DRAFT

HIGH FLUX BEAM REACTOR
AND
BALANCE OF PLANT STRUCTURES
PRELIMINARY ASSESSMENT/SITE INSPECTION
REPORT

Prepared For:

BROOKHAVEN
NATIONAL LABORATORY

Prepared By:

P.W. GROSSER CONSULTING
Bohemia, New York

JUNE 2003

EXECUTIVE SUMMARY

This Preliminary Assessment/Site Inspection (PA/SI) Report has been prepared to document the Site Inspection activities performed relative to the High Flux Beam Reactor (HFBR) and Balance of Plant (BOP) Structures at Brookhaven National Laboratory (BNL), Upton, New York. The Preliminary Assessment (PA) findings were documented in the *High Flux Beam Reactor and Balance of Plant Structures Preliminary Assessment/Site Inspection (PA/SI) Work Plan* dated May 2001, revised August 2001 and was used to develop the scope of work for the Site Inspection (SI) activities.

The PA identified issues that have the potential to impact surface or subsurface soils, and ultimately groundwater, and classified them as Areas of Interest (AOIs). A total of 53 AOIs were identified during the PA and are summarized as follows:

- 26 AOIs were addressed or are being monitored as part of other projects, such as BGRR, and the groundwater monitoring program. Subsequent to the completion of the PA/SI Work Plan an additional AOI was identified. This new AOI is also being monitored under the current groundwater program,
- The remaining 27 AOIs were investigated as part of the SI activities.

SI actions were AOI specific and included the following activities: inspections, radiological walkover surveys and soil or groundwater sampling. These SI activities were then performed in accordance with the project Sampling Analysis Plan (SAP), which was reviewed by the U.S. Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC). Results from these activities were compared to specific criteria (Refer to Section 4.4 Data Evaluation Criteria) to determine if additional actions were warranted. Non-radiological data were compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Administrative Guidance Memorandum, HWR94-4046, for *Determination of Soil Cleanup Objectives and Cleanup Levels*, February 3, 1995 (TAGM). Radiological soil data were compared to industrial use Preliminary Remediation Guidelines (PRGs) for 50 years of institutional controls (PRGs-50 Years criteria). However, BNL is evaluating future-land use scenarios for the Site, including industrial use, with 100 years of institutional controls. Groundwater results were compared to NYSDEC criteria contained in *Ambient Water Quality Standards and Guidance Values*, June 1998.

SI activities performed throughout the HFBR complex included the collection of approximately 40 soil and groundwater samples as well as radiological walkover surveys covering approximately four acres. Based upon the results of the survey, 43 soil samples were collected, both initial and endpoint samples.

Of the 27 AOIs investigated, 23 have been eliminated as AOIs and four warrant additional action. These are discussed below by building and AOI designation.

Building 704-Fan House: The PA identified 17 AOIs relative to this building, six of which required investigation as part of this PA/SI. Two of the six, AOI 006 and AOI 007, require additional action.

- AOI 006—Two soil samples were collected in the basement of the building where evidence of leaks through floor seams and drain piping, from the above fan cells, was present. At one location (AOI 006-02) results for cesium-137 and strontium-90 were above their respective PRGs-50 Years. A sample collected from this location at a depth of 5 feet did meet the PRGs-50 Years criteria. Subsequent to sampling, a walkover survey of the basement was performed and no additional areas with elevated activity were present. Based upon this, limited soil removal will be performed with endpoint sample collection.
- AOI 007—The discharge point for a cable trench drain, located inside Building 704, was not identified. Several issues prevented access to the trench, such as: electrical hazards, asbestos, and lead sheathed and oil filled cables It was not possible to secure the trench within the time frame of this project. If it is determined that the drain discharges to soil, a sample will be collected.

Building 705-Stack: This structure was formerly associated with the BGRR. Four AOIs were identified during the PA and each warranted action. One AOI requires additional action.

- AOI 021—Groundwater sampling performed indicates that strontium-90 in excess of the NYSDEC's standard is present in the vicinity of the Stack. The highest level reported was 392 pCi/g. This issue will be evaluated further by the Environmental Management Directorate's (EMD) Groundwater Group.

Building 751-CNF: One AOI relative to a support structure for Building 751 was identified and warrants action.

- AOI 051—An inspection of the interior of this building revealed a puddle on the floor. The floor is asphalt and is cracked in areas. This building was used to store solvents, oils and activated parts. Based upon these observations, soil sampling will be performed.

Monitoring will continue under programs such as the Environmental Management's Sitewide Groundwater Monitoring Program and Environmental Services Division Compliance Monitoring Program. Should significant changes in groundwater concentrations or trends become evident, further evaluation would be necessary.

TABLE OF CONTENTS

HFBR & BOP STRUCTURES PA/SI REPORT

HFBR & BOP STRUCTURES PA/SI REPORT

TABLE OF CONTENTS

Located at Back of Report

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS

AOC	Area of Concern
AOI	Area of Interest
ARARS	Applicable or Relevant and Appropriate Requirements
BGRR	Brookhaven Graphite Research Reactor
BNL	Brookhaven National Laboratory
BOP	Balance of Plant (Structures)
BSA	Brookhaven Science Associates
CNF	Cold Neutron Facility
cpm	counts per minute
D2O	Heavy Water - Deuterium Oxide
DECON	Decontaminated Water
D&D	Decomission and Demolish
DOE	Department of Energy
DQO	Data Quality Objective
D-waste	Radiologically Contaminated Light Water
ELF	Equipment Level Floor
ERD	Environmental Restoration Division
EM	Environmental Management (Directorate)
EMD	Environmental Management Directorate (Formerly ERD)
ESD	Environmental Services Division
FR	Facility Review
FSAR	Final Safety & Analysis Report
GEL	General Engineering Labs (Analytical Laboratory)
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Filter
HFBR	High Flux Beam Reactor
HSR	Historical Site Review
ISOCS	In-Situ Object Counting System
LLRW	Low-Level Radioactive Waste
MCL	Maximum Contaminant Levels
MW	Megawatt
NCP	National Contingency Plan
NYS	New York State
NYSDEC	NYS Department of Environmental Conservation
OMS	Office of Management Services
OSHA	Occupational Safety and Health Administration Regulations
PA	Preliminary Assessment
PCS	Primary Cooling Water System
PE	Plant Engineering
PFS	Pile Fan Sump
PID	Photo-Ionization Detector
POC	Principal Organic Contaminants
PPE	Personal Protective Equipment
PS	Portable Structure
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RMMS	Reactor Maintenance Machine Shop
ROD	Record of Decision
RRSG	Residential Radionuclide Soil Guidelines
RRSG 0 Year	0-Years of Instiiutional Controls
RRSG 50 year	50-Years of Institutional Controls
RWP	Radiation Work Permit
SAP	Sampling and Analysis Plan
SBMS	Standard Based Management System
SCDHS	Suffolk County Department of Health Services
SCS	Secondary Cooling Water System
SDWA	Safe Drinking Water Act
SFP	Spent Fuel Pool
SI	Site Inspection
SPDES	State Pollution Discharge Elimination System
STP	BNL's on-site Sanitary Treatment Plant
SVOC	Semi-Volatile Organic Compound
TAGM	NYSDEC Technical & Administrative Guidance Memorandum, Recommended Soil Clean-up Objectives, HWR-94-4046
TCLP	Toxic Characteristic Leaching Procedure
TRP	Tritium Remediation Project
TSi	Tritium Source Identification
UIC	Underground Injection Control
UST	Underground storage tank
VOC	Volatile Organic Compound
WMP	Waste Management Plan
WP	Work Plan

1.0 INTRODUCTION

This Preliminary Assessment/Site Inspection (PA/SI) Report has been prepared to document the Site Inspection activities performed relative to the High Flux Beam Reactor (HFBR) and Balance of Plant (BOP) Structures at Brookhaven National Laboratory (BNL), Upton, New York. The Preliminary Assessment was documented in the *High Flux Beam Reactor and Balance of Plant Structures Preliminary Assessment/Site Inspection Work Plan* dated May 2001, revised August 2001 (Work Plan) and used to develop the Site Inspection activities. The scope of work for the Site Inspection was detailed in the project Sampling and Analysis Plan (SAP). Buildings and structures investigated as part of this project were:

- Building 704 Fan House
- Building 705 Stack
- Building 707 Cooling Towers and Basin
- Building 707A Pump House
- Building 707B Chemical Treatment Building
- Building 715 Stack Monitoring Facility
- Building 750 HFBR
- Building 751 Cold Neutron Facility
- Building 752 Secondary Water Hold-up Tank
- Building 753 Former Guard Booth/Radio Transmitter Post

P.W. Grosser Consulting, Inc. has prepared this report in association with the Reactor Division (RD) and Environmental Management Directorate (EMD).

1.1 BNL Site Description

BNL is located in Upton, Suffolk County, New York, near the geographic center of Long Island. Figure 1 shows BNL and its surrounding area. Although the principal population centers in this portion of Long Island are shoreline communities, residential development has occurred near BNL. Information contained in this section was obtained from the *BNL Site Baseline Report.*

The site, formerly Camp Upton, was occupied by the U.S. Army during World Wars I and II. Between the wars, it was operated by the Civilian Conservation Corp. The site was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to the DOE in 1977.

The BNL property is roughly square, approximately three miles on each side, comprising an area of 5,265 acres. The developed region includes the principal BNL facilities, which are located near the center of the site on relatively high ground. These facilities occupy approximately 900 acres, of which 500 acres were originally developed for Army use. Outlying facilities include an apartment area, biology field, hazardous-waste-management facility, sewage-treatment plant, fire breaks, and a former landfill area.

1.2 Project Description

A Preliminary Assessment (PA) was performed to determine if the HFBR & BOP activities have the potential to impact surface or subsurface soils, and ultimately groundwater. The PA phase consisted of a review of historical records as well as previous environmental data to develop a scope of work to investigate areas with the potential for soil contamination. Based upon the potential for environmental impact, Areas of Interest (AOIs) were identified and a scope of work developed to investigate these areas as part of the Site Inspection phase of the project. To assess environmental impact, radiological surveys as well as soil and groundwater sampling were performed. The purpose of the Site Inspection was to eliminate the AOI as a potential concern or identify additional actions.

2.0 HFBR HISTORICAL BACKGROUND

A brief history of the HFBR and BOP structures are provided here and details on the building layout, routine historical operations, and reactor support systems are provided in the project Work Plan. A site plan of the HFBR facility and associated BOP structures is contained on Figure 2.

The HFBR was constructed in close proximity to the Brookhaven Graphite Research Reactor (BGRR) so that some structures such as: Building 707A Pump House, Cooling Towers, Building 704 Fan House, and Building 705 Stack could be shared.

The final shutdown of the HFBR occurred in December 1996. The facility underwent stabilization, and Decontamination and Decommissioning (D&D) studies are in progress. Many systems have been drained, experimental equipment removed and building characterization completed.

2.1 Building 750 HFBR Overview

The High Flux Beam Reactor was a heavy water moderated, reflected, and cooled, thermal-neutron reactor, which was used for research for physics, biology, and chemistry disciplines. The HFBR was constructed for basic experimental research, particularly that performed with neutron beams. Nine external beam ports (H-1 through H-9) were provided for research and seven irradiation facilities (thimbles) were available for exposure of small samples to either fast or thermal neutrons. The HFBR achieved criticality in October 1965, and operated at nominal power of 40 megawatts (MW). The Reactor was upgraded and began operating at 60 MW in 1982 until 1990 when operating power was reduced to 30 MW. The HFBR confinement structure is Building 750 which is constructed as a welded steel hemispheric dome consisting of four basic levels: equipment (lowest); experimental; balcony; and operations.

The reactor vessel was supported by several coolant systems that are summarized below with their respective capacities.

Primary (D_2O)	6,000 gallons
Experimental (D_2O)	500 gallons
Thermal Shield (H_2O)	1,300 gallons
Biological Shield (H_2O)	~ 350 gallons
Secondary (H_2O)	226,000 gallons

These systems are located on or above the Equipment Level floor. Except for the secondary coolant system (SCS), treatment of primary coolant water systems was performed inside the confinement structure. The secondary coolant system removed heat from the other four water systems through heat exchangers located on the Equipment level. The secondary coolant system

was non-contact and went to the Cooling Tower Basin, Building 707. Treatment for the secondary water was performed adjacent to the Cooling Towers in Building 707B. After installation of the FA-310 Tank (Building 752), secondary water was temporarily stored pending sample results, then discharged to the storm water system. Support systems to the HFBR that exit the confinement structure are:

- Sanitary System
- Secondary Coolant System
- D-Waste
- Air Exhaust (via filter room and stack)
- Air conditioning cooling water

The building's sanitary waste is discharged to BNL's on-site Sewage Treatment Plant (STP). The air exhaust for the confinement structure is processed through the Exhaust Air By-pass Filter Facility (EABFF) that is below grade connected to Building 704. Air exhaust leaving the filter facility is released to the atmosphere via the stack, Building 705. The ambient temperature inside Building 750 is maintained by two air conditioning units where water is cooled by the air-conditioning cooling tower located on the west side of the building, shown in Figure 2.

2.2 Building 704

Building 704 was originally the BGRR Fan House that was constructed in 1950. The BGRR reactor was air-cooled and ambient air was pulled through the pile by one or more fans that were located inside Building 704. The building housed the five primary fans and a secondary fan used to cool the BGRR exhaust duct. These fans discharged into the below grade exhaust duct directly below the fan compartments, which is still intact and runs under and along the northern portion of the building in the basement. Currently the building is a radiological controlled area that houses the electrical switchgear supplying Buildings 701/703 and 750 with both ac and dc power.

Access to the EABFF on the upstream side is from within Building 704. Figure 3 illustrates the location of the facility.

