Selenium	4.82			4.20	mg/kg		87.2	(80%-120%)			
QC1202204849	MB										
Arsenic			U	ND	mg/kg					09/07/10	03:43
Lead			U	ND	mg/kg						
Selenium			U	ND	mg/kg						
QC1202204852	259812001	MS									
Arsenic	4.78		1.82	5.74	mg/kg		81.9	(75%-125%)		09/07/10	04:07
Lead	4.78		22.7	27.0	mg/kg		N/A	(75%-125%)			
Selenium	4.78	U	ND	4.01	mg/kg		79.7	(75%-125%)			
QC1202204854	259812001	MSD									
Arsenic	4.72		1.82	5.87	mg/kg	2.28	85.7	(0%-20%)		09/07/10	04:13
Lead	4.72		22.7	27.5	mg/kg	1.94	N/A	(0%-20%)			
Selenium	4.72	U	ND	4.09	mg/kg	2.11	82.4	(0%-20%)			
QC1202204853	259812001	SDILT									
Arsenic			9.15	2.10	ug/L	14.8		(0%-10%)		09/07/10	04:19
Lead			114	28.9	ug/L	26.4*		(0%-10%)			
Selenium		U	ND	ND	ug/L	N/A		(0%-10%)			
Metals Analysis-ICP											
Batch	1020185										
QC1202204860	259812001	DUP									
Barium			14.0	15.8	mg/kg	12.0		(0%-20%)	CYL1	09/01/10	16:17
Cadmium		U	ND	ND	mg/kg	N/A					
Chromium			7.48	9.11	mg/kg	19.6		(0%-20%)			
Silver		U	ND	ND	mg/kg	N/A					
QC1202204859	LCS										
Barium	49.0			50.7	mg/kg		103	(80%-120%)		09/01/10	16:13
Cadmium	49.0			50.8	mg/kg		104	(80%-120%)			
Chromium	49.0			49.5	mg/kg		101	(80%-120%)			
Silver	49.0			49.2	mg/kg		100	(80%-120%)			
QC1202204858	MB										
Barium			U	ND	mg/kg					09/01/10	16:11
Cadmium			U	ND	mg/kg						
Chromium			U	ND	mg/kg						

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QC Summary

Workorder: 259812

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1020185										
Silver			U	ND	mg/kg						
QC1202204861	259812001	MS									
Barium	46.4		14.0	60.5	mg/kg		100	(75%-125%)	CYL1	09/01/10	16:19
Cadmium	46.4	U	ND	45.4	mg/kg		97.8	(75%-125%)			
Chromium	46.4		7.48	53.7	mg/kg		99.8	(75%-125%)			
Silver	46.4	U	ND	44.9	mg/kg		96.9	(75%-125%)			
QC1202204866	259812001	MSD									
Barium	48.2		14.0	63.3	mg/kg	4.63	102	(0%-20%)		09/01/10	16:20
Cadmium	48.2	U	ND	47.6	mg/kg	4.75	98.6	(0%-20%)			
Chromium	48.2		7.48	54.9	mg/kg	2.20	98.4	(0%-20%)			
Silver	48.2	U	ND	47.0	mg/kg	4.44	97.4	(0%-20%)			
QC1202204862	259812001	SDILT									
Barium			140	28.0	ug/L	.0107		(0%-10%)		09/01/10	16:21
Cadmium		U	ND	ND	ug/L	N/A		(0%-10%)			
Chromium			74.9	15.7	ug/L	5.04		(0%-10%)			
Silver		U	ND	ND	ug/L	N/A		(0%-10%)			
Metals Analysis-Mercury											
Batch	1020742										
QC1202206072	259812001	DUP									
Mercury		J	0.122	J	0.181	mg/kg	39.0 ^	(+/-0.200)	JXL1	09/10/10	07:47
QC1202206071	LCS										
Mercury	0.102		J	0.105	mg/kg		104	(80%-120%)		09/10/10	07:44
QC1202206070	MB										
Mercury			U	ND	mg/kg					09/10/10	07:42
QC1202206073	259812001	MS									
Mercury	0.114	J	0.122	0.282	mg/kg		141 *	(80%-120%)		09/10/10	07:49
QC1202206076	259812001	MSD									
Mercury	0.111	J	0.122	0.243	mg/kg	14.7	109	(0%-20%)		09/10/10	07:50
QC1202206075	259812001	SDILT									
Mercury		J	2.17	J	0.383	ug/L	11.9*			09/10/10	07:52

Notes:

The Qualifiers in this report are defined as follows:

- ** Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- DL Failed required detection limit.
- E Metals--%difference of sample and SD is >10%. Sample concentration must meet flagging criteria

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QC Summary

Workorder: 259812

Page 3 of 3

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
F	Estimated Value										
H	Analytical holding time was exceeded										
H	Holding time exceeded										
J	Estimated value; the result was greater than the MDA but less than the required detection limit.										
J	Value is estimated										
JN	Presumptive evidence of the analyte at an estimated quantity.										
M	Matrix Related Failure										
N/A	RPD or %Recovery limits do not apply.										
ND	Analyte concentration is not detected above the detection limit										
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.										
R	Sample results are rejected										
R	The data are unusable (radionuclide may or may not be present).										
U	Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.										
U	Undetected; sample result < MDA										
UI	Uncertain identification for gamma spectroscopy.										
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Y	QC Samples were not spiked with this compound										
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.										
h	Preparation or preservation holding time was exceeded										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

259231.1.

BROOKHAVEN

NATIONAL LABORATORY

P.O.# _____

30050

DOL

SAMPLING CHAIN OF CUSTODY

Analysis Requested By		Sampling Contractor		Analytical Laboratory	
Name: Andy Lockwood	Name: PW Grosser	Name: GEL			
Life: No. Ext.	Contact: Chris Amato	Address: 2040 Savage Rd			
Acct. No: 05070/65074 Dept: ERP	Phone: 631.365.5202	City: Charleston St: SC Zip: 29407			
Email Reports To:	Email/Fax:	Contact: Ann Skreski			
1 lockwood@BNI.60V	Sampler: Chris Amato	Phone: 843.556.8171			
2 Holindei@BNI.90V		Email/Fax: www.GEL.com			
Project Name:	Project Manager:	Field Engineer:			
Fran House P30	Andy Lockwood	Kent Heckman			

Comments:

[illegible]