2.3 Building 705 - Stack

Building 705, the Stack, was originally built to exhaust reactor cooling air from the BGRR. Exhaust air from the HFBR flows through the EABFF and enters the Stack on the west side. The Stack is currently in service for Building 801 exhaust. A by-pass valve located in a pit on the south side of the stack allowed exhaust air to by-pass the filter facility and vent directly out of the Stack when the reactor was in shut down mode.

The Stack was constructed with a line to drain water that accumulated in the base and a low point trough in the air exhaust line. This water historically drained to the Pile Fan Sump (PFS). In 1999, when the PFS was removed, water was re-routed to a temporary holding tank inside Building 704.

2.4 Cooling Towers & Buildings 707A/B

The Cooling Towers, Building 707 and the Pump House, Building 707A, were constructed for Heating Ventilation and Air-Conditioning (HVAC) for Building 701/703 to ambient cool air. To increase capacity for the HFBR secondary coolant system (SCS), a sump and two pumps were added to the north end of the Cooling Tower basin.

The SCS held 266,000 gallons of which, the largest volume was held by the cooling tower basin. The tower super structure has been removed, but the basin remains in place.

Building 707A, the Pump House, contains pumps, switchgear, controls and monitoring equipment to provide secondary water flow. The Pump House contains a sump fed from the Cooling Tower basin.

Building 707B, the Water Treatment Building, was constructed to chemically treat the SCS inventory to minimize corrosion deposition and microbiological growth. Sulfuric acid and Betz chemicals were added routinely and these chemicals were stored in diked, above ground storage tanks outside the building. Prior to the installation of these tanks, chemicals were stored inside the building in day tanks and in Building 704.

2.5 Building 715 - Stack Monitoring Facility

This building houses instrumentation used to monitor the activity level of air released from the Stack, on the downside of the EABFF. A small volume of air is drawn into the instrumentation and the unused portion of the air is vented back to the stack. The instrumentation contains sealed radioactive sources for calibration, which were kept inside the building, and have been removed. This building does not contain sinks, bathrooms or drains.

2.6 Building 751 - Cold Neutron Facility

Building 751 of the Cold Neutron Facility (CNF) housed a cryogenic helium system used to liquefy hydrogen for the cold neutron moderator located on the Experimental level inside the HFBR (at Beam H9). This facility was constructed to further moderate the neutron beam for experimental purposes. The building was constructed in 1980 with a bathroom facility and floor drains that went to the on-site Sewage Treatment Plant (STP). Other structures that were associated with the CNF were: Trailer 129 Office space; TR512 Chemical Storage Trailer; TR549 Equipment/Material Storage; TR737 Emergency Equipment Storage Shed, liquid nitrogen tanks and helium tanks. Prior to use, PS512 chemicals were stored in Building 751 then in PS549. PS549 is a wood structure with a concrete floor.

2.7 Building 752 - FA 310 Hold-Up Tank

The Hold-Up Tank was installed in 1978 on the northeast side of the HFBR. After installation, the tank held normal overflow and blow-down for the SCS, which ultimately discharged to the HO basin. Secondary water to be discharged would pass through the FA-310 tank and held for 30 minutes so that tritium levels could be monitored. As part of the Stabilization Project, this tank was removed in November 2000. Oil-contaminated soils under the tank were also removed at this time. Endpoint sample results were submitted to the regulatory agencies and no further action was warranted.

2.8 Building 753 - Former Guard Booth

Building 753 is a small structure with no bathrooms sinks or drains and was used for Reactor Security. Reactor Security was moved inside the Building in 1987. This building is currently a radio transmitter room. Prior to moving the guard booth into Building 750 in 1987, access was

controlled by a fence and gate on the north side of Building 753. Personnel exiting the facility then would have to pass through the gate.

3.0 GEOLOGIC SETTING

The following description of the hydrogeologic framework gives an overview of portions of the aquifer system beneath BNL and has been excerpted from *1999 Sitewide Groundwater Monitoring Report* prepared by BNL's Environmental Restoration Division (ERD). More detailed descriptions of the hydrogeologic setting (including lithology and aquifer geometry) underlying BNL and surrounding areas can be found in previous reports generated as part of the Remedial Investigation/Feasibility Study process and other investigative programs including the *BNL Site Baseline Report.*

The hydrogeology underlying BNL consists of approximately 1,300 ft of unconsolidated deposits overlying bedrock. Of these unconsolidated deposits, environmental investigation work performed at BNL generally focuses on the Upper Pleistocene deposits, the Gardiners Clay, and the upper portions of the Matawan Group-Magothy Formation.

The Upper Pleistocene deposits, generally ranging from 100 to 200 ft thick, have been divided into two primary hydrogeologic units that comprise the Upper Glacial aquifer: undifferentiated sand and gravel outwash and moraine deposits; and, the finer-grained, more poorly sorted stratigraphic Unidentified Unit which is discussed in the report by Wallace deLaguna *Geology of Brookhaven National Laboratory and Vicinity, Suffolk County New York*, 1963. The Unidentified Unit is typically encountered within the lower portion of the Upper Glacial aquifer beneath various areas of the site and generally consists of fine- to medium-white to greenish sand with interstitial clay. In addition to these two major hydrogeologic units, there are several other distinct hydrogeologic units within the Upper Glacial aquifer. They include localized, near-surface clay layers encountered in the upper portion of the Upper Glacial aquifer (near the Sewage Treatment Plant [STP]) and reworked Magothy deposits (a transitional interval between the Magothy- and Upper Glacial- aquifer generally located within the lower portion of the Upper Glacial aquifer). The Gardiners Clay is a regionally defined geologic unit that is discontinuous

beneath portions of BNL and areas to the south. Typically, it is characterized by variable amounts of massive green clay; silty, sandy, and gravelly green clay, and clayey silt. Where it exists, the Gardiners Clay acts as a confining or semi-confming unit that impedes the vertical flow and migration of contaminants between the Upper Glacial aquifer and the underlying Magothy aquifer. The HFBR and BOP PA/SI will focus primarily on the Upper Glacial aquifer and the unsaturated sand and gravel zone above it.

The Magothy aquifer is comprised of the continental deltaic deposits of the Cretaceous-Age Magothy Formation, which unconformably underlies the Upper Glacial aquifer and Gardiners Clay. The Magothy aquifer at BNL is approximately 800-ft thick and because it is composed of fine sand mixed and interbedded with silt and clay, it is inferred to be less permeable than the deposits making up the Upper Glacial aquifer. Massive grey-brown to yellow-brown clay layers exist at varying depths within the Magothy aquifer, reflecting its highly stratified character. Of particular importance underlying BNL, is a massive, locally continuous, grey-brown clay layer encountered within the upper portion of the Magothy aquifer (referred to herein as the Magothy Grey-Brown Clay). Regionally, the Magothy Grey-Brown Clay is not interpreted as being continuous; however, beneath BNL and adjacent off-site areas, the Magothy Grey-Brown Clay acts as a confining unit (where it exists), impeding the vertical flow and migration of contaminants between the Upper Glacial and Magothy aquifers.

Regional patterns of groundwater-flow near BNL are influenced by both natural and artificial factors. Under natural conditions, recharge to the regional aquifer system is derived solely from precipitation and enters the saturated groundwater system at the water table. A regional groundwater divide exists immediately to the north of BNL in the vicinity of Route 25. It is oriented roughly east-west, and is interpreted to coincide with the regional recharge area. Groundwater to the north of this divide flows to the north, ultimately discharging to the Long Island Sound. Regional groundwater in the vicinity of BNL generally flows south, ultimately to the Great South Bay and Atlantic Ocean, and towards major local surface-water bodies, such as the Peconic and Carmans rivers. Vertical groundwater flow is predominantly downward near of the recharge area, becoming essentially horizontal as groundwater moves towards regional discharge boundaries and ultimately upward toward the regional discharge boundaries (e.g.,

Carmans River and Great South Bay). Superimposed on the natural, regional groundwater flow-field are the effects of artificial influences such as pumping and recharging. Close to the pumping centers, the water-table is locally depressed; in the vicinity of recharging activities the water table is locally mounded.

Groundwater flow through the aquifer system underlying BNL, and ultimately the migration of contaminants within this groundwater-flow regime, in large part are controlled by the hydrogeologic framework and the natural and artificial factors described above. Groundwater flow direction in the vicinity of the HFBR and BOP structures is generally to the south-southeast. Depth to water varies from 40 to 80 feet below grade based upon location within the HFBR complex.

4.0 SITE INSPECTION GENERAL PROCEDURES

This section discusses general sampling techniques and procedures performed during the HFBR and BOP Structures Site Inspection (SI) activities. The PA findings used to develop the SI scope of work are contained in Table 1. Prior to performing environmental sampling, a radiological walkover survey was performed around specific facilities and is detailed in Section 5.0. Environmental sampling included the collection of soil and groundwater samples from various locations and depths throughout the HFBR Complex. Samples were collected both manually and using Geoprobe technology. Analyses performed were based upon available information for each AOI and were tailored to historical uses of the particular structure/facility.

In some cases adherence to general procedures were not practical, and in these instances deviations will be discussed in the respective sections with the respective AOI. Sample collection, storage, transportation to the laboratory and analyses, were conducted in accordance with the procedures and protocols recognized by DOE, BNL, EPA, NYSDEC, Suffolk County Department of Health Services (SCDHS) and the Department of Transportation (DOT).

4.1 Soil and Groundwater Sample Extraction

This project warranted collection of soil and groundwater samples. In most cases, Geoprobe technology was used for sample extraction. The Geoprobe is a truck-mounted hydraulic-driven hammer used to advance sampling equipment to the required depth.

Soil and groundwater sampling techniques are discussed in the following sections. Samples submitted to the analytical laboratory are contained in Table 2, along with the analyses performed.

4.1.1 Soil Sampling Procedures

Surface soil and shallow soil samples were collected manually using a hand auger or hand trowel sampling device. At locations where deeper sampling depths were required, soil samples were collected using a Geoprobe sampling device. Soil sampling was performed to various depths depending on the AOI being investigated and samples submitted for analyses are summarized on Table 2.

Surface soil samples were collected from grade to a depth of six inches. The only exception to this protocol was surface soil samples to be analyzed for polychlorinated biphenyls (PCBs), which were collected from grade to a two-inch depth.

Soil sampling from deeper depths was performed using a Geoprobe and either the four-foot long macro core sampler or the two-foot long large bore sampler. The sampler was fitted with an acetate liner to preserve sample integrity and prevent cross-contamination. The sample depth and site conditions determined whether the two-foot or four-foot sampling device was used. Soil samples submitted to the analytical laboratory for analysis were based upon the sampling objective for the AOI, field screening results and field observations.

Soil sample containers were filled in the following order: volatile organic compounds (VOCs), PCBs, metals and radiological, in the appropriate laboratory supplied containers. Prior to opening the sample liner, soils were screened initially, through the liner, for radiological activity using a Ludlum 3. The liner was then opened lengthwise and soils screened for VOCs using a Photo-Ionization Detector (PID). Soils were then screened directly for gross beta and gamma

activity using both the Ludlum 3 and 19 meters. Soils exhibiting the greatest response were homogenized and placed in the appropriate glassware. If a soil sample was to be analyzed for VOCs, these containers were filled prior to homogenization.

Based upon field observations, screening results and visual evidence of contamination, one worst-case sample per boring location was sent to the analytical laboratory. If no instrument responses or evidence of contamination were noted, the interval that was expected to be worst case was submitted for analyses.

4.1.2 Groundwater Sampling Procedures

Groundwater samples were collected at a few locations using a Geoprobe. Samples were collected at the water table and submitted for laboratory analyses. Analyses performed were AOI-specific and are summarized on Table 2.

The Geoprobe rods were driven to the appropriate depth and a four foot drop-out wire wrapped screen used. The screen remained sealed until the desired depth was achieved. Once at the desired depth, the driving rods were lifted four feet, exposing the screen to the water-bearing formation. Groundwater samples were collected using an oscillating pump and dedicated tubing equipped with a check valve.

Sample containers were filled in the following order: metals, PCBs and radiological. VOC containers were filled last by turning the pump off, removing the tubing from the rods and slowly pouring into the sample container. Groundwater samples were also field filtered using a 0.45 micron filter and archived on-site.

4.2 Laboratory Analyses

Soil and groundwater samples were submitted to General Engineering Laboratories, Inc., Charleston, South Carolina (GEL) for analysis. Samples were delivered via Federal Express overnight service. GEL is a participant in the NYSDEC Environmental Laboratory Approval Program.

Primarily soil and groundwater samples were analyzed for radiological parameters. Based upon location specific history, some samples were also analyzed for VOCs, PCBs, and total metals. The analytical methods and compound specific lists are summarized below.

Contaminant	Analytical Method	Parameter List
VOCs	EPA Method 8260	Suffolk County List
Total Metals	EPA Methods 6000/7000 series	Target Analyte List
PCBs	EPA Method 8081	Not applicable

The VOC analysis included a list for tentatively identified compounds. A few unknown compounds were reported with estimated concentrations. Since significant levels were not detected, they are not discussed further.

The identification numbers for each sample submitted to the analytical laboratory are contained in Table 2. Data are presented in tables at the back of this report and copies of data sheets will be maintained with the project files.

4.3 Quality Assurance/Quality Control

To assess the adequacy of the sample collection and decontamination procedures performed in the field as well as analytical laboratory procedures, quality assurance/quality control (QA/QC) samples were collected and analyzed. In addition, approximately 10 percent of the samples were submitted to a third party for data validation, which is discussed in Section 4.3.2. The types and frequencies of QA/QC samples collected are discussed in the following section.

QA/QC samples confirmed that the procedures performed in the field were consistent and acceptable. Reported detections in the trip and field blanks did not impact the interpretation of sample data. Third party data validation indicated adherence to procedures andlaboratory data were found suitable for their intended use. These issues are discussed in more detail in the following sections.

4.3.1 QA/QC Samples

QA/QC samples were collected and analyzed throughout the project. The types and frequencies of QA/QC samples collected are listed below.

Type	Frequency
Trip Blank	One per cooler (when VOC samples collected)
Field Blank*	One per week
Blind Duplicates	One per 20 samples per matrix
Matrix Spike/Matrix Spike Duplicate	One per 20 samples per matrix

* The field blank was also referred to as a rinsate blank for this project.

Table 3 summarizes the QA/QC samples collected and analyses performed.

During the project a total of eight trip blanks were submitted and analyzed. Trip blanks accompanied environmental samples whenever VOCs were collected. Three of the eight trip blanks reported no VOC detections. However, the reported detections did not impact the use of analytical data. Trip blank detections are summarized in the following table.

Trip Blank	Compound(s)	Concentration ppb	Matrix/Associated Samples	Comment
10802-005	Acetone	3.3 J	Soil/AOI 006-01 & AOI 006-02	Acetone also reported with blank contamination in sample.
10803-001	1,4 dichlorobenzene	0.17 JB	GW/AOI 012A-01 & AOI 025-01	This compound was not detected in the groundwater samples and is a suspected laboratory artifact.
10151-001	Unknown TIC	5.3 J	AOI 036-02	
10153-001	Methylene chloride	0.92 JB	AOI 046-02	Compound also reported with blank contamination in sample results.
10154-001	Methylene chloride	1.5 JB	AOI 047-01	Blank contamination in sample results.
	Trichlorethylene	0.25 J		Not detected in sample.
	1,4 dichlorobenzene	0.22J		Not detected in sample.

Notes:
J - estimated concentration
B – compound reported in blank sample TIC – Tentatively Identified Compound

A total of six field blanks were collected during the project. Collection of field blanks was performed by pouring distilled water over sampling equipment and collecting in the appropriate sample container(s). Non-dedicated sampling equipment such as the hand auger was decontaminated, then the field blank collected by pouring water over the sampler. Field blanks for dedicated sampling equipment such as acetate liners and polyethylene tubing for Geoprobe soil and groundwater sampling were also collected by pouring water through the device then using to collect the appropriate sample.

Field Blank ID	Compound(s)	Concentration ppb	Matrix/Associated Samples	Comment
10150-001	Benzene	0.65J	Soil/AOI 023-01	Hand Auger
	Toluene	0.65 J		
	Iron	7.1 B,		
	Magnesium	9.11 B,		
	Potassium	18.7 B		
	Sodium,	22.4 B		
	Zinc	10.2 B		
10147-013	Cesium-137	8.31 pCi/L	Soil/AOI 019-01	Geoprobe dedicated acetate liner
10803-003	Cesium-137	5.03 J	Groundwater/ AOI 025-01	Polyethylene tubing
	Gross beta,	1.42 J,		
	Acetone	8.0		
	Benzene	091 J,		
	Toluene	0.61 J,		
	Naphthalene	0.24 J		
10800-004	Europium-155	11.4 J-I,	Soil/AOI 041-01	Geoprobe dedicated acetate liner
10154-002	Uranium233/234	0.117 J,	Soil/AOI 047-01	Geoprobe dedicated acetate liner
	Iodine129	1.94 DL,		
	Methylene chloride	0.83 JB,		
	1,4dichlorobenzene	0.21 J,		
	Arsenic,	3.63 B		
	Barium	0.406 B,		
	Iron	10.5 B,		
	Magnesium	10.3 B,		
	Manganese,	0.382 B		
	Potassium,	20.0 B		
	Vanadium and	0.836 B		
	Zinc	11.1 B		

4.3.2 Data Validation

Data validation was performed on approximately 10 percent of the samples. Data were sent to two separate third party validators, which were chosen based upon experience with radiological and non-radiological analyses. The radiological data were sent to MJW Corporation,

Williamsville, New York and non-radiological data were sent to IT Corporation, Somerset, New Jersey. Copies of the validation narratives are contained in Appendix A.

Chemical Validation

Chemical results were found to be acceptable quality with the following exceptions to sample results for AOI 023-01:

- Methylene chloride was qualified as non-detect due to laboratory blank contamination;
- Recovery for antimony was below QC limits; and
- Recoveries for several metals (calcium, lead, magnesium, manganese, potassium, and zinc) were above QC limits.

In general, chemical results were found to be acceptable for their intended purposes. The detections did not impact data use or interpretation of sample data.

Radiological Validation

Radiological data were validated using BNL's Radiochemical Data Validation procedure EM-SOP-209. The results were found to be acceptable as submitted with the following notes:

- The detection limits for Fe-55, I-129, and Pu-241 could not be checked because BNL does not have required detection limits for theses analytes. Based on the analytical laboratory's required limits all are acceptable.
- Some isotopes were qualified as undetected due to either blank contamination or precision problems. Not all of the following isotopes were qualified in each sample: Plutonium-238; Europium-154; Manganese-54; Sodium-22; and Uranium-238.

In General, the radiological data were validated and approved for the intended use with qualification. The qualifiers were added to the data tables.

4.4 Data Evaluation Criteria

To determine if an AOI requires additional action, laboratory data were compared to specific criteria. Several sets of criteria were used in the evaluation process depending upon the sample's matrix and identified contaminants. If data exceeded the respective criteria, the result was flagged by bold lettering or shading in the data tables. Exceedances are discussed in the narrative of this report.

4.4.1 Criteria for Soils

Non-radiological soil sample results were compared to criteria contained in the NYSDEC Technical and Administrative Guidance Memorandum HWR94-4046, for *Determination of Soil Cleanup Objectives and Cleanup Levels*, February 3, 1995 (TAGM). These criteria are referred to as Objectives throughout the remainder of this report. The Objectives contained in the TAGM were established based upon EPA's Health Effects Assessment Summary Tables (HEASTs). If Objectives are less than background values, than the background value should be used as the objectives. Eastern background ranges for metals contained in the TAGM were included on the metals data table for comparison to analytical results. In addition data for storm drains, sanitary systems and encatchments were compared to action levels contained in the Suffolk County Department of Health's (SCDHS) Standard Operating Procedure for the Administration of Article 12 of the Suffolk County Sanitary Code, *SOP 9-95 – Pumpout and Soil Cleanup Criteria*, January 1999.

Radiological results were compared to industrial land use Preliminary Remediation Goals (PRGs) contained in the *Brookhaven National Laboratory Final Feasibility Study Report, Operable Unit I and Radiologically-Contaminated Soils*, prepared by CDM Federal Programs Corporation, March 1999, for 50 years of institutional controls. The 50 years institutional control criteria is commonly used for comparison of data at BNL. However, the BNL land use vision, from open space to industrial, and various time-options are under evaluation, including industrial land-use scenario with 100 years of institutional controls. For the purpose of this report data will be compared to the PRGs-50 Years criteria. Contained in Table 2A are BNL Site Background Levels.

4.4.2 Criteria for Groundwater

Groundwater results were compared to NYSDEC criteria contained in *Ambient Water Quality Standards and Guidance Values*, June 1998. These criteria will be referred to as standards.

5.0 RADIOLOGICAL WALKOVER SURVEY

A radiological walkover survey was conducted over three large areas around Building 704, 705 and 750, during the summer of 2001, to evaluate if past operations have impacted soils. Walkover surveys were performed based upon historical information and the potential for the spread of contamination. The surveys performed were to address AOIs identified during the preliminary assessment. A summary of the AOIs warranting a radiological walkover survey is provided below.

Building	AOI No.	Comment
704	012	Building 704 Survey, discussed in Section 5.2.1
707A	025	Sump not accessible for survey due to water in base, groundwater sampling performed downgradient of building, discussed in Section 6.3.2
705	020	Building 705 Survey, discussed in Section 5.2.2
715	031	Building 705 Survey, discussed in Section 5.2.2
750	044	Building 750 Survey, discussed in Section 5.2.3
751	051	Building 750 Survey, discussed in Section 5.2.3
753	053	Building 750 Survey, discussed in Section 5.2.3

The following section discusses the general procedure used when conducting the survey. Deviations from the procedures are discussed in the building results sections.

5.1 Survey Procedure

Prior to beginning the radiological walkover survey, the locations of known points of elevated activity, typically fixed contamination, were obtained from the Reactor Division Health Physics (RDHP) and noted. Previously identified points were not addressed under this PA/SI. Survey boundaries were set up around each facility taking into consideration topography, personnel traffic patterns, locations of spills, and orientation of utilities. Within each survey area, a grid with five-foot centers was established.

The survey was performed using a 2x2" sodium iodide (NaI) detector coupled with an Eberline E-600 ratemeter. Twine and/or painted grid points were used to establish grid lines. Locations exceeding 5,000 counts per minute (cpm) above background, were logged, flagged and labeled sequentially Gamma 1, Gamma 2, etc. To confirm detected activity and determine if postings were necessary, each point was further evaluated by RDHP using Ludlum 3 and 19 meters. Detections of 1,000 cpm or greater above background activity were also recorded.

5.1.1 Gamma Point Sampling Procedure

Locations exhibiting activity greater than 5,000 cpm were sampled. Typically, contamination was located within the top one inch of soil. If the contamination was not contained within the top one inch, soils were screened in one-inch lifts, and the worst-case interval was submitted for analysis. Soil above the initial sample was backfilled if meter readings were not greater than background. Locations in asphalt were sampled by cutting the asphalt using a Hilti TE-905 electric hammer. Soils with elevated activity were removed and disposed of in accordance with Environmental Management (EM) procedures. Sampling activities were conducted under a Radiological Work Permit (RWP).

Initial samples were submitted to the on-site Analytical Services Laboratory (ASL) for Gamma Spectroscopy analysis. Endpoint samples were submitted to GEL for Gamma Spectroscopy analysis and associated isotopes, as necessary, depending on location.

5.2 Radiological Walkover Survey Findings

The radiological walkover survey resulted in the identification of 21 locations with activity greater than 5,000 cpm above background over a total survey area of approximately 166,000 square feet. For each location identified, sampling was performed and 43 initial and endpoint samples were collected. A summary of the locations identified is as follows:

- 7 Gamma Points around Building 704 (Fan House),
- No locations were identified around Building 705 (Stack), and
- 14 Gamma Points around Building 750 (HFBR)

These results are discussed in detail in the following sections. Initial and endpoint sample results are presented in Tables 4 and 5, respectively.

5.2.1 Building 704 -AOI 012

The radiological walkover survey around Building 704 consisted of an area of approximately 25,000 square feet. This survey was performed as a result of the potential for contamination from spills and activities associated with the Fan House, which was formerly associated with the BGRR) and this issue was identified as AOI 012. The survey identified seven points (Gamma 15 through 21) with activity greater than 5,000 cpm above background. The locations identified were on the north and west sides of the building. The locations were in or below asphalt except for Gamma 17, which was in soil. Due to the location of Gamma 17, the survey was expanded to include the slope on the north side. A small section on the north-west side of the grid was not accessible for surveying due to slope instability. The survey area and locations are illustrated on Figure 3.

Both the initial sample and endpoint samples collected at Gamma 15 met PRGs-50 Years.

At Gamma locations 16, 19, 20, and 21, activity was equal to background during sampling activities, and therefore, only initial samples were collected. At these locations, a sample was collected at two to three inches below grade, which represents the interval with the highest activity. At Gamma 16, strontium-90 was detected at 42.4 pCi/g, which is is above the PRG-50 Years of 15 pCi/g. This sample was collected below the asphalt. Cesium-137 was reported at Gamma 19 at 24 pCi/g, which is below the PRG-50 Years of 67 pCi/g. Cesium-137 was also reported at Gamma 20 below the PRG-50 Years (67 pCi/g) with a level of 17.1 pCi/g. Sample results at Gamma 21 met PRGs-50 Years.

Survey results at Gamma 17 indicated an area of soil contamination, as opposed to the presence of an isolated particle. Approximately 1.5 cubic feet of contaminated soil was removed prior to collecting an endpoint sample. Soil was properly disposed in accordance with BNL's Waste Management Division procedures. Analytical results for the initial sample exceeded the PRG-50

Years for Cesium-137 (67 pCi/g) with a level of 104 pCi/g, the endpoint result met PRGs-50 Years.

The initial sample from Gamma 18 exceeded PRGs for:

Isotope Units pCi/g	PRG 50 Years	Result
Cesium-137	67	1,480
Plutonium-239/240	170	177
Strontium-90	15	1,670

The endpoint sample results were well below these levels. The isotopes detected and corresponding locations are consistent with historical BGRR activities.

In summary, endpoint results for samples collected around Building 704 indicate t levels are below PRGs-50 Years, with one exception. The strontium-90 result at Gamma 16 was slightly in excess of the PRG-50 Years for the initial sample,(only an initial sample was collected at this location) and was collected below asphalt.The survey and sample results for soils adjacent the pavement met PRGs-50 Years, as well as other soil results for samples collected below the pavement in this area. Based upon these results, no further action relative to the radiological walkover survey results.

5.2.2 Building 705-AOI 020

The radiological walkover survey area around Building 705, the Stack, was approximately 11,600 square feet (Figure 4). The survey was performed as a result of an area posted by RDHP as a soil contamination area and this issue was identified as AOI 020. Included in the survey area around the Stack was Building 715. Building 715 warranted a survey based upon records that indicated condensate was bottled inside the building, AOI 031. There were no points identified around the Stack or Building 715 with activity 5,000 cpm above background during the walkover survey. However, it should be noted that an unusually high background is present on the west side of the Stack where the plenum rises above grade, which may have prevented the identification of some points.

Four soil samples were collected around the Stack and results were below PRGs-50 Years criteria. These results are discussed in detail in Section 6.2 under AOI020.

Based upon the walkover survey and soil results, no further action is warranted.