1 Relinquished By/Date/Time	2 Relinquished By/Date/Time	3 Relinquished By/Date/Time
Print Chris Amato 8/19/10	Print	Print
Signature [Signature] 0945	Signature	Signature
1 Received By/Date/Time	2 Received By/Date/Time	3 Received By/Date/Time
Print Butty Delep 8/20/10	Print	Print
Signature [Signature] 0855	Signature	Signature

Contractor Lab Sample Disposal:

☐ Return To Client ☒ Disposal by Lab

☐ Archive For _____ Months

Data Package: ☒ Full ☐ Summary

Turn-Around Time Required:

☒ Rush (1 Day) ☐ 14 Days ☐ 30 Days

☒ 7 Days ☐ Other ()

Client: <u>BPKL</u>			SDG/AR/COC/Work Order: <u>2592311</u>		<u>30050</u>
Received By: <u>BD</u>			Date Received: <u>8-20-10</u>		
Suspected Hazard Information	Yes	No	*If Counts > x2 area background on samples not marked "radioactive", contact the Radiation Safety Group of further investigation.		
COC/Samples marked as radioactive?		☒	Maximum Counts Observed*: <u>CPM 20</u>		
Classified Radioactive II or III by RSO?		☒			
COC/Samples marked containing PCBs?		☒			
Shipped as a DOT Hazardous?		☒	Hazard Class Shipped: UN#:		
Samples identified as Foreign Soil?		☒			

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	☒	☒		Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Samples requiring cold preservation within ($0 \leq 6$ deg. C)?	☒	☒		Preservation Method: <u>5°C</u> Ice bags Blue ice Dry ice None Other (describe)
2a	Daily check performed and passed on IR temperature gun?	☒	☒		Temperature Device Serial #: <u>41502182</u> Secondary Temperature Device Serial # (If Applicable):
3	Chain of custody documents included with shipment?	☒	☒		
4	Sample containers intact and sealed?	☒	☒		Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5	Samples requiring chemical preservation at proper pH?		☒		Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	VOA vials free of headspace (defined as < 6mm bubble)?		☒		Sample ID's and containers affected:
7	Are Encore containers present?		☒		(If yes, immediately deliver to Volatiles laboratory)
8	Samples received within holding time?	☒	☒		ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	☒	☒		Sample ID's and containers affected:
10	Date & time on COC match date & time on bottles?	☒	☒		Sample ID's affected:
11	Number of containers received match number indicated on COC?	☒	☒		Sample ID's affected:
12	COC form is properly signed in relinquished/received sections?	☒	☒		
13	Carrier and tracking number.	☒	☒		Circle Applicable: <u>FedEx Air</u> FedEx Ground UPS Field Services Courier Other <u>9800 5395 4170</u>

Comments (Use Continuation Form if needed):

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 30, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30050-001
Sample ID: 259231001
Matrix: S
Collect Date: 18-AUG-10 15:45
Receive Date: 20-AUG-10 08:55
Collector: Client
Moisture: .906%

Project: BRKL00500
Client ID: BRKL005
COC: 30050
Samp Recv.:
Client Desc.: Bld. 704
Vol. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis-CVAA											
<i>TCLP Hg in Solid "As Received"</i>											
Mercury	U	ND	0.00066	0.002	mg/L	1	JXL1	08/27/10	1107	1017941	1
Metals Analysis-ICP											
<i>TCLP ICP Metals for Solid "As Received"</i>											
Arsenic	U	ND	0.050	0.300	mg/L	1	CYL1	08/25/10	1659	1017397	2
Barium		0.157	0.010	0.050	mg/L	1					
Cadmium	U	ND	0.010	0.050	mg/L	1					
Chromium	J	0.0177	0.010	0.050	mg/L	1					
Lead		0.747	0.033	0.100	mg/L	1					
Selenium	J	0.0904	0.050	0.300	mg/L	1					
Silver	U	ND	0.010	0.050	mg/L	1					
Semi-Volatile-GC/MS											
<i>3550/8270C TCL BNA Soil "Dry Weight Corrected"</i>											
1,2,4-Trichlorobenzene	U	ND	67.2	336	ug/kg	1	AGS1	08/24/10	0122	1016829	3
1,2-Dichlorobenzene	U	ND	67.2	336	ug/kg	1					
1,3-Dichlorobenzene	U	ND	67.2	336	ug/kg	1					
1,4-Dichlorobenzene	U	ND	67.2	336	ug/kg	1					
2,4,5-Trichlorophenol	U	ND	67.2	336	ug/kg	1					
2,4,6-Trichlorophenol	U	ND	67.2	336	ug/kg	1					
2,4-Dichlorophenol	U	ND	67.2	336	ug/kg	1					
2,4-Dimethylphenol	U	ND	118	336	ug/kg	1					
2,4-Dinitrophenol	U	ND	128	672	ug/kg	1					
2,4-Dinitrotoluene	U	ND	33.6	336	ug/kg	1					
2,6-Dinitrotoluene	U	ND	33.6	336	ug/kg	1					
2-Chloronaphthalene	U	ND	11.1	33.6	ug/kg	1					
2-Chlorophenol	U	ND	67.2	336	ug/kg	1					
2-Methyl-4,6-dinitrophenol	U	ND	67.2	336	ug/kg	1					
2-Methylnaphthalene	U	ND	6.72	33.6	ug/kg	1					
2-Nitrophenol	U	ND	67.2	336	ug/kg	1					
3,3'-Dichlorobenzidine	U	ND	101	336	ug/kg	1					
4-Bromophenylphenylether	U	ND	67.2	336	ug/kg	1					
4-Chloro-3-methylphenol	U	ND	67.2	336	ug/kg	1					
4-Chloroaniline	U	ND	67.2	336	ug/kg	1					
4-Chlorophenylphenylether	U	ND	67.2	336	ug/kg	1					
4-Nitrophenol	U	ND	111	336	ug/kg	1					
Acenaphthene	U	ND	11.1	33.6	ug/kg	1					

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 30, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30050-001
Sample ID: 259231001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatile-GC/MS											
<i>3550/8270C TCL BNA Soil "Dry Weight Corrected"</i>											
Acenaphthylene	U	ND	10.1	33.6	ug/kg	1					
Anthracene	U	ND	6.72	33.6	ug/kg	1					
Benzo(a)anthracene		48.5	10.1	33.6	ug/kg	1					
Benzo(a)pyrene		48.9	10.1	33.6	ug/kg	1					
Benzo(b)fluoranthene		74.6	10.1	33.6	ug/kg	1					
Benzo(ghi)perylene	J	29.0	10.1	33.6	ug/kg	1					
Benzo(k)fluoranthene	J	29.3	10.1	33.6	ug/kg	1					
Butylbenzylphthalate	U	ND	67.2	336	ug/kg	1					
Carbazole	U	ND	10.1	33.6	ug/kg	1					
Chrysene		56.3	10.1	33.6	ug/kg	1					
Di-n-butylphthalate	U	ND	67.2	336	ug/kg	1					
Di-n-octylphthalate	U	ND	67.2	336	ug/kg	1					
Dibenzo(a,h)anthracene	U	ND	10.1	33.6	ug/kg	1					
Dibenzofuran	U	ND	67.2	336	ug/kg	1					
Diethylphthalate	U	ND	67.2	336	ug/kg	1					
Dimethylphthalate	U	ND	67.2	336	ug/kg	1					
Diphenylamine	U	ND	67.2	336	ug/kg	1					
Fluoranthene		79.6	10.1	33.6	ug/kg	1					
Fluorene	U	ND	10.1	33.6	ug/kg	1					
Hexachlorobenzene	U	ND	67.2	336	ug/kg	1					
Hexachlorobutadiene	U	ND	67.2	336	ug/kg	1					
Hexachlorocyclopentadiene	U	ND	67.2	336	ug/kg	1					
Hexachloroethane	U	ND	67.2	336	ug/kg	1					
Indeno(1,2,3-cd)pyrene	J	22.9	10.1	33.6	ug/kg	1					
Isophorone	U	ND	67.2	336	ug/kg	1					
N-Nitrosodipropylamine	U	ND	67.2	336	ug/kg	1					
Naphthalene	U	ND	10.1	33.6	ug/kg	1					
Nitrobenzene	U	ND	67.2	336	ug/kg	1					
Pentachlorophenol	U	ND	84.0	336	ug/kg	1					
Phenanthrene	J	33.3	10.1	33.6	ug/kg	1					
Phenol	U	ND	67.2	336	ug/kg	1					
Pyrene		84.2	10.1	33.6	ug/kg	1					
bis(2-Chloroethoxy)methane	U	ND	67.2	336	ug/kg	1					
bis(2-Chloroethyl) ether	U	ND	67.2	336	ug/kg	1					
bis(2-Chloroisopropyl)ether	U	ND	67.2	336	ug/kg	1					
bis(2-Ethylhexyl)phthalate	U	ND	67.2	336	ug/kg	1					
m,p-Cresols	U	ND	101	336	ug/kg	1					
m-Nitroaniline	U	ND	67.2	336	ug/kg	1					
o-Cresol	U	ND	67.2	336	ug/kg	1					
o-Nitroaniline	U	ND	67.2	336	ug/kg	1					
p-Nitroaniline	U	ND	101	336	ug/kg	1					

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 30, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30050-001
Sample ID: 259231001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Semi-Volatiles-PCB											
<i>8082/3550B PCB soil-Fed "Dry Weight Corrected"</i>											
Aroclor-1016	U	ND	5.58	16.8	ug/kg	5	JAOC	08/24/10	1011	1016839	4
Aroclor-1221	U	ND	5.58	16.8	ug/kg	5					
Aroclor-1232	U	ND	5.58	16.8	ug/kg	5					
Aroclor-1242	U	ND	5.58	16.8	ug/kg	5					
Aroclor-1248	U	ND	5.58	16.8	ug/kg	5					
Aroclor-1260	J	12.4	5.58	16.8	ug/kg	5					
Aroclor-1254	P	19.2	5.58	16.8	ug/kg	5	JAOC	08/24/10	1011	1016839	5
Semi-Volatiles-Pesticide											
<i>8081A/3550B Pesticide Soil "Dry Weight Corrected"</i>											
4,4'-DDD	JP	0.997	0.336	1.34	ug/kg	1	MXS2	08/24/10	1836	1016842	6
4,4'-DDE		6.06	0.336	1.34	ug/kg	1					
4,4'-DDT		6.50	0.336	1.34	ug/kg	1					
Aldrin	U	ND	0.168	0.672	ug/kg	1					
Chlordane (tech.)	U	ND	1.68	8.40	ug/kg	1					
Dieldrin	U	ND	0.336	1.34	ug/kg	1					
Endosulfan I	U	ND	0.168	0.672	ug/kg	1					
Endosulfan II	U	ND	0.336	1.34	ug/kg	1					
Endosulfan sulfate	U	ND	0.336	1.34	ug/kg	1					
Endrin	U	ND	0.336	1.34	ug/kg	1					
Endrin aldehyde	U	ND	0.336	1.34	ug/kg	1					
Endrin ketone	U	ND	0.336	1.34	ug/kg	1					
Heptachlor	U	ND	0.168	0.672	ug/kg	1					
Heptachlor epoxide	U	ND	0.210	0.672	ug/kg	1					
Methoxychlor	U	ND	1.68	6.72	ug/kg	1					
Toxaphene	U	ND	5.60	16.8	ug/kg	1					
alpha-BHC	U	ND	0.168	0.672	ug/kg	1					
beta-BHC	U	ND	0.168	0.672	ug/kg	1					
delta-BHC	U	ND	0.168	0.672	ug/kg	1					
gamma-BHC (Lindane)	U	ND	0.168	0.672	ug/kg	1					
Volatile Organics											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
1,1,1-Trichloroethane	U	ND	0.303	1.01	ug/kg	1	AXO1	08/25/10	2224	1017830	7
1,1,2,2-Tetrachloroethane	U	ND	0.303	1.01	ug/kg	1					
1,1,2-Trichloroethane	U	ND	0.303	1.01	ug/kg	1					
1,1-Dichloroethane	U	ND	0.303	1.01	ug/kg	1					
1,1-Dichloroethylene	U	ND	0.303	1.01	ug/kg	1					
1,2-Dichloroethane	U	ND	0.303	1.01	ug/kg	1					
1,2-Dichloroethylene (total)	U	ND	0.303	1.01	ug/kg	1					
1,2-Dichloropropane	U	ND	0.303	1.01	ug/kg	1					
2-Butanone	U	ND	1.51	5.05	ug/kg	1					