5.2.3 Building 750-AOI 044

The radiological walkover survey was performed around Building 750 since records indicated past activities had resulted in contamination outside the facility, e.g. particles outside the Air Equipment Handling Room. AOI 044 was designated for outside issues relative to Building 750. Other areas included under the Building 750 survey were Buildings 751 and 753. Surveys were warranted in these areas as a result of storage of materials or traffic patterns associated with the HFBR and were identified as AOI 051 and AOI 053.

The total area covered under the Building 750 survey was approximately 130,000 square feet, which includes areas that were added as a result of high background or the identification of particles. One of the areas added was to the east as a result of a consistently high background and the survey was expanded approximately five feet beyond the eastern fence. The survey was expanded into the adjacent parking lot as a result of a loose particle that was found in sand on asphalt in the northwest corner of the survey area. A nearby catch basin that receives run-off from the north side of Building 750 was also surveyed.

Fourteen locations Gamma 1 through 14, were identified around the HFBR facility, refer to Figure 5. No new points were identified in the vicinity of Building 751. However, a few were located in close proximity to Building 753, which were likely the result of traffic flow past the guard booth on the north side of Building 750 as personnel exited the facility.

The 14 points were in soil except for Gamma 11 and 14. During further investigation the activity at Gamma 3, 11, and 14 was at or below action levels, and subsequently samples were not collected.

The initial samples collected indicate the presence of cobalt-60 above the PRG at seven Gamma locations: 1, 2, 5, 6, 8, 9, and 10. The endpoint results for these seven locations met PRGs-50 Years.

Walkover survey results at Gamma 7, 12 and 13 indicated a small area of soil contamination. After collection of initial samples, a small volume of soil was removed, and properly disposed in accordance with BNL's WMD procedures. After soil removal, endpoint samples were collected. Gamma 12 and 13 were spatially close and after soil removal, the locations merged and one endpoint sample was collected. The endpoint sample results from location 7 and 12/13 met PRG-50 Years.

Of the locations identified during the walkover survey, Gamma 9 was the highest activity, which was a result of a loose particle found in sand on top of asphalt. Since the particle was loose and removed, and no residual activity was detected, the collection of an endpoint sample (asphalt) was not performed. The presence of this loose particle resulted in the north parking lot and catch basin included as part of the survey area.

An initial sample was collected at the surface at Gamma 10; however, additional investigation (field screening) indicated that some residual contamination was fixed in the concrete foundation of the 90-day storage area. Activity was significantly less than original detections and further action was not performed due to the potential for compromising the integrity of the concrete. The RDHP collected an endpoint sample from adjacent the concrete pad, which met PRGs-50 Years. Based upon the walkover survey results, no further action is warranted. Since Gamma 10 could not be evaluated further the location was placarded as a reminder should changes to the 90-day storage area occur.

5.3 Radiological Walkover Survey Conclusions

A total area of 144,000 square feet was surveyed that was centered around three structures: Buildings 704, 705 and 750. The walkover survey resulted in locating individual radiological

particles, as well as small volumes of radiologically contaminated soil. When survey results indicated soil contamination, the soil was removed and disposed.

Endpoint results for samples collected around Building 704 indicate sample results were below PRGs-50 Years, with one exception. The sample collected at Gamma 16 was slightly in excess of the PRG-50 Years for strontium-90, this was an initial sample and the only one collected. This sample was collected below pavement and other samples collected in this vicinity met PRGs-50 Years.

Contamination was not identified during the walkover around the Stack. Since no points were identified, samples were not collected during the walkover survey. Surface soil samples were collected to satisfy specific issues and are discussed in Section 6.2. It should be noted that an area around the Stack did have a high background and may have prevented identifying contamination above the 5,000 cpm and below the stack background. The area is currently posted as a controlled area and will be evaluated as part of RDHP controls to de-post the area, when the background level drops.

Endpoint samples collected around the Building 750 met PRG-50 Years. Based upon endpoint data, no further action is necessary in the vicinity of Building 750, with the exception of Gamma 10. Gamma 10 could not be completely retrieved and is in the concrete for the 90-day storage area. RDHP placarded the location to remind personnel, should changes to the area occur area this can be evaluated further, and appropriate action taken. Sample results for soils collected adjacent to the pad indicate levels met PRGs-50 Years. It is possible that the contamination is fixed.

Based upon the radiological walkover survey results, no further action is warranted relative to surface soil in the three survey areas around Buildings 704, 705 and 750.

6.0 AREAS OF INTEREST - SITE INSPECTION FINDINGS

This section summarizes the findings of the Site Inspection activities for each Area of Interest (AOI) identified during the Preliminary Assessment (PA) for the HFBR & BOP structures. A total of 53 AOIs were identified during the PA phase and are summarized on Table 1. Site Inspection (SI) activities included: inspections, radiological walkover surveys (discussed in the previous section) and soil and groundwater sampling. If an AOI did not warrant action under the SI, information can be found in the Work Plan.

The primary focus of this investigation was to identify soil contamination. Soil samples were analyzed for a variety of contaminants such as: radiological, VOCs, PCBs and metals. These data are summarized on Tables 6, 7, 8 and 9. If access to desired soil sampling locations was not possible due to existing structures, groundwater sampling was performed down gradient, with respect to groundwater flow direction, of the AOI. Groundwater samples were submitted for radiological and VOC analyses (Tables 10 and 11).

The findings of the Site Inspection activities are summarized in the following sections by building, then AOI number.

6.1 Building 704

AOI numbers that pertain to Building 704 are AOI 001 through AOI 017, of which six warranted action as part of this PA/SI. This building was one of four that were investigated under this PA/SI that was originally constructed for the BGRR. Only portions of Building 704 are included in the HFBR scope of work and some AOIs identified did not warrant action since the issue is included under the BGRR decommissioning scope of work.

AOI 002 – Building 704 Below Grade Exhaust Duct in Basement

Due to suspected contamination in the basement of Building 704, sampling was performed. Soil samples were collected from two locations adjacent to the exhaust duct that crosses through the basement of Building 704. The basement has a soil floor, which consists of loose sands with

cobble. The first sampling location, AOI 002-01, was collected outside the access hatch to the duct and the second location, AOI 002-02, was collected under the duct as it enters the building on the west end. These samples were analyzed for the BGRR list of isotopes. Data are summarized on Table 6.

Detections were low and included both naturally occurring isotopes as well as those associated with BGRR activities. Results for both samples met PRGs-50 Years.

Based upon the sample results, no further action is warranted relative to the soil in the vicinity of the below grade exhaust duct and this issue will be eliminated as a potential AOI. Refer to AOI 006 for additional soil sample results for the basement of Building 704.

AOI 006—Soil In Basement Under Fan Cell Floor Drains & Floor Seams

Sampling in the basement of Building 704 was performed at two locations in areas where evidence of leaks through floor seams and drain piping, from the above fan cells, was present. The basement, due to limited access and egress, is considered a confined space. In addition, work was performed under a RWP due to high background, which required wearing tyvek suits and full-face respirators due to the potential for airborne contamination from dusty conditions.

A survey of areas below floor seams and drain piping was performed using the Ludlum 3 meter to determine the areas with the highest activity. Two small areas approximately one-foot square were identified and soil samples were collected. Sampling was performed to a depth of 1.5 feet at both locations in six-inch intervals. Sampling to deeper depths was not possible due to the dry conditions of the soil, which prevented sampling extraction with standard sampling equipment. The soil samples were containerized and moved to the east end of the basement where background activity was lowest. Screening results indicated the worst-case sample was a zero to six-inch depth and these samples were submitted for radiological analysis, BGRR list (AOI 006-01 and AOI 006-02). Refer to Figure 3 for sample locations.

Results from AOI 006-01 indicate that activity levels present met PRGs-50 Years. Results from sample location AOI 006-02 indicate that contamination in excess of PRGs-50 Years is present. Cesium-137 is present in excess of the PRG-50 Years of 67 pCi/g with a level of 217 pCi/g. Strontium-90 was also detected above the PRG-50 Years of 15 pCi/g, with a level of 33.1 pCi/g. Contamination at this location was likely the result of water leaking through the floor seams from the fan cell above. The isotopes detected were associated with BGRR and likely the result of historical work practices.

Based upon the sample results for location AOI 006-02, a radiological walkover survey was performed in the basement to identify other potential locations with elevated activity. The survey was performed following the procedures discussed in Section 5.0. The survey indicated that the two previously identified areas were the only areas above background. Sampling was then performed to five feet adjacent to the previously sampled locations. At both AOI 006-01 and AOI 006-02 locations the 4.5 to 5.0 foot interval was collected and submitted for analysis.

Sampling was conducted using a four-foot macro-core sampler (Geoprobe sampling equipment) that was manually advanced to five feet. Prior to using the sampler, a hole was opened to one foot. Screening results indicated activity was present greater than background in the shallow interval, zero to six inches.

Results for the 4.5 to 5.0 foot samples met PRGs-50 Years. At location AOI 006-02 cesium-137 was detected at 7.8 pCi/g, which is below the respective PRG-50 Years of 67 pCi/g. Based upon these results, limited soil removal will be performed in the vicinity of AOI 006-02, with endpoint sample collection.

AOI 007—Cable/Electrical Trench Drain

A cable/electrical trench inside Building 704 has a drain with an unknown discharge point. A records search was performed and a cross-section drawing was located, which indicated that the drain discharges to a drywell. Copies of the relative portion of drawing numbers A-704-1A, C704-3A, and M704-18A are contained in Appendix B. However, a plan view drawing indicating the horizontal location of the drywell relative to the building is not available.

The cable trench is approximately 2 feet wide by 3.5 feet deep and contains wires both cut (hanging loose) and intact. Due to access limitations, entry into the trench was not possible. In addition, during inspection of the trench, it was noted that many cables are lead sheathed and are oil filled. As many cables date to the late 1940s and early 1950s, it is suspected that the oil contains PCBs. Also noted was that the composition of the cable tray material is asbestos.

To determine where the drain discharges, tracing the line with a locating device is necessary. Due to the electrical wires and cables, as well as the inability to shut-off the power, entry into the trench could not be performed.

Several issues have to be addressed prior to obtaining access to the drain in the base of the trench. The drain will be traced to determine the discharge location and sampling performed if the drain discharges to soil. This sample will be analyzed for radiological parameters (HFBR and BGRR list), PCBs and total metals.

AOI 011—Two Transformers on the south side of Building 704

One surface soil sample (0 to 2 inches) was collected adjacent to the transformer pad. Sampling was performed due to the age of Building 704 and the potential for PCB contamination relative to the transformers. An inspection of the area around the transformers was performed to identify staining by moving the gravel base away from the pad. Minor staining was observed and a soil sample was collected southwest of the eastern transformer. The soil sample was submitted for PCB analysis.

Aroclor 1260 was detected at 12.6 ug/Kg in soil sample AOI 011-001. This is well below the TAGM cleanup objective of 1,000 ug/Kg. Based upon this result no further action is warranted relative to the Building 704 transformers, 704.trans.1 and 704.trans.2, and this issue will be eliminated as an AOI.

AOI 012—Contamination from Surface Spills/Maintenance Activities

Due to the historical use of the building, surface spills and maintenance activities performed, a radiological walkover survey was performed around Building 704 (Facility Review Issue No. 410). Seven points with activity greater than 5,000 cpm were identified during the survey. The survey and results are discussed in detail in Section 5.2.1.

In addition to the radiological walkover survey, a groundwater sample location, AOI 012A–01, was positioned down-gradient of Building 704. This sample was submitted for VOC and radiological analyses (BGRR list). Acetone was reported with a low, estimated concentration of 4.4 ug/L and the NYSDEC standard is 50 ug/L. Radiological results also met PRGs. Reported results include: gross alpha at 8.77 pCi/L; gross beta at 19.2 pCi/L and strontium-90 at 3.87 pCi/L.

Based upon the groundwater sample results, no additional groundwater sampling is warranted in this area. No further action is warranted relative to this AOI and closure of Facility Review Issue No. 410 will be performed.

AOI 017—Ventilation Valve Pit at Entrance to EABFF

The ventilation valve pit at the entrance to the EABFF was inspected by RDHP to verify the integrity and confirm that no drains are present. Access to this pit is through a manhole located inside Building 704. The pit appeared in good condition with a concrete bottom and no drains. Two pipes were cut and capped flush to the west wall of the pit. Near the two cut pipes on the wall was evidence of a watermark that ran approximately one foot down the wall. There was no evidence of water staining on the floor. No sampling was recommended and no further action is warranted. The ventilation valve pit will be eliminated as an AOI.

6.2 Building 705

A total of four AOIs (AOI 019 through AOI 021) were identified relative to Building 705, the Stack, and each warranted action as part of this PA/SI. The Stack was one of four structures that were investigated under this PA/SI that was originally constructed for the BGRR.

Figure 4 illustrates the sample locations around the Stack. Soil and groundwater sampling was performed at specific locations around the stack.

Prior to initiating Geoprobe activities, RDHP collected four soil samples from three locations around the Stack. The locations were: AOI 018-01, AOI 021-03 and AOI 021-04. At location AOI 018-01, soil samples were collected from two depths, 1 foot and 3 feet, and at locations AOI 021-03 and AOI 021-04 from 0 to 2 inches. This information was used to evaluate soil conditions around the Stack and determine health and safety requirements. Based upon the results, no postings or additional health and safety requirements were warranted. Data for these four samples are contained in Table 5A and discussed under each AOI as appropriate.

AOI 018—Exhaust Duct from Building 704 to Stack

One soil boring was performed on the south side of and adjacent to the plenum between Building 704 and the Stack. This location was also positioned at the point where the plenum bends approximately 30 degrees and rises up through the ground to the Stack. A groundwater sample was to be collected at this location. However, since additional groundwater samples were added immediately down-gradient of this point it was not performed.