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 30, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30050-001
Sample ID: 259231001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Volatile Organics											
<i>5035/8260B TCL in Solid "Dry Weight Corrected"</i>											
2-Hexanone	U	ND	1.51	5.05	ug/kg	1					
4-Methyl-2-pentanone	U	ND	1.26	5.05	ug/kg	1					
Acetone	BJ	2.29	1.68	5.05	ug/kg	1					
Benzene	U	ND	0.303	1.01	ug/kg	1					
Bromodichloromethane	U	ND	0.303	1.01	ug/kg	1					
Bromoform	U	ND	0.303	1.01	ug/kg	1					
Bromomethane	U	ND	0.303	1.01	ug/kg	1					
Carbon disulfide	U	ND	1.26	5.05	ug/kg	1					
Carbon tetrachloride	U	ND	0.303	1.01	ug/kg	1					
Chlorobenzene	U	ND	0.303	1.01	ug/kg	1					
Chloroethane	U	ND	0.303	1.01	ug/kg	1					
Chloroform	U	ND	0.303	1.01	ug/kg	1					
Chloromethane	U	ND	0.303	1.01	ug/kg	1					
Dibromochloromethane	U	ND	0.303	1.01	ug/kg	1					
Ethylbenzene	U	ND	0.303	1.01	ug/kg	1					
Methylene chloride	U	ND	2.02	5.05	ug/kg	1					
Styrene	U	ND	0.303	1.01	ug/kg	1					
Tetrachloroethylene	U	ND	0.303	1.01	ug/kg	1					
Toluene	U	ND	0.303	1.01	ug/kg	1					
Trichloroethylene	U	ND	0.333	1.01	ug/kg	1					
Vinyl chloride	U	ND	0.303	1.01	ug/kg	1					
Xylenes (total)	U	ND	0.303	1.01	ug/kg	1					
cis-1,3-Dichloropropylene	U	ND	0.303	1.01	ug/kg	1					
trans-1,3-Dichloropropylene	U	ND	0.303	1.01	ug/kg	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 1311	SW846 1311 TCLP Leaching	EXF1	08/23/10	1600	1016863
SW846 3010A	ICP-TRACE TCLP by SW846 3010A	AXG2	08/25/10	0730	1017396
SW846 3550B	3550B BNA Soil Prep-8270 Analysis	AXV1	08/23/10	1923	1016826
SW846 3550B	3550B PCB Prep Soil	MXS4	08/23/10	1910	1016838
SW846 3550B	3550B Pesticide/PCB Prep Soil	AXV1	08/23/10	1905	1016841
SW846 5035	5035/8260B Prep	AXO1	08/25/10	1701	1017829
SW846 7470A Prep	EPA 7470A Mercury Prep TCLP Liquid	JXL1	08/26/10	1054	1017940

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	

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Certificate of Analysis

Company : Brookhaven National Laboratory
Address : Building 462
Upton, New York 11973--5000

Report Date: August 30, 2010

Contact: Mr. John Burke
Project: **Hazardous & Radiochemical Analytical
Services--Full**

Client Sample ID: 30050-001
Sample ID: 259231001

Project: BRKL00500
Client ID: BRKL005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
2	SW846	3010/6010B									
3	SW846	8270C									
4	SW846	8082									
5	SW846	8082									
6	SW846	8081A									
7	SW846	8260B									

Surrogate/Tracer recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
2-Fluorobiphenyl	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1210 ug/kg	1680	72.3	(25%-109%)
Nitrobenzene-d5	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1580 ug/kg	1680	94.0	(31%-105%)
p-Terphenyl-d14	3550/8270C TCL BNA Soil "Dry Weight Corrected"	1670 ug/kg	1680	99.2	(13%-150%)
2,4,6-Tribromophenol	3550/8270C TCL BNA Soil "Dry Weight Corrected"	2900 ug/kg	3360	86.4	(37%-106%)
2-Fluorophenol	3550/8270C TCL BNA Soil "Dry Weight Corrected"	2500 ug/kg	3360	74.3	(29%-99%)
Phenol-d5	3550/8270C TCL BNA Soil "Dry Weight Corrected"	2420 ug/kg	3360	72.1	(33%-98%)
4cmx	8082/3550B PCB soil-Fed "Dry Weight Corrected"	4.54 ug/kg	6.70	67.8	(32%-120%)
Decachlorobiphenyl	8082/3550B PCB soil-Fed "Dry Weight Corrected"	4.71 ug/kg	6.70	70.3	(30%-116%)
4cmx	8081A/3550B Pesticide Soil "Dry Weight Corrected"	29.8 ug/kg	33.6	88.6	(32%-120%)
Decachlorobiphenyl	8081A/3550B Pesticide Soil "Dry Weight Corrected"	28.6 ug/kg	33.6	85.2	(30%-116%)
1,2-Dichloroethane-d4	5035/8260B TCL in Solid "Dry Weight Corrected"	62.5 ug/kg	50.0	124	(66%-134%)
Bromofluorobenzene	5035/8260B TCL in Solid "Dry Weight Corrected"	51.2 ug/kg	50.0	102	(65%-130%)
Toluene-d8	5035/8260B TCL in Solid "Dry Weight Corrected"	53.2 ug/kg	50.0	105	(71%-128%)

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: August 30, 2010

Page 1 of 11

Brookhaven National Laboratory

Building 462

Upton, New York

Contact: Mr. John Burke

Workorder: 259231

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1017397										
QC1202198424	259231001	DUP									
Arsenic		U	ND	U	ND	mg/L	N/A		CYL1	08/25/10	17:01
Barium			0.157		0.163	mg/L	4.04 ^	(+/-0.050)			
Cadmium		U	ND	U	ND	mg/L	N/A				
Chromium		J	0.0177	J	0.0203	mg/L	13.9 ^	(+/-0.050)			
Lead			0.747		0.789	mg/L	5.49	(0%-20%)			
Selenium		J	0.0904	J	0.153	mg/L	51.4 ^	(+/-0.300)			
Silver		U	ND	U	ND	mg/L	N/A				
QC1202198423	LCS										
Arsenic	5.00				4.47	mg/L		89.5 (80%-120%)		08/25/10	16:57
Barium	5.00				4.87	mg/L		97.3 (80%-120%)			
Cadmium	5.00				4.69	mg/L		93.7 (80%-120%)			
Chromium	5.00				4.87	mg/L		97.5 (80%-120%)			
Lead	5.00				4.82	mg/L		96.3 (80%-120%)			
Selenium	5.00				4.11	mg/L		82.2 (80%-120%)			
Silver	5.00				4.82	mg/L		96.5 (80%-120%)			
QC1202198422	MB										
Arsenic				U	ND	mg/L				08/25/10	16:53
Barium				U	ND	mg/L					
Cadmium				U	ND	mg/L					
Chromium				J	0.013	mg/L					
Lead				U	ND	mg/L					
Selenium				J	0.0984	mg/L					
Silver				U	ND	mg/L					
QC1202197103	259231001	MS									
Arsenic	5.26	U	ND		4.34	mg/L		82.5 (75%-125%)		08/25/10	17:03
Barium	10.5		0.157		9.43	mg/L		88.1 (75%-125%)			
Cadmium	1.05	U	ND		0.889	mg/L		84.4 (75%-125%)			
Chromium	5.26	J	0.0177		4.65	mg/L		87.9 (75%-125%)			
Lead	5.26		0.747		5.31	mg/L		86.6 (75%-125%)			
Selenium	1.05	J	0.0904		0.889	mg/L		75.9 (75%-125%)			
Silver	0.526	U	ND		0.471	mg/L		89.5 (75%-125%)			
QC1202198426	259231001	SDILT									
Arsenic		U	ND	U	ND	ug/L	N/A	(0%-10%)		08/25/10	17:06
Barium			15.7	J	3.26	ug/L	3.97	(0%-10%)			
Cadmium		U	ND	U	ND	ug/L	N/A	(0%-10%)			
Chromium		J	1.77	J	1.53	ug/L	334	(0%-10%)			
Lead			74.7		15.7	ug/L	5.13	(0%-10%)			
Selenium		J	9.04	J	6.41	ug/L	255	(0%-10%)			

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1016829										
1,2,4-Trichlorobenzene			U	ND	ug/kg					08/23/10	23:43
1,2-Dichlorobenzene			U	ND	ug/kg				AGS1		
1,3-Dichlorobenzene			U	ND	ug/kg						
1,4-Dichlorobenzene			U	ND	ug/kg						
2,4,5-Trichlorophenol			U	ND	ug/kg						
2,4,6-Trichlorophenol			U	ND	ug/kg						
2,4-Dichlorophenol			U	ND	ug/kg						
2,4-Dimethylphenol			U	ND	ug/kg						
2,4-Dinitrophenol			U	ND	ug/kg						
2,4-Dinitrotoluene			U	ND	ug/kg						
2,6-Dinitrotoluene			U	ND	ug/kg						
2-Chloronaphthalene			U	ND	ug/kg						
2-Chlorophenol			U	ND	ug/kg						
2-Methyl-4,6-dinitrophenol			U	ND	ug/kg						
2-Methylnaphthalene			U	ND	ug/kg						
2-Nitrophenol			U	ND	ug/kg						
3,3'-Dichlorobenzidine			U	ND	ug/kg						
4-Bromophenylphenylether			U	ND	ug/kg						
4-Chloro-3-methylphenol			U	ND	ug/kg						
4-Chloroaniline			U	ND	ug/kg						
4-Chlorophenylphenylether			U	ND	ug/kg						
4-Nitrophenol			U	ND	ug/kg						
Acenaphthene			U	ND	ug/kg						
Acenaphthylene			U	ND	ug/kg						
Anthracene			U	ND	ug/kg						
Benzo(a)anthracene			U	ND	ug/kg						
Benzo(a)pyrene			U	ND	ug/kg						
Benzo(b)fluoranthene			U	ND	ug/kg						
Benzo(ghi)perylene			U	ND	ug/kg						
Benzo(k)fluoranthene			U	ND	ug/kg						
Butylbenzylphthalate			U	ND	ug/kg						
Carbazole			U	ND	ug/kg						
Chrysene			U	ND	ug/kg						
Di-n-butylphthalate			U	ND	ug/kg						
Di-n-octylphthalate			U	ND	ug/kg						
Dibenzo(a,h)anthracene			U	ND	ug/kg						
Dibenzofuran			U	ND	ug/kg						
Diethylphthalate			U	ND	ug/kg						
Dimethylphthalate			U	ND	ug/kg						
Diphenylamine			U	ND	ug/kg						
Fluoranthene			U	ND	ug/kg						
			U	ND							

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1016829										
Fluorene					ug/kg						
Hexachlorobenzene			U	ND	ug/kg				AGS1	08/23/10	23:43
Hexachlorobutadiene			U	ND	ug/kg						
Hexachlorocyclopentadiene			U	ND	ug/kg						
Hexachloroethane			U	ND	ug/kg						
Indeno(1,2,3-cd)pyrene			U	ND	ug/kg						
Isophorone			U	ND	ug/kg						
N-Nitrosodipropylamine			U	ND	ug/kg						
Naphthalene			U	ND	ug/kg						
Nitrobenzene			U	ND	ug/kg						
Pentachlorophenol			U	ND	ug/kg						
Phenanthrene			U	ND	ug/kg						
Phenol			U	ND	ug/kg						
Pyrene			U	ND	ug/kg						
bis(2-Chloroethoxy)methane			U	ND	ug/kg						
bis(2-Chloroethyl) ether			U	ND	ug/kg						
bis(2-Chloroisopropyl)ether			U	ND	ug/kg						
bis(2-Ethylhexyl)phthalate			U	ND	ug/kg						
m,p-Cresols			U	ND	ug/kg						
m-Nitroaniline			U	ND	ug/kg						
o-Cresol			U	ND	ug/kg						
o-Nitroaniline			U	ND	ug/kg						
p-Nitroaniline			U	ND	ug/kg						
**2,4,6-Tribromophenol	3330			3080	ug/kg		92.5	(37%-106%)			
**2-Fluorobiphenyl	1670			1340	ug/kg		80.5	(25%-109%)			
**2-Fluorophenol	3330			2730	ug/kg		81.8	(29%-99%)			
**Nitrobenzene-d5	1670			1570	ug/kg		94.1	(31%-105%)			
**Phenol-d5	3330			2580	ug/kg		77.5	(33%-98%)			
**p-Terphenyl-d14	1670			2040	ug/kg		122	(13%-150%)			
QC1202196995 259231001 MS											
1,2,4-Trichlorobenzene	1680	U	ND	1290	ug/kg		76.7	(28%-99%)		08/24/10	01:47
1,4-Dichlorobenzene	1680	U	ND	1190	ug/kg		70.7	(27%-96%)			
2,4-Dinitrotoluene	1680	U	ND	1370	ug/kg		82	(33%-107%)			
2-Chlorophenol	1680	U	ND	1210	ug/kg		72	(29%-96%)			
4-Chloro-3-methylphenol	1680	U	ND	1300	ug/kg		77.4	(29%-110%)			
4-Nitrophenol	1680	U	ND	1080	ug/kg		64.5	(15%-110%)			
Acenaphthene	1680	U	ND	1180	ug/kg		70.3	(17%-109%)			
N-Nitrosodipropylamine	1680	U	ND	1410	ug/kg		83.9	(29%-102%)			
Pentachlorophenol	1680	U	ND	984	ug/kg		58.7	(23%-110%)			
Phenol	1680	U	ND	1250	ug/kg		74.6	(33%-94%)			
Pyrene	1680		84.2	1950	ug/kg		111	(24%-118%)			
**2,4,6-Tribromophenol	3350		2900	3080	ug/kg		91.8	(37%-106%)			