Soil sampling was performed from grade to 16 feet continuously and in five-foot intervals to 42 feet below grade. Field screening did not indicate evidence of contamination, so the sample immediately below the plenum (16 to 20 feet) was submitted for analysis. A four-foot interval was submitted due to poor recovery. The sample was submitted for radiological analysis (HFBR and BGRR list of isotopes).

Isotopes were reported with low, estimated activities, and include: cesium-137 (0.02 pCi/g), cobalt-57 (0.0066 pCi/g), europium-155 (0.0258 pCi/g), manganese-54 (0.007 pCi/g), thorium 228/230/232 (0.36 / 0.263 / 0.349 pCi/g), uranium 233/234/238 (0.291 / 0.246 / 0.284 pCi/g). The activities reported are well below PRGs-50 Years.

Based upon these results it does not appear that the exhaust duct has impacted soils in the vicinity of the Stack. The exhaust duct will be eliminated as an AOI. The sampling performed also addressed Facility Review Issue No. 2797.

AOI 019—Stack Drain Line

The stack drain line was excavated for a maintenance repair in April 2001. The maintenance is due to a small volume of rainwater recovered from the stack drain line after a heavy rain event in March 2001. The volume recovered was significantly less than expected, and it was suspected that the line was leaking. The stack drain line gravity feeds into a tank in the basement of Building 704, Figure 4 illustrates the location of the line. Prior to excavating, the line inside Building 704 was disconnected from the tank and a tee installed to perform a pressure test. The line was filled with water to approximately a 30-inch head. Water loss was observed and the line was excavated.

A break in the line at a cleanout, which was located just outside Building 704 to the east, was found. The cleanout section of pipe was removed and a new pipe installed. The line was tested again and visual inspection identified two leaking joints. The joints were repaired. The pipe was tested again and passed.

The pressure test is performed semiannually for early detection of leaks until the line is replaced by a connection from the Stack to Building 801. The line between the Stack and Building 704 was installed when the PFS was removed from service.

Soil samples were collected from the open excavation at three locations, AOI 019 SB-1 through SB-3. At one location, AOI 019 SB-1, a sample was collected under the line where the break was found closest to Building 704; at AOI 019 SB-2, a sample was collected at a leaking joint; and at AOI 019 SB-3, a sample was collected from an open excavation between the stack and Building 715. This area was previously excavated as part of the stack drain line upgrade to connect to Building 801. This area is posted as a soil contamination area. These three samples were submitted for radiological analysis, BGRR and HFBR list of isotopes.

Analytical results indicate the presence of isotopes with low, estimated activity in each of the samples, at levels below PRGs-50 Years.

In addition to the three samples collected from the open excavation, one soil boring was performed adjacent to the stack drain line, at the low point trough near the standpipe. This was performed to address potential leaks. Soil samples were collected continuously to 16 feet below grade, then every five feet to 42 feet below grade. Screening results did not indicate evidence of contamination and the interval below the line was submitted for laboratory analysis.

At AOI 019-01, a sample was collected at four to six feet below grade immediately below the line and analyzed for the HFBR and BGRR list of isotopes. Plutonium-239/240 was reported at 0.109 pCi/g, which is well below the PRG-50 Years of 40 pCi/g. It is likely that this is not a real detection since the activity was at the instrument detection limit and the reported error was 0.127 pCi/g, which is greater than the detection. Other isotopes were reported with low, estimated activities and are also below their respective PRGs-50 Years.

The results for the samples collected below the stack drain line and adjacent to the low-point trough, indicate that a significant release has not occurred in these areas. Based upon this, no further action is warranted and the stack drain line will be eliminated as an AOI. The sampling satisfied Facility Review Issue Nos. 398, 825, 3546, and Suffolk County No. 583.

AOI 020—Area with Soil Contamination

A posted soil contamination area is present at the base of the stack, with an approximate size of 16 feet square. As part of this PA/SI, a radiological walkover survey was performed around the stack to identify other potential soil contamination areas. Two shallow soil samples were collected from the posted area and two samples were collected from location AOI 018.

The survey was performed over the soil area at the base of the stack in accordance with the procedures contained in Section 5.1, and details relative to the Stack are contained in Section 5.2.2. The radiological walkover survey area around Building 705 was approximately 11,600 square feet (Figure 4). There were no points identified around the stack with activity above

5,000 cpm during the walkover survey. However, it should be noted that an unusually high background is present on the west side of the Stack, which may have prevented the identification of small, isolated, contaminated points/areas.

The two soil samples collected from the posted area were analyzed for radiological isotopes, BGRR list. Uranium-238 was detected at 1.11 pCi/g, which is well below the PRG-50 Years. Other isotopes were also reported with low, estimated results, which are all below their respective PRGs-50 Years.

Soil samples were collected from location AOI 018 at one-foot and three feet below grade. This sampling was performed by RDHP to evaluate soil conditions in this area, prior to sampling, since background activity was elevated. These samples were submitted to ASL for gamma spectroscopy analysis. Results indicate levels are well below PRGs-50 Years.

The soil samples collected from the posted soil contamination area, indicate that shallow soil contamination does not exist around the stack. Based upon this no further action is necessary relative to surface soils around the Stack and this AOI will be eliminated as a potential concern.

AOI 021—Standing Water in Base of Stack

Since the original construction of the Stack allowed standing water to accumulate, it is possible that soils beneath the structure are impacted. Based upon this and the fact that sampling of the soils beneath the Stack could not be performed, groundwater sampling was conducted down-gradient and side-gradient of the Stack. Figure 4 illustrates the four sample locations AOI 021-01 through AOI 021-04.

One location AOI 021-01 was positioned due east of the Stack. This location was chosen based upon historical fluctuations in groundwater flow direction in this area. This was discussed in Section 4.2.1 of the Work Plan and maps illustrating flow were provided in that document in Appendix D.

Prior to sampling, RDHP evaluated soil conditions by collecting soil samples from 0 to two inch depth at AOI 021-03 and AOI 021-04. These samples were submitted to ASL for gamma spectroscopy analysis. Results indicate levels are well below PRGs-50 Years.

Groundwater samples were collected at the water table. Samples were submitted for radiological analysis: gross alpha, gross beta, strontium-90 and gamma spectroscopy. Sample depths and results are presented in Table 10.

Except for strontium–90, radiological results were well below NYSDEC standards. Strontium-90 is an isotope associated with the BGRR. Strontium-90 was detected at three of the four locations in excess of the NYSDEC standard. The locations are AOI 021-02, AOI 020-03 and AOI 021-04 with levels of 11 pCi/L, 392 pCi/L, and 75.5 pCi/L, respectively.

A strontium-90 plume exists and is emanating from the area north of the Stack. Based upon the groundwater sample results, additional action is warranted to evaluate groundwater in the vicinity of the Stack and determine if it is a contributing source of groundwater contamination. Additional characterization work will be performed by EM's Groundwater Group.

6.3 Cooling Towers & Buildings 707A/B

A total of nine AOIs were identified relative to the Cooling Towers and Building 707A/B. Three are related to the Cooling Towers (Building 707), two related to Building 707A, and four related to Building 707B. These structures are illustrated on Figure 6.

The Cooling Towers and Building 707A were originally constructed to support BGRR activities.

6.3.1 Building 707 (Cooling Towers)

The three AOIs identified relative to Building 707 were AOI 022 through AOI 024, and only AOI 023 warranted action.

AOI 022—Cooling Tower Basin

The basin, which held approximately 266,000 gallons of water, had an estimated leak rate of 10 gallons per hour. Soil sampling to be performed to investigate the basin was conducted under the Stabilization project. Results of the sampling indicated no further action was warranted and were documented in the *Investigation of HFBR Cooling Tower Sub-soils*, August 2001, prepared by BNL's Environmental Services Division (ESD).

AOI 023—Valve Pit with Soil Bottom

The secondary water valve pit contained an open soil bottom from which a zero to six inch surface soil sample was collected. The sample was analyzed for VOCs, total metals and radiological (HFBR/BGRR list of isotopes).

The VOC analysis reported 1, 4 dichlorobenzene at an estimated concentration of 0.51 ug/Kg, which is well below the TAGM objective of 1,800 ug/Kg. Radiological results were also reported at low, estimated levels, which are well below the PRGs-50 Years. The metals analysis reported iron at 27,800 mg/Kg, nickel at 18.9 mg/Kg, and zinc at 46.1 mg/Kg, and these concentrations are in excess of their respective TAGM objectives. The concentrations for these metals were compared to Eastern USA background levels and found to fall within the given ranges of 2000 mg/Kg to 550,000 mg/Kg for iron, 0.5 mg/Kg to 25 mg/Kg for nickel and 9 mg/Kg to 50 mg/Kg for zinc.

Metals typically adhere to sediments and are not very mobile in the subsurface. In addition, the valve pit is covered and the water system has been drained and is no longer in use, minimizing the potential spread of contamination. Based upon this and the metal concentrations present, no further action is warranted relative to the valve pit and this AOI will be eliminated.

AOI 024—Northern Sump

The northern sump was subjected to the same water as the cooling tower basin. A groundwater sample was also collected down-gradient of this area and is discussed in the following section, under AOI 025. Based upon the results of the cooling tower basin samples and the groundwater sample, no further action is warranted for the northern sump.

6.3.2 Building 707A

AOI 025 and AOI 026 were identified relative to Building 707A and both warranted action.

AOI 025—Pump House Sump

As part of this PA/SI, the pump house sump was to be inspected and a radiological survey performed. However, due to the presence of water in the base of the sump, the survey could not be performed. Since the inspection and survey could not be performed, groundwater sampling downgradient of the building to the south-southeast was conducted. The sample was submitted for VOCs and radiological analysis.

Acetone was the only VOC reported with a low, estimated concentration at 1.5 ug/L, which is well below the standard of 50 ug/L. The radiological analysis indicated gross beta was the only detection at 4.99 pCi/L, which is well below the NYSDEC standard of 1,000 pCi/L.

Based upon the groundwater results, it is not suspected that the Pump House Sump is a contributing source of groundwater contamination and no further action is necessary. This issue will be eliminated as an AOI.

AOI 026—Transformer South of Building 707A

One surface soil sample was collected adjacent to the transformer pad and submitted for PCB analysis. Prior to sample collection the pad was inspected. The gravel base surrounding the pad was temporarily removed and the sides of the pad and soil inspected. An area that was slightly stained was observed and a soil sample, AOI 026-01, was collected from 0 to 2 inches. The sample was submitted for PCB analysis.

Results reported PCB congener Aroclor 1260 at 273 ug/Kg (0.273 ppm), which is below the TAGM objective of 1,000 ug/Kg (1 ppm). The analytical laboratory performed a metals analysis in error. The results reported iron and zinc at concentrations in excess of the TAGM objectives with concentrations of 4,340 mg/Kg and 22.7 mg/Kg respectively. The TAGM objectives for iron and zinc are 2,000 mg/Kg and 20 mg/Kg respectively. The Eastern USA

background range for iron is 2,000 to 550,000 mg/Kg and zinc is 9 to 50 mg/Kg. The reported concentrations for these metals fall within this range.

Based upon these results, no further action is warranted relative to the Building 707A transformers and this issue will be eliminated as an AOI. The sampling also satisfied the Historical Site Review (HSR) issue AOI No. 3058.

6.3.3 Building 707B

Four AOIs were identified and two warranted action as part of this PA/SI. Figure 6 illustrates the location of Building 707B.

AOI 027—Pipe Pit in Building

A pipe pit is present in the south-west corner of Building 707B and has a soil bottom. This building is currently not in use. A metal plate covers the pit. A soil sample was collected from the base of the pit from 0 to 6 inches, refer to Figure 6 for location. The sample was analyzed for VOCs, total metals and radiological parameters.

Methylene chloride was the only VOC detected with a low, estimated concentration of 1.8 ug/Kg, which is well below the TAGM objective of 50 ug/Kg. Metals results indicate copper, (91.3 mg/Kg) iron (4,160 mg/Kg), mercury (1.22 mg/Kg) and zinc (365 mg/Kg) are present in excess of the TAGM objectives (25 mg/Kg, 2000 mg/Kg, 0.1 mg/Kg, and 20 mg/Kg respectively). Of these, copper, mercury, and zinc are slightly in excess of the respective Eastern USA background of 50 mg/Kg 0.2 mg/Kg, and 50 mg/Kg, respectively. The concentrations of metals in the pipe pit soils are below SCDHS action levels.

Radiological results indicate activities are well below the applicable PRGs-50 Years. Several isotopes were detected and qualified with low, estimated activity, except for plutonium. Plutonium-238 was detected at the instrument's detection limit of 0.0892 pCi/g, with an error of greater than the detection of 0.104 pCi/g, it is likely that this is not an actual detection.

Metal sample results indicate limited soil contamination adjacent to Building 707B. However, metals typically adhere to sediments and are not very mobile in the subsurface. In addition, these levels are below SCDHS action levels. Based upon this no further action is warranted and this AOI will be eliminated.

AOI 030—Chemical Spills in and Around Building 707B

Chemical spills have been reported in and around Building 707B. As documented in the Work Plan, sampling was previously performed at six locations on the north side of the building and based upon results, did not warrant further action. As part of this PA/SI, four surface soil samples (AOI 030-01 through AOI 030-04) were collected from the zero to six-inch depth on the south side of the building. Sample locations are illustrated on Figure 6. These samples were submitted for total metals.

Results indicate concentrations of iron and zinc are in excess of the TAGM objectives in the four samples. However, the iron concentrations were below the Eastern USA background range. Zinc was above the Eastern background range of 50 mg/Kg in two samples, at AOI 030-01 and AOI 030-02 with levels of 139 mg/Kg and 206 mg/Kg respectively. In addition, at location AOI 030-02 mercury was above the TAGM with a concentration of 0.361 mg/Kg, which is slightly in excess of the Eastern USA background range of 0.001 to 0.2 mg/Kg.