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1016829										
**2-Fluorobiphenyl	1680		1210	1220	ug/kg		73	(25%-109%)			
**2-Fluorophenol	3350		2500	2410	ug/kg		71.9	(29%-99%)	AGS1	08/24/10	01:47
**Nitrobenzene-d5	1680		1580	1470	ug/kg		87.4	(31%-105%)			
**Phenol-d5	3350		2420	2380	ug/kg		70.9	(33%-98%)			
**p-Terphenyl-d14	1680		1670	1560	ug/kg		92.7	(13%-150%)			
QC1202196996 259231001 MSD											
1,2,4-Trichlorobenzene	1680	U	ND	1300	ug/kg	1.23	77.6	(0%-30%)		08/24/10	02:12
1,4-Dichlorobenzene	1680	U	ND	1200	ug/kg	1.12	71.4	(0%-30%)			
2,4-Dinitrotoluene	1680	U	ND	1350	ug/kg	2.00	80.3	(0%-30%)			
2-Chlorophenol	1680	U	ND	1230	ug/kg	1.80	73.3	(0%-30%)			
4-Chloro-3-methylphenol	1680	U	ND	1300	ug/kg	0.0863	77.4	(0%-30%)			
4-Nitrophenol	1680	U	ND	1030	ug/kg	5.21	61.1	(0%-30%)			
Acenaphthene	1680	U	ND	1230	ug/kg	4.15	73.2	(0%-30%)			
N-Nitrosodipropylamine	1680	U	ND	1340	ug/kg	4.80	79.9	(0%-30%)			
Pentachlorophenol	1680	U	ND	1050	ug/kg	6.42	62.5	(0%-30%)			
Phenol	1680	U	ND	1250	ug/kg	0.176	74.4	(0%-30%)			
Pyrene	1680		84.2	1730	ug/kg	12.3	97.9	(0%-30%)			
**2,4,6-Tribromophenol	3360		2900	2980	ug/kg		88.7	(37%-106%)			
**2-Fluorobiphenyl	1680		1210	1230	ug/kg		73.1	(25%-109%)			
**2-Fluorophenol	3360		2500	2410	ug/kg		71.9	(29%-99%)			
**Nitrobenzene-d5	1680		1580	1340	ug/kg		80	(31%-105%)			
**Phenol-d5	3360		2420	2390	ug/kg		71.1	(33%-98%)			
**p-Terphenyl-d14	1680		1670	1930	ug/kg		115	(13%-150%)			
Semi-Volatiles-PCB											
Batch	1016839										
QC1202197030 LCS											
Aroclor-1016	33.3			27.0	ug/kg		81	(39%-102%)	JAOC	08/24/10	10:00
Aroclor-1260	33.3			31.1	ug/kg		93.3	(45%-118%)			
**4cmx	6.67			5.31	ug/kg		79.6	(32%-120%)			
**Decachlorobiphenyl	6.67			5.73	ug/kg		86	(30%-116%)			
QC1202197029 MB											
Aroclor-1016			U	ND	ug/kg					08/24/10	09:48
Aroclor-1221			U	ND	ug/kg						
Aroclor-1232			U	ND	ug/kg						
Aroclor-1242			U	ND	ug/kg						
Aroclor-1248			U	ND	ug/kg						
Aroclor-1254			U	ND	ug/kg						
Aroclor-1260			U	ND	ug/kg						
**4cmx	6.67			5.21	ug/kg		78.1	(32%-120%)			
**Decachlorobiphenyl	6.67			5.62	ug/kg		84.3	(30%-116%)			
QC1202197031 259231001 MS											
Aroclor-1016	33.6	U	ND	33.1	ug/kg		98.4	(23%-119%)		08/24/10	10:22
Aroclor-1260	33.6	J	12.4	36.0	ug/kg		70.2	(28%-124%)			

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-PCB											
Batch	1016839										
QC1202197032	259231001	MSD									
**4cmx	6.73	4.54		4.78	ug/kg		71.1	(32%-120%)			
**Decachlorobiphenyl	6.73	4.71		4.94	ug/kg		73.5	(30%-116%)	JAOC	08/24/10	10:22
Aroclor-1016	33.5	U	ND	25.9	ug/kg	24.4	77.3	(0%-28%)		08/24/10	10:34
Aroclor-1260	33.5	J	12.4	37.4	ug/kg	3.81	74.6	(0%-30%)			
**4cmx	6.71	4.54		4.10	ug/kg		61.2	(32%-120%)			
**Decachlorobiphenyl	6.71	4.71		3.90	ug/kg		58.2	(30%-116%)			
Semi-Volatiles-Pesticide											
Batch	1016842										
QC1202197038	LCS										
4,4'-DDD	41.7			39.7	ug/kg		95.4	(60%-129%)	MXS2	08/24/10	18:22
4,4'-DDE	41.7			39.1	ug/kg		93.8	(59%-122%)			
4,4'-DDT	41.7			41.6	ug/kg		99.8	(50%-142%)			
Aldrin	16.7			14.2	ug/kg		85.3	(51%-124%)			
Chlordane (tech.)			U	ND	ug/kg			(58%-139%)			
Dieldrin	41.7			37.4	ug/kg		89.8	(52%-120%)			
Endosulfan I	16.7			13.8	ug/kg		83.1	(43%-126%)			
Endosulfan II	41.7			36.4	ug/kg		87.3	(50%-126%)			
Endosulfan sulfate	41.7			39.3	ug/kg		94.2	(61%-132%)			
Endrin	41.7			41.1	ug/kg		98.6	(61%-135%)			
Endrin aldehyde	41.7			37.2	ug/kg		89.2	(47%-117%)			
Endrin ketone	41.7			38.3	ug/kg		92	(57%-129%)			
Heptachlor	16.7			14.3	ug/kg		85.7	(51%-131%)			
Heptachlor epoxide	16.7			14.5	ug/kg		87	(52%-123%)			
Methoxychlor	167			145	ug/kg		86.8	(59%-140%)			
Toxaphene			U	ND	ug/kg			(50%-129%)			
alpha-BHC	16.7			15.3	ug/kg		91.6	(57%-130%)			
beta-BHC	16.7			14.0	ug/kg		84	(53%-123%)			
delta-BHC	16.7			14.6	ug/kg		87.6	(56%-130%)			
gamma-BHC (Lindane)	16.7			15.3	ug/kg		91.9	(56%-132%)			
**4cmx	33.3			28.6	ug/kg		85.7	(32%-120%)			
**Decachlorobiphenyl	33.3			27.2	ug/kg		81.7	(30%-116%)			
QC1202197037	MB										
4,4'-DDD			U	ND	ug/kg					08/24/10	18:09
4,4'-DDE			U	ND	ug/kg						
4,4'-DDT			U	ND	ug/kg						
Aldrin			U	ND	ug/kg						
Chlordane (tech.)			U	ND	ug/kg						
Dieldrin			U	ND	ug/kg						
Endosulfan I			U	ND	ug/kg						
Endosulfan II			U	ND	ug/kg						
Endosulfan sulfate			U	ND	ug/kg						

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1016842										
Endrin			U	ND	ug/kg						
Endrin aldehyde			U	ND	ug/kg				MXS2	08/24/10	18:09
Endrin ketone			U	ND	ug/kg						
Heptachlor			U	ND	ug/kg						
Heptachlor epoxide			U	ND	ug/kg						
Methoxychlor			U	ND	ug/kg						
Toxaphene			U	ND	ug/kg						
alpha-BHC			U	ND	ug/kg						
beta-BHC			U	ND	ug/kg						
delta-BHC			U	ND	ug/kg						
gamma-BHC (Lindane)			U	ND	ug/kg						
**4cmx	33.3			30.7	ug/kg		92	(32%-120%)			
**Decachlorobiphenyl	33.3			28.5	ug/kg		85.6	(30%-116%)			
QC1202197039	259231001	MS									
4,4'-DDD	41.9	JP	0.997	48.3	ug/kg		113	(34%-131%)		08/24/10	18:49
4,4'-DDE	41.9		6.06	47.6	ug/kg		99	(36%-127%)			
4,4'-DDT	41.9		6.50	31.7	ug/kg		60	(30%-147%)			
Aldrin	16.8	U	ND	14.1	ug/kg		84.3	(40%-120%)			
Chlordane (tech.)		U	ND	U	ND			(50%-150%)			
Dieldrin	41.9	U	ND	37.5	ug/kg		89.5	(32%-126%)			
Endosulfan I	16.8	U	ND	13.6	ug/kg		81.3	(31%-118%)			
Endosulfan II	41.9	U	ND	34.7	ug/kg		82.7	(25%-128%)			
Endosulfan sulfate	41.9	U	ND	36.5	ug/kg		86.9	(32%-127%)			
Endrin	41.9	U	ND	43.9	ug/kg		105	(37%-137%)			
Endrin aldehyde	41.9	U	ND	31.3	ug/kg		74.6	(30%-120%)			
Endrin ketone	41.9	U	ND	44.4	ug/kg		106	(35%-130%)			
Heptachlor	16.8	U	ND	14.5	ug/kg		86.3	(33%-128%)			
Heptachlor epoxide	16.8	U	ND	15.1	ug/kg		89.9	(30%-128%)			
Methoxychlor	168	U	ND	112	ug/kg		66.7	(32%-144%)			
Toxaphene		U	ND	U	ND			(50%-150%)			
alpha-BHC	16.8	U	ND	14.7	ug/kg		87.7	(36%-122%)			
beta-BHC	16.8	U	ND	9.90	ug/kg		59	(33%-129%)			
delta-BHC	16.8	U	ND	13.8	ug/kg		82	(32%-125%)			
gamma-BHC (Lindane)	16.8	U	ND	15.1	ug/kg		89.8	(37%-126%)			
**4cmx	33.6		29.8	27.0	ug/kg		80.6	(32%-120%)			
**Decachlorobiphenyl	33.6		28.6	26.9	ug/kg		80.1	(30%-116%)			
QC1202197040	259231001	MSD									
4,4'-DDD	41.9	JP	0.997	53.4	ug/kg	10.1	125	(0%-25%)		08/24/10	19:03
4,4'-DDE	41.9		6.06	47.7	ug/kg	0.341	99.4	(0%-31%)			
4,4'-DDT	41.9		6.50	18.2	ug/kg	54.1*	27.9*	(0%-27%)			
Aldrin	16.8	U	ND	13.6	ug/kg	3.81	81.2	(0%-31%)			
Chlordane (tech.)		U	ND	U	ND	N/A		(0%-30%)			