Metal sample results indicate limited soil contamination adjacent to Building 707B. However, metals typically adhere to sediments and are not very mobile in the subsurface. Although zinc and mercury were reported in excess of the TAGM, these concentrations are not indicative of a significant source of groundwater contamination and no further action is warranted. This AOI will be eliminated.

6.4 Building 715

One AOI was identified relative to Building 715 and warranted action. Figure 4 illustrates the location of Building 715. A soil sample was collected (AOI 019-SB3) from the open excavation that exists between the Stack and 715 and results met PRGs-50 Years. This is discussed in Section 6.2 under AOI 019.

AOI 031-Exhaust Air Dried & Condensate Bottled

A radiological walkover survey was performed around the exterior of the building, to determine if areas with soil contamination were present. The area outside the building was performed as part of the stack survey. There were no points identified around the building with activity above 5,000 cpm during the walkover survey.

Based upon the radiological walkover survey results, no further action is warranted relative to the exterior of Building 715. This issue will be eliminated as an AOI.

6.5 Building 750

Building 750 is the confinement structure for the HFBR. A total of 16 AOIs were identified relative to the building during the PA. One, AOI 042, was eliminated as an AOI based on the findings of previous investigations (detailed in the PA/SI Work Plan). Three AOIs 032, 033, and 033A, could not be accessed due to structural limitations. These AOIs are relative to support systems to the reactor have been drained, are no longer in use and can be adequately monitored under the existing groundwater sampling program using the complex well network south the HFBR. Should groundwater data suggest a possible source in these areas, a more intrusive evaluation of these areas may be justified.

The remaining ten AOIs warranted action and are discussed in the following paragraphs. Prior to sampling, buried piping such as: D-waste, air exhaust, secondary water, and sanitary were exposed and borings installed immediately adjacent the line(s).

One AOI, Cooling Tower Emergency Pump GA303A Sump, was not previously documented in the Work Plan and a description is provided below under AOI 033A. This issue was added to Table 1.

AOI 033A- Cooling Tower Emergency Pump GA303A Sump

The Cooling Tower Emergency Pump sits on top of a 100-gallon sump. The pump returned water to the Cooling Tower Basin. The pump and sump are located in the southwest quadrant of the building in the Equipment Level Floor, near the FA-311 tank.

The pump is not normally energized and water collected would overflow the sump through a loop seal and drain to the storm water system. The sump collected light water from several sources, which were:

- Shutdown heat exchanger EA103,
- Primary heat exchanger EA101A&B vents,
- Primary heat exchanger EA101A&B drains,
- Steam condensate from test heat exchanger,
- Tritium monitoring panel sample flow,
- Break tank H305 flow, and
- Breathing air compressor coolant.

Due to the structural orientation of the sump, soil samples could not be collected during the SI. This AOI will be evaluated under the existing groundwater sampling program. Should groundwater data suggest a possible source in the area of the sump, a more intrusive investigation of the sump may be justified.

AOI 034—D Waste Line

The D-waste line transfers radiological waste from Building 750 to Building 801. This coaxial line exits Building 750 on the northeast side and terminates on the north side of Building 801. Refer to Figure 6 for location of buildings and line. Soil borings were performed at four locations (AOI 034-01 through AOI 034-04) along the D-waste line to evaluate potential leaks.

Soil sampling was performed continuously to 16 feet below grade then every five feet in two-foot intervals to approximately 42 feet below grade. Field screening did not indicate evidence of

contamination and the sample interval from directly below the line, 4 to 6 feet was submitted to the analytical laboratory for analysis of radiological parameters, HFBR list of isotopes.

In the four samples, most of the isotopes were reported as non-detect or with low, estimated activity. Detected isotopes such as: thorium 228/232 and uranium 238 were reported with low activities and the highest activities were 0.691 / 0.669 pCi/g, and 1.01 pCi/g, respectively. These levels are well below PRGs-50 Years.

Based upon the sample results and that the D-waste line was installed as a coaxial line, no further action is warranted. This AOI will be eliminated as a potential concern.

AOI 036—Secondary/Storm Water Lines

The secondary cooling water system provided for transfer of heat from the primary cooling system through the heat exchangers. Water would be transferred from Building 750 to the Cooling Towers where water was added or released from the system. Water would either return to Building 750 or discharge to the FA-310 tank (Building 752). Refer to Figure 6 for locations.

Soil sampling was performed at two locations (AOI 036-01 and AOI 036-02) along the secondary cooling water lines on the west side of Building 750. Sample location AOI 036-01 was positioned at an elbow where the secondary water rises above grade and AOI 036-02 was located at the east end of the line where it enters Building 750, which is also a low point.

After exposing the line, sampling was performed from the invert of the pipe until the boring was terminated. Sampling at location AOI 036-01 was performed continuously from 12 feet to 40 feet below grade. At location AOI 036-02 sampling commenced at four feet and ceased at 28 feet below grade due to refusal and the boring was terminated.

Field screening did not indicate readings above background. The soil interval immediately below the secondary water line was submitted for analyses and the intervals were: AOI 036-01 12 to 14 feet and AOI 036-02 4 to 6 feet. The samples were analyzed for VOCs, total metals, radiological parameters, HFBR list of isotopes.

Methylene chloride and 1,4 dichlorobenzene were the only two VOCs reported in AOI 036-01 with low, estimated concentrations that are well below their respective TAGM objectives. The total metals results indicate that iron (3,290 mg/Kg) and zinc (27.1 mg/Kg) were reported above the TAGM objectives of 2,000 mg/Kg and 20 mg/Kg, but below the Eastern background values (iron 550,000 mg/Kg and zinc 50 mg/Kg) in AOI 036-01. Iron was detected at 2,850, which is in excess of the TAGM objective but below the Eastern USA background value in AOI 036-02. At location AOI 036-01 thorium 228 and 232 were detected as well as other isotopes with low, estimated activities, which were below PRGs-50 Years. For location AOI 036-02, isotopes were reported with low, estimated activities and levels were below PRGs-50 Years as well.

Based upon the analytical results no further action is necessary relative to the secondary water lines between the HFBR and the Cooling Towers. This issue will be eliminated as an AOI.

AOI 037—Sanitary Lines (Manhole MH232)

Since the sanitary system received organic, inorganic and radiological discharges, through sinks and floor drains, one soil boring was performed adjacent to manhole MH232. The sanitary line exits Building 750 on its' south-west side. The boring (AOI 037-01) was positioned adjacent to manhole MH232 and discharge line. Refer to Figure 6 for location.

Soil sampling was performed continuously from grade to 16 feet, then every five feet in two-foot intervals to a completion depth of 52 feet. Field screening and visual inspection did not indicate evidence of contamination. The interval collected at 14 to 16 feet below grade was submitted for laboratory analysis, which represents the interval immediately below the base of the manhole. The sample was submitted for VOC, total metals and radiological analysis.

Methylene chloride was the only VOC detected with a low, estimated concentration of 0.53 ug/Kg, which is well below the TAGM objective of 50 ug/Kg. The total metals results indicate that iron was reported at 3,100 mg/Kg, which is above the TAGM objective of 2,000 mg/Kg but below the Eastern background range of 2,000 mg/Kg to 550,000 mg/Kg. The radiological

analysis indicates low, estimated levels for several isotopes (europium-152 (0.068 pCi/g), thorium 228/230/232 (04.67 / 0.253 / 0.456 pCi/g) and uranium 234 (0.255 pCi/g), which are well below PRGs-50 Years criteria.

Given the extensive tritium groundwater investigation that has been performed on the south side of the HFBR, including down-gradient of the sanitary line, and soil sample results adjacent to MH232, no further action is warranted relative to the sanitary line. The sanitary line will be eliminated as an AOI.

AOI 038—Air Exhaust Lines

A portion of the air exhaust line from the EABFF to the Stack, was shared with the BGRR. The section before the filter facility is contaminated. The line was inspected by video and the results indicated the line was in good condition. However, there was evidence of condensate at two locations. Based upon these results, two soil borings (AOI 038-01 and AOI 038-02) were performed adjacent the line to evaluate if soils were impacted. Soil sampling was performed from grade to 16 feet continuously, then every five feet in two-foot intervals, to a total depth of 42 feet.

Screening results for AOI 038-01 did not indicate evidence of contamination and the sample interval immediately below the line, 6 to 8 feet, was submitted for radiological analysis, HFBR list of isotopes. Sampling at location AOI 038-02 was performed on a hot, humid summer day and elevated responses were noted with the PID. Readings were noted in every sample, starting from grade to the completion depth, and ranged from 250 ppm to 750 ppm. It was suspected that the readings were a result of humidity as no evidence of staining was noted. The sample interval immediately below the line, 4 to 6 feet, was submitted for laboratory analysis for VOCs and radiological parameters, HFBR list of isotopes. This interval also corresponded with the highest PID response of 750 ppm.

Uranium-238 was detected in both samples, AOI 038-01 and AOI 038-02, at 1.29 pCi/g and 1.08 pCi/g, respectively. These levels are slightly above instrument detection limits and well below the PRGs-50 Years. Thorium-228 was also reported in sample AOI 038-01 at 0.505 pCi/g.

Other isotopes and activities reported as low, estimated levels in one or both samples were: cesium-137 (0.0977 pCi/g), europium-154 (0.049 pCi/g), sodium-22 (0.0177 pCi/g), thorium 230/232 (0.232 /0.325 pCi/g), and uranium 234 (0.266 pCi/g) and each of these were well below their respective PRGs-50 Years.

At location AOI 038-02, methylene chloride was the only VOC detected with a low, estimated concentration of 2.2 ug/Kg, which is well below the TAGM objective of 50 ug/Kg.

Based upon these results, no further action is warranted relative to the air exhaust line. This issue will be eliminated as a potential AOI and Facility Review Issue Nos. 841 and 2550 closed.

AOI 039—Air Exhaust Line By-pass Valve Pit

Under this AOI, the Exhaust Air By-pass Valve Pit, located on the south side of the Stack (see Figure 4), was also inspected. The pit contains the by-pass valve for the air exhaust, which allows air to by-pass the EABFF and exit directly through the Stack. The base of the pit was approximately eight feet below grade and found to contain a soil bottom. A soil sample was collected from the zero to six-inch depth under the air exhaust line at an elbow. This sample was incorrectly labeled as AOI 017-01, and is presented on the Table 6 as AOI 039-01. This soil sample was analyzed for the HFBR and BGRR list of isotopes. Analytical results for this sample indicate low detections. Americium-241 was detected at 0.0915 pCi/g with an error of 0.106. Other isotopes that were reported with low, estimated activities were: cesium-137 (0.135 pCi/g), thorium 228/ 230/ 232 (0.385/ 0.211 / 0.377 pCi/g), and uranium 233/234 (0.291 pCi/g). These activities are below PRGs-50 Years criteria.

Based upon these radiological results from the soils collected at the base of the Air Exhaust Line By-pass Valve Pit, no further action is warranted. This AOI will be eliminated as a potential concern.

AOI 041—Elevator Shafts

Due to PCB contamination in the passenger elevator shaft and potential releases from the equipment level that had the potential to be discharged from the pit, soil sampling was

performed. One boring was positioned on the east side of the HFBR in an alcove, as close to the building as possible, refer to Figure 6 for location.

Soil sampling was performed from 10 to 26 feet below grade continuously then every five feet, in two-foot intervals, until 37 feet below grade. No staining was observed and field screening did not indicate evidence of contamination and the sample interval from below the pits was submitted for laboratory analysis, 14-16 feet below grade. The sample was submitted for PCB and radiological analysis.

Laboratory results indicate PCBs were not detectable and therefore, concentrations are well below TAGM objectives. The results of the radiological analysis detected low levels of potassium-40 (6.59 pCi/g), thorium 228/230/232 (0.79/ 0.545/ 0.768 pCi/g), and uranium 234/238 (0.719/ 0.75 pCi/g). The levels present are well below PRGs-50 Years criteria.

Based upon the sample results it does not appear that the elevator pits are a significant source of groundwater contamination and this AOI will be eliminated.

AOI 043—Loading Dock Drain

A flow test was performed and determined that the loading dock drain discharges to the surface on the east side of the Reactor Maintenance Machine Shop (RMMS). A soil sample was collected close to the point of discharge and analyzed for total metals and radiological analysis, HFBR list of isotopes.

The results indicate two metals, iron and zinc, are present in excess of the TAGM objective with concentrations of 5,460 mg/Kg and 75.7 mg/Kg respectively. The TAGM objectives for iron and zinc are 2,000 m/Kg and 20 mg/Kg. Iron was within the Eastern USA background range of 2,000 to 550,000 mg/Kg, but and zinc was in excess of the background range of 9 to 50 mg/Kg. The radiological results indicate eight isotopes were detected at low levels that are below PRGs-50 Years criteria. The isotopes are beryllium-7 (0.339 pCi/g), cesium-137 (0.0806 pCi/g), cobalt-60 (0.0566 pCi/g), thorium228/230/232 (0.516/ 0.382/ 0.505 pCi/g), and uranium 234/235 (0.394/ 0.0885 pCi/g)

Metal results indicate zinc is present in slightly excess of the Eastern USA background range. As previously mentioned, metals tend to adhere to sediments ant are not very mobile in the subsurface. Based upon these soil sample results, no further action is warranted relative to the loading dock drain and this issue will be eliminated as an AOI.

AOI 044—Outside Issues

The Facility Review identified two activities that had the potential to result in soil contamination outside Building 750 and were: people wiping shoes in grass and maintenance activities in the air handling equipment room. Based upon this, a radiological walkover was performed around the building. The survey resulted in the identification of 14 Gamma Points around Building 750. Figure 5 depicts the area surveyed and the points identified with activity greater than 5,000 cpm. Survey procedures are contained in Section 5.1 and results of AOI 044 survey is discussed in detail in Section 5.2.3.

The results of the survey indicate that single particles or small pockets of soil contamination were present. Endpoint sampling confirmed remaining levels were less than PRGs-50 Years. One location, Gamma 10, was in concrete and access prevented retrieval of the particle or limited soil contamination. At this location, a soil sample adjacent the concrete pad was collected and also met the PRGs-50 Years. The location was placarded by RDHP as a reminder to personnel in the event changes to the 90-day storage area occurs, this location can be evaluated further. Based upon the survey results, this issue will be eliminated as an AOI.

AOI 046—Air Conditioning Unit

Sampling adjacent the Air Conditioning Unit was performed, based upon records that indicated the unit had overflowed in the past. Soil sampling was performed continuously to 20 feet below grade from two locations adjacent the unit, AOI 046-01 and AOI 046-02. Locations are illustrated on Figure 6.

Field screening and visual inspection did not indicate evidence of contamination and the 0 to 2 foot interval was submitted for laboratory analysis. Soil samples were analyzed for VOCs, total metals and radiological parameters (HFBR list of isotopes).

VOCs detected at low, estimated levels were methylene chloride and 1,4 dichlorobenzene, with concentrations of 2.28 and 0.49 ug/Kg respectively. These levels are well below their respective TAGM objectives. The metals detected were iron and zinc, in both samples. The highest iron result was 3,390 mg/Kg, which is above the TAGM objective but within the range for Eastern USA background (2,000 to 550,000 mg/Kg). Zinc was detected in excess of the Eastern USA background at location AOI 046-01 at 159 mg/Kg and below at location AOI 046-02 with a concentration of 21.5 mg/Kg. The radiological results indicate a low level for cesium-137, which is below the PRG, in both samples. Also, in both samples low detects for thorium228/230/232, and uranium-234 were and the highest levels were 0.554/ 0358/ 0.544 pCi/g and 0.422 pCi/g, respectively. The levels for these isotopes were well below PRGs-50 Years.

Based upon the soil sample results, no further action is warranted relative to the Air Conditioning Unit and this issue will be eliminated as an AOI.

AOI 047—Square Pit Near Manhole No. 6

A square pit with inlet and outlet pipes is present on the northeast side of the Building 750 Annex, near Manhole MH6. The origin of the inlet pipe is not certain and sampling was performed. The pit was found to have a solid bottom, and a soil boring was performed immediately adjacent on the discharge side of the pit to 24 feet below grade, AOI 047-01. The sample location is illustrated on Figure 6.

Visual inspection and field screening did not indicate evidence of contamination and the sample interval from 0 to 2 feet was submitted for laboratory analysis. This depth corresponds with the invert of the discharge pipe. The sample was submitted for analysis of VOCs, total metals and radiological parameters.

Two VOCs, chloroform and methylene chloride, were detected with low, estimated concentrations, which were well below the TAGM objectives. Copper and iron were detected at 28.6 mg/Kg and 5,120 mg/Kg, respectively, which are in excess of TAGM objectives but within the Eastern USA background of 50 mg/Kg and 550,000 mg/Kg. Additionally, zinc was also detected at 72.5 mg/Kg, exceeding both the TAGM objective and the upper limit of the Eastern USA background of 50 mg/Kg. Isotopes reported at low levels include: potassium-40 (20.4 pCi/g), thorium 228/230/232 (0.695/ 0.41/ 0.678 pCI/g), tritium (6.23 pCi/g), and uranium 233/234/238 (0.247/ 0.532/ 0.191 pCi/g) at levels below PRGs-50 Years.

Although zinc was detected in excess of Eastern background, the concentration detected is not indicative of a significant source of groundwater contamination. In addition, metals tend to adhere to sediments. Based upon the soil sample results, no further action is warranted relative to the square pit near Manhole MH6 and this issue will be eliminated as an AOI.

6.6 Building 751

Four AOIs were identified relative to Building 751 (Figure 6) and one warranted action as part of this PA/SI. AOI 048 through AOI 050 were identified as part of the PA and previous action was satisfactory and therefore, did not warrant further action.

AOI 051-Portable Structure 549 (TR0549)

The historic use of this structure was a storage room for oils/solvents and activated materials. A radiation walkover survey of the building's exterior was performed. The area outside the building was surveyed as part of the HFBR radiation walkover survey and no points were identified. Figure 6 illustrates the location and the area surveyed. Additional information on the HFBR walkover survey can be found in Section 5.2.3, as part of AOI 044.

This is an old structure and upon inspection, puddles were noted on the floor. In addition, the asphalt was cracked. Based upon this, sampling of the soil below the asphalt, in areas where the integrity of the asphalt is compromised, will be performed.

6.7 Building 752

Building 752 was given an AOI number, AOI 052, for tracking purposes. This building was a tank that had a 250,000-gallon capacity and was located on the northeast side of the HFBR, Figure 6. The tank held normal overflow and blow-down for the SCS.

AOI 052—FA-310 Hold-Up Tank

This tank was decommissioned and removed as part of the Stabilization Project. The soils were removed and endpoint samples collected. No additional action was warranted and this issue will be eliminated as an AOI.

6.8 Building 753

Building 753 was a small structure that was constructed for HFBR security. This building is located on the north side of the HFBR and Figure 6 illustrates the location. One AOI was identified relative to Building 753.

AOI 053—Building 753 Outside Issues

A radiological walkover survey was performed around the guard booth to evaluate the potential spread of contamination from the movement of staff and guards in and out of Building 750. Prior to moving the guard booth into Building 750 in 1987, access was controlled by a fence and gate on the north side of Building 753, personnel had to pass this point. The fence is illustrated on Figures 5 and 6.

The survey indicated that radiological points were present in the vicinity of the guard booth. The results of the survey are discussed in detail in Section 5.2.3, as part of AOI 044, the Building 750 radiological walkover survey.

Results of the walkover survey indicated that the activity was a result of single particles or small pockets of soil contamination, which were removed and properly disposed. Endpoint soil sampling confirmed activity that met PRGs-50 Years criteria. Based upon this, no further action is necessary relative to Building 753 and this issue will be eliminated as an AOI.

7.0 CONCLUSIONS & RECOMMENDATIONS

As part of this PA/SI, the HFBR and BOP structures were investigated based upon the PA findings that identified 53 Areas of Interest (AOIs). The AOIs were identified as issues that have the potential to impact surface or subsurface soils, and ultimately groundwater. Of the 53 AOIs, 27 warranted action under this SI, which consisted of performing: inspections, radiological walkover surveys and soil/groundwater sampling. These actions were performed to determine if identified AOIs warrant additional action.

The PA/SI resulted in the collection of approximately 40 soil and groundwater samples throughout the HFBR complex. Sample depths and analyses were dependent upon AOI location and historical information. Approximately 10 percent of the analytical results were sent to a third party for validation and found to be acceptable.

The radiological walkover survey performed adjacent to and around several of the facilities covered a total area of approximately four acres. An additional 43 initial and endpoint samples were collected based upon results of the walkover survey. The results indicate that the contamination identified during the survey was the result of single particles or limited soil contamination. Endpoint samples were collected to verify remaining activity met PRGs and concluded that results met PRGs-50 Years.

Of the 27 AOIs investigated, 23 have been eliminated as AOIs and four warrant action and are discussed below. Of the seven, the first three are related to former BGRR structures.

- AOI 006--Soil samples collected in the basement of Building 704, where water likely leaked through floor seams from the fan cell above, indicate that cesium-137 and strontium-90 are present above their respective PRGs-50 Years and warrant additional action. Based upon the walkover survey performed in the basement, it is believed that a small volume of soil is impacted and warrants removal. Therefore, soil excavation will be performed and confirmed with endpoint sample collection.

- AOI 007—The discharge point for the cable trench drain from inside Building 704 needs to be located. Tracing this line warrants the trench to be secured, which was not possible during the time frame of this project. After tracing, if it is determined that the drain discharges to soil, a sample will be collected and analyzed for radiological parameters, BGRR list.
- AOI 021—Groundwater sampling performed indicates that strontium-90 is present in the vicinity of the Stack in excess of the NYSDEC standard. The highest level reported was 392 pCi/g. At this time it is not known if the Stack is a contributing source of groundwater contamination and a groundwater investigation will be performed. It should be noted that the strontium-90 plume is present in this area, and recent sample results may represent current water quality.
- AOI051—Puddles were noted on floor inside the building and the asphalt floor is cracked. Based upon this, sampling of the soil below the asphalt, in areas where the integrity of the asphalt is compromised, will be performed.

In addition to the AOIs mentioned above, four AOIs could not be investigated due to structural limitations relative to Building 750 are: AOI 032, AOI 033, AOI033A, and AOI 035. AOI033A was documented in this report and the remaining three AOIs were discussed in detail in the project Work Plan. The HFBR has been shut down since 1997, the support systems have been drained, and the building is currently not occupied.

Sampling was performed based upon accessibility to locations and was generally adjacent to structures of interest and results do not indicate that a significant source of contamination exists. However, Monitoring will continue under such programs as the Environmental Management's Sitewide Groundwater Monitoring Program and Environmental Services Division Compliance Monitoring Program. Should significant changes in groundwater concentrations or trends become evident, further evaluation would be necessary.

Table 1
HFBR & BOP Structures PA/SI
PA/SI Findings: Areas of Interest

AOI No. HFBR-	Bldg No.	PA Issue	NPA	PA-I	PA-S	SI Recommended Action	SI Findings / Recommended Action	Comments
001	704	Above grade exhaust duct and primary air fans are contaminated with radioactive material.			X	No action. BGRR scope of work (SOW).		Removal action performed under BGRR decommissioning project. FR # 400, 827 & 2793.
002	704	Below grade exhaust duct basement Building 704.	X			Soil sampling in basement adjacent exhaust duct.	No further action. Eliminate as an AOI.	FR No. 400, 827, 2793 and 2795.
003	704	Pile fan sump pit.			X	No action. BGRR SOW.		Removal action was performed under BGRR decommissioning project. FR No. 826 and 399.
004	704	704 DW-1, drywell.	X			No action. BGRR SOW.		Drywell permitted. Duplicate of AOI 015.
005	704	Motor side floor drains to STP.			X	No action. BGRR SOW.		Floor drains were abandoned under BGRR decommissioning project. FR No. 392.
006	704	Soil in basement under Fan Cell floor drains and floor seams.	X			Soil sample.	Limited soil removal to be performed.	
007	704	Electrical trench drain max flow to drywell under trench.	X			If drywall to soil, sample. SCDHS parameters and radionuclides.	Trace line when trench secured.	FR No. 392 and 2794.
008	704	Lead/acid battery storage >250 gallons of sulfuric acid.	X			No action.		FR Nos. 3318 & 402 because not registered with SCDHS, battery banks in process of being dismantled.
009	704	Oil Spill.	X			No action.		HSR AOI 7048.
010	704	Transformer pad north of building.	X			No action under this PA/SI		Transformer associated with Building 801 not a Building 704 issue. HSR AOI 3025.
011	704	Two transformers south side of building.	X			Sample surface soils - PCBs.		704.trans.1 and 704.trans.2
012	704	Outside issues: potential contamination on pavement from spills, battery storage in structure attached to S. side of Bldg 704.	X			Radiation survey, soil sampling as necessary.	No further action. Eliminate as an AOI.	Due to nature of BGRR and history of contamination, FR No. 410.
013	704	"F" waste piping. Lines run underground to 801.			X	No action. BGRR SOW.		Line outside from Bldg. 704 to Pile Fan Sump to Bldg. 801. Lines were removed by BGRR decommissioning project. FR No. 397.
014	704	Water treatment chemical storage in Fan Cells (No. 5).	X			No action. No documented releases & fan cells had floor drains.		FR No. 401 and 828.
015	704	BGRR primary air cooling water valve pit - drain to pit.			X	No action. BGRR SOW.		Pipe was sampled and abandoned in place by BGRR decommissioning project. FR No. 404.
016	704	Exhaust Air Bypass Filter Facility (EABFF)- below grade filter room.	X			No action.		
017	704	Ventilation valve pit at entrance to EABFF (access inside Building 704)	X			Inspect and verify no drain is present.	No further action. Eliminate as an AOI.	Pit in good condition, no drain present.
018	705	Exhaust duct from Building 704 to Stack (underground plenum).		X		Sample soil and groundwater downgradient line.	No further action. Eliminate as an AOI.	FR No. 2797.
019	705	Main exhaust stack drain lines. Line from Stack to outside Bldg. 704.		X		No action.		Repair currently being performed for suspected leak. FR No. 398, 825, 3456 and SC No. 583.

Table 1
HFBR & BOP Structures PA/SI
PA/SI Findings: Areas of Interest

AOI No. HFBR-	Bldg No.	PA Issue	NPA	PA-I	PA-S	SI Recommended Action	SI Findings / Recommended Action	Comments
020	705	Area with soil contamination.		X		Radiation survey around Stack to determine if there are additional areas and soil sampling.	No further action. Eliminate as an AOI. Walkover survey did not identify contamination.	Weed with couple hundred counts per minute at access hatch area.
021	705	Historically standing water in base of Stack.		X		Sample groundwater adjacent to stack down gradient side	To be evaluated by EM's GW Group.	Water no longer stands in base of stack due to modification.
022	707	Cooling Tower Basin - estimated 10 gallons per hour leak rate.	X			No action. Soil sampling conducted by ESD.		FR No. 3243 and 836 (listed under Building 750). Issue closed August 2001
023	707	Valve pit soil bottom.	X			Soil sampling. VOCs, total metals and radionuclides.	No Further Action	Valve pit east of basin. Results below SCDHS' action levels.
024	707	Northern Sump (Cooling Tower Basin).	X			No action. Soil sampling to be conducted under HFBR D&D Project.		
025	707A	Pump House sump.	X			Radiation survey & visual inspection. Soil sampling, as necessary.	No further action. Eliminate as an AOI.	Could not inspect due to standing water. GW sample collected. Results met MCLs.
026	707A	Transformer pad south of 707A.	X			Sample surface soils - PCBs.		HSR AOI No. 3058.
027	707B	Pipe pit in building	X			Soil sampling. VOCs, total metals and radionuclides.	No Further Action	
028	707B	Two sumps (acid and phosphate mixing).			X	No action.		Sumps were cleaned and sealed. HSR AOI # 5035 and 5036.
029	707B	Discharge from building to surface.			X	No action.		HSR AOI 1001, Indicated bldg. 707B discharged to open pit NE of bldg. 750. FR No. 2806 and 3374. RDWR 97-0861
030	707B	Chemical spills in and around 707B		X		Surface soil samples near door and tanks, analyze for metals.	No Further Action	Previous sampling at rear of building. Results indicate limited metal contamination below SCDHS' action levels.
031	715	Exhaust air dried and condensate bottled.	X			Radiation survey, determine if additional action necessary	No further action. Eliminate as an AOI.	No points identified during walkover.
032	750	All piping systems located in and below concrete floor of equipment level.	X			No action.		Monitoring under GW program.
033	750	All vaults, pits, sumps below elevation of equipment level.	X			No action.		Monitoring under GW program.
033A	750	GA303A Cooling Tower Emergency Pump Sump	X					Issue not documented during Preliminary Assessment. Monitoring under GW program.
034	750	"D" waste lines outside bldg. 750.	X			Soil sampling adjacent to line.	No further action. Eliminate as an AOI	Sampling due to nature of waste managed.
035	750	Spent fuel pool (also referred to as canal).		!		No action.		Monitoring under GW program, AOC 23.
036	750	Secondary/storm water lines outside Building 750.	X			Soil sampling adjacent to line.	No further action. Eliminate as an AOI.	Sampling due to tritium and possible other contaminants.
037	750	Sanitary Lines outside Building 750.	X			Sample soil adjacent MH-232.	No further action. Eliminate as an AOI.	Sanitary not previously investigated. Area groundwater extensively sampled for tritium.

Table 1

HFBR & BOP Structures PA/SI

PA/SI Findings: Areas of Interest

AOI No. HFBR-	Bldg No.	PA Issue	NPA	PA-I	PA-S	SI Recommended Action	SI Findings / Recommended Action	Comments
038	750	Air Exhaust Lines. Building 750 underground plenum	X			Soil sample adjacent to line.	No further action. Eliminate as an AOI.	Locate samples where condensate accumulates. FR No. 841 and 2550.
039	750	Air Exhaust Line By-Pass Valve Pit.	X			Inspect and verify no drains are present.	No further action. Eliminate as an AOI.	
040	750	Passenger elevator shaft-PCBs.		X		No action.	No further action. Eliminate as an AOI.	Equipment cleaned, PCBs remain. FR No. 850 and 3212.
041	750	Elevator pits and shafts possible release of spills from equipment level floor,	X			Soil sampling outside building adjacent elevator pits.	No further action. Eliminate as an AOI.	FR No. 851 and 2548
042	750	Drywell/pit			X	No action.		HSR AOI No. 1001, sampled previously under RDWR 97-0861.
043	750	Loading dock drain, discharges to surface on east side of Annex.	X			Verify drain discharges to surface east side of RMMS and collect soil sample.	No further action. Eliminate as an AOI.	
044	750	Shoes wiped in grass & contamination found outside Air Handling Equipment Room.	X			Radiation survey around each exit, surface soil sampling as necessary	No further action. Eliminate as an AOI.	
045	750	Propane tank.	X			No action.		
046	750	Air conditioning unit overflowed	X			Surface/subsurface soil sampling, metals and VOCs.	No further action. Eliminate as an AOI.	Vegetation distressed around unit.
047	750	Square pit near Manhole #6	X			Soil sampling.	No further action. Eliminate as an AOI.	Suspected storm water mgmt system.
048	751	Drywell, 751-DW-1			X	No action.		Sample results satisfactory. Drywell permitted and remained open. FR No. 3228.
049	751	Pipe Trench			X	No action.		
050	751	Vacuum line east side HFBR, radiation survey found elevated levels in pipe			X	No action.		
051	751	PS549 - History of oil/solvent & activated parts storage. Integrity of concrete compromised, rainwater enters bldg.	X			Radiation survey.	Soil sampling to be performed.	Solvents/oils stored, maintenance work. Analyze samples for VOCs, metals and radiation contaminants.
052	752	Tank sludges contained trace levels of cobalt-60, & tank exterior coated with lead-based paint. Oil coated soils beneath tank.			X	No action. Soil sampling conducted under Stabilization Project.		Stabilization project.
053	753	Potential spread of contamination to floor if guards entered reactor.	X			Radiation survey	No further action. Eliminate as an AOI.	

NOTES:

NPA - No Previous Action.

PA - i Previous Action inconclusive, refer to Work Plan for details.

PA - S Previous Action Satisfactory, refer to Work Plan for details.

I - Investigation/action in-progress

BGRR - Brookhaven Graphite Research Reactor

X - Indicates status of issue

RD- Reactor Division

FR - Facility Review

RDWR - Reactor Division Work Request

SOW - Scope of work

Indicates radiation walkover survey performed.

Inspection performed.

Indicates soil or groundwater sampling performed

GW - Groundwater

TABLE 2

HFBR & BOP Structures PA/SI

SAMPLES SUBMITTED TO OFF-SITE LABORATORY

DATE SAMPLED	BLDG	SITE ID	SAMPLE ID	DESCRIPTION	SAMPLE DEPTH (ft)	MATRIX	ANALYSES				SDG No.
							VOCs	PCBs	Radiological*	Metals	
9/14/2001	704	075-539	704002-01	AOI 002-01 0 - 0.5	0 - 0.5	S			B		49341S
9/14/2001	704	075-536	704002-02	AOI 002-02 0 - 0.5	0 - 0.5	S			B		49341S
9/14/2001	704	075-538	704006-01	AOI 006-01 0 - 0.5	0 - 0.5	S	X		B		49341S
9/14/2001	704	075-537	704006-02	AOI 006-02 0 - 0.5	0 - 0.5	S	X		B		49341S
8/20/2001	704	075-540	704011-01	AOI 011-01 0 - 2	0 - 2 in	S		X			48015S
9/27/01	704	075-533	704012A	AOI 012A-01	84 - 88	W	X		G		49708W
8/24/2001	705	075-544	705017-01	AOI 017-01 0 - 0.5	0 - 0.5	S			H/B		48078S
8/15/2001	705	075-534	705018-01	AOI 018-01 16 - 20	16 - 20	S			H/B		47744S
8/16/2001	705	065-291	705019-01	AOI 019-01 4 - 6	4 - 6	S			H/B		47744S
9/5/2001	705	075-546	705019-SB1	AOI 019-SB1 5 - 6	5 - 6	S			H/B		48796S
9/5/2001	705	075-545	705019-SB2	AOI 019-SB2 5 - 6	5 - 6	S			H/B		48796S
9/5/2001	705	065-297	705019-SB3	AOI 019-SB3 5 - 6	5 - 6	S			H/B		48796S
11/16/2001	705	075-551	705020-01	AOI 020-01 0 - 2	0 - 2 in	S			B		52242S
11/16/2001	705	075-550	705020-02	AOI 020-02 0 - 2	0 - 2 in	S			B		52242S
8/13/2001	705	065-290	705021-01	AOI 021-01 88 - 92	88 - 92	W			G		47743W
8/6/2001	705	075-530	705021-02	AOI 021-02 90 - 94	90 - 94	W			G		47743W
8/10/2001	705	075-531	705021-03	AOI 021-03 88 - 92	88 - 92	W			G		47743W
8/9/2001	705	075-532	705021-04	AOI 021-04 88 - 92	88 - 92	W			G		47743W
8/24/2001	707	075-541	707023-01	AOI 023-01 0 - 0.5	0 - 0.5	S	X		H/B	X	48078S
8/20/2001	707A	075-542	707A026-01	AOI 026-01 0 - 2	0 - 2 in	S		X		X	48015S
8/21/2001	707B	065-295	707B027-01	AOI 027-01 0 - 0.5	0 - 0.5	S	X		H/B	X	48015S
8/13/2001	707B	065-294	707B030-01	AOI 030-01 0 - 0.5	0 - 0.5	S				X	47744S
8/13/2001	707B	065-293	707B030-02	AOI 030-02 0 - 0.5	0 - 0.5	S				X	47744S
8/13/2001	707B	065-292	707B030-03	AOI 030-03 0 - 0.5	0 - 0.5	S				X	47744S
8/13/2001	707B	075-535	707B030-04	AOI 030-04 0 - 0.5	0 - 0.5	S				X	47744S
9/5/2001	750	065-299	750034-01	AOI 034-01 4 - 6	4 - 6	S			H		48793S
8/31/2001	750	065-286	750034-02	AOI 034-02 4 - 6	4 - 6	S			H		48793S
8/30/2001	750	065-285	750034-03	AOI 034-03 4 - 6	4 - 6	S			H		48381S
10/18/2001	801	065-301	801034-01	*AOI 034-04 4 - 6	4 - 6	S			H		50921S
8/28/2001	750	075-527	750036-01	AOI 036-01 12 - 14	12 - 14	S	X		H/B	X	48310S
8/27/2001	750	075-526	750036-02	AOI 036-02 4 - 6	4 - 6	S	X		H/B	X	48224S
8/21/2001	750	065-289	750037-01	AOI 037-01 14 - 16	14 - 16	S	X		H	X	48015S
8/17/2001	750	075-529	750038-01	AOI 038-01 6 - 8	6 - 8	S			H		48015S
8/21/2001	750	075-525	750038-02	AOI 038-02 4 - 6	4 - 6	S	X		H		48015S
9/7/2001	750	065-288	750041-01	AOI 041-01 14 - 16	14 - 16	S		X			49154S
9/7/2001	750	065-288	750041-01	AOI 041-01 16-18	16 - 18	S			H		48793S
8/24/2001	750	065-287	750043-01	AOI 043-01 0 - 0.5	0 - 0.5	S	X		H	X	48078S
8/28/2001	750	075-543	750046-01	AOI 046-01 0 - 2	0 - 2	S	X		H	X	48224S
8/29/2001	750	075-543	750046-02	AOI 046-02 0 - 2	0 - 2	S	X		H	X	48381S
8/31/2001	750	065-284	750047-01	AOI 047-01 0 - 2	0 - 2	S	X		H/B	X	48417S
9/25/01	707A	075-528	707A-025	AOI-025 74 - 78	74 - 78	W	X		G		49708W
11/15/01	704	075-553	704-01	BLDG 704-01 4 - 5 (AOI 006 - 03)	4 - 5	S			GS		52242S
11/15/01	704	075-552	704-02	BLDG 704-02 4 - 5 (AOI 006 - 04)	4 - 5	S			GS		52242S
10/10/2001	750	065-282	GAMMA 1 EP	GAMMA 1 EP	6 - 9 in	S			H		50921S
10/11/2001	750	065-271/272	GAMMA 12/13 EP	GAMMA 12/13 EP	8 - 12 in	S			H		50921S
10/19/2001	704	065-279	GAMMA 16 EP	GAMMA 16 EP	2 - 3 in	S			H/B		50921S
10/12/2001	704	065-280	GAMMA 17 EP	GAMMA 17 EP	13 - 14 in	S			B		50921S
10/19/2001	704	065-281	GAMMA 18	GAMMA 18	1 - 2 in	S			H/B		50921S
10/19/2001	704	065-281	GAMMA 18 EP	GAMMA 18 EP	2 - 3 in	S			H/B		50921S
10/22/2001	704	075-522	GAMMA 19 EP	GAMMA 19 EP	2 - 3 in	S			H/B		50921S
9/5/2001	750	065-283	75082	GAMMA 2 EP	2 - 6 in	S			H/B		49154S
9/6/2001	750	065-273	75086	GAMMA 6 EP	1 - 2 in	S			H/B		49154S
10/12/2001	750	065-274	GAMMA 7 EP	GAMMA 7 EP	12 - 14 in	S			H		50921S
9/7/2001	750	065-275	75088	GAMMA 8 EP	1 - 2 in	S			H/B		49154S
10/19/2001	704	075-520	GAMMA 15	***GAMMA 15	2 - 3 in	S			H/B		50921S
10/22/2001	704	075-523	GAMMA 20	***GAMMA 20	2 - 3 in	S			H/B		50921S
10/22/2001	704	075-521	GAMMA 21	***GAMMA 21	2 - 3 in	S			H/B		50921S
10/23/2001	750	075-518	GAMMA 4	***GAMMA 4	23 - 24 in	S			H/B		50921S
9/13/2001	750	065-271	750812	**GAMMA 12 EP	0 - 6 in	S			H/B		49154S
9/13/2001	750	065-272	750813	**GAMMA 13 EP	0 - 6 in	S			H/B		49154S
9/10/2001	750	075-519	GAMMA 5	WEST OF HFBR 4 - 5	0 - 6 in	S			H		48796S

NOTES:

S - SOIL

W - GROUNDWATER

H - HFBR list, gamma spec., tritium, & iron-55.

B - BGRR list: gamma spec., tritium, radium-226, plutonium 238/239/240/241, iodine-129, technecium-99, strontium-90, uranium-234/235/238.

G - gross alpha/beta, gamma spec., strontium-90, and tritium analyses.

GS - gamma spec. & strontium-90 analyses.

X - Indicates analysis performed.

* - Sample Identification was incorrectly marked on Chain of Custody as AOI 034 - 01.

** - Sample