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time		
Semi-Volatiles-Pesticide													
Batch	1016842												
Dieldrin	41.9	U	ND	36.8	ug/kg	2.01	87.8	(0%-31%)	MXS2	08/24/10 19:03			
Endosulfan I	16.8	U	ND	12.9	ug/kg	5.93	76.7	(0%-29%)					
Endosulfan II	41.9	U	ND	33.4	ug/kg	3.64	79.8	(0%-31%)					
Endosulfan sulfate	41.9	U	ND	32.0	ug/kg	13.1	76.3	(0%-30%)					
Endrin	41.9	U	ND	40.7	ug/kg	7.63	97.1	(0%-27%)					
Endrin aldehyde	41.9	U	ND	28.3	ug/kg	9.98	67.6	(0%-30%)					
Endrin ketone	41.9	U	ND	32.2	ug/kg	31.9*	76.8	(0%-26%)					
Heptachlor	16.8	U	ND	12.4	ug/kg	15.7	73.8	(0%-33%)					
Heptachlor epoxide	16.8	U	ND	14.1	ug/kg	6.58	84.3	(0%-32%)					
Methoxychlor	168	U	ND	69.9	ug/kg	46.2*	41.7	(0%-31%)					
Toxaphene		U	ND	ND	ug/kg	N/A		(0%-30%)					
alpha-BHC	16.8	U	ND	14.0	ug/kg	4.92	83.6	(0%-32%)					
beta-BHC	16.8	U	ND	12.2	ug/kg	20.8	72.7	(0%-30%)					
delta-BHC	16.8	U	ND	13.5	ug/kg	2.09	80.4	(0%-29%)					
gamma-BHC (Lindane)	16.8	U	ND	14.0	ug/kg	7.04	83.8	(0%-29%)					
**4cmx	33.5		29.8	26.3	ug/kg		78.5	(32%-120%)					
**Decachlorobiphenyl	33.5		28.6	24.8	ug/kg		74.1	(30%-116%)					
Volatile-GC/MS													
Batch	1017830												
QC1202199469	LCS												
1,1-Dichloroethylene	50.0			47.4	ug/kg		94.7	(71%-129%)	AXO1	08/25/10 15:03			
Benzene	50.0			49.2	ug/kg		98.4	(74%-120%)					
Chlorobenzene	50.0			50.3	ug/kg		101	(76%-120%)					
Toluene	50.0			46.2	ug/kg		92.3	(74%-120%)					
Trichloroethylene	50.0			51.5	ug/kg		103	(77%-124%)					
**1,2-Dichloroethane-d4	50.0			55.6	ug/L		111	(66%-134%)					
**Bromofluorobenzene	50.0			48.1	ug/L		96.2	(65%-130%)					
**Toluene-d8	50.0			50.0	ug/L		100	(71%-128%)					
QC1202199466	MB												
1,1,1-Trichloroethane			U	ND	ug/kg				08/25/10 17:13				
1,1,2,2-Tetrachloroethane			U	ND	ug/kg								
1,1,2-Trichloroethane			U	ND	ug/kg								
1,1-Dichloroethane			U	ND	ug/kg								
1,1-Dichloroethylene			U	ND	ug/kg								
1,2-Dichloroethane			U	ND	ug/kg								
1,2-Dichloroethylene (total)			U	ND	ug/kg								
1,2-Dichloropropane			U	ND	ug/kg								
2-Butanone			U	ND	ug/kg								
2-Hexanone			U	ND	ug/kg								
4-Methyl-2-pentanone			U	ND	ug/kg								
Acetone			J	2.56	ug/kg								
Benzene			U	ND	ug/kg								

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Volatile-GC/MS											
Batch	1017830										
Bromodichloromethane			U	ND	ug/kg						
Bromoform			U	ND	ug/kg				AXO1	08/25/10	17:13
Bromomethane			U	ND	ug/kg						
Carbon disulfide			U	ND	ug/kg						
Carbon tetrachloride			U	ND	ug/kg						
Chlorobenzene			U	ND	ug/kg						
Chloroethane			U	ND	ug/kg						
Chloroform			U	ND	ug/kg						
Chloromethane			U	ND	ug/kg						
Dibromochloromethane			U	ND	ug/kg						
Ethylbenzene			U	ND	ug/kg						
Methylene chloride			U	ND	ug/kg						
Styrene			U	ND	ug/kg						
Tetrachloroethylene			U	ND	ug/kg						
Toluene			U	ND	ug/kg						
Trichloroethylene			U	ND	ug/kg						
Vinyl chloride			U	ND	ug/kg						
Xylenes (total)			U	ND	ug/kg						
cis-1,3-Dichloropropylene			U	ND	ug/kg						
trans-1,3-Dichloropropylene			U	ND	ug/kg						
**1,2-Dichloroethane-d4	50.0			57.5	ug/L		115	(66%-134%)			
**Bromofluorobenzene	50.0			48.8	ug/L		97.6	(65%-130%)			
**Toluene-d8	50.0			51.2	ug/L		102	(71%-128%)			
QC1202199467 259231001 PS											
1,1-Dichloroethylene	50.0	U	ND	34.3	ug/L		68.6	(55%-128%)		08/26/10	00:03
Benzene	50.0	U	ND	35.2	ug/L		70.4	(58%-120%)			
Chlorobenzene	50.0	U	ND	28.5	ug/L		57.1	(50%-130%)			
Toluene	50.0	U	ND	30.3	ug/L		60.5	(54%-119%)			
Trichloroethylene	50.0	U	ND	32.7	ug/L		65.3	(54%-130%)			
**1,2-Dichloroethane-d4	50.0		62.0	59.4	ug/L		119	(66%-134%)			
**Bromofluorobenzene	50.0		50.8	51.6	ug/L		103	(65%-130%)			
**Toluene-d8	50.0		52.7	51.8	ug/L		104	(71%-128%)			
QC1202199468 259231001 PSD											
1,1-Dichloroethylene	50.0	U	ND	36.2	ug/L	5.37	72.3	(0%-20%)		08/26/10	00:36
Benzene	50.0	U	ND	37.6	ug/L	6.73	75.3	(0%-20%)			
Chlorobenzene	50.0	U	ND	31.8	ug/L	10.7	63.5	(0%-24%)			
Toluene	50.0	U	ND	33.4	ug/L	9.77	66.8	(0%-23%)			
Trichloroethylene	50.0	U	ND	35.1	ug/L	7.23	70.2	(0%-23%)			
**1,2-Dichloroethane-d4	50.0		62.0	57.6	ug/L		115	(66%-134%)			
**Bromofluorobenzene	50.0		50.8	50.8	ug/L		102	(65%-130%)			
**Toluene-d8	50.0		52.7	50.1	ug/L		100	(71%-128%)			

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
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Notes:

The Qualifiers in this report are defined as follows:

- ** Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B For General Chemistry and Organic analysis the target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- DL Failed required detection limit.
- E Metals--%difference of sample and SD is >10%. Sample concentration must meet flagging criteria
- E Organics--Concentration of the target analyte exceeds the instrument calibration range
- F Estimated Value
- H Analytical holding time was exceeded
- H Holding time exceeded
- J Estimated value; the result was greater than the MDA but less than the required detection limit.
- J Value is estimated
- JN Presumptive evidence of the analyte at an estimated quantity.
- JNX Non Calibrated Compound
- M Matrix Related Failure
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, difference is also <70%
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- R The data are unusable (radionuclide may or may not be present).
- U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.
- U Undetected; sample result < MDA
- UI Uncertain identification for gamma spectroscopy.
- UJ Compound cannot be extracted
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
h	Preparation or preservation holding time was exceeded										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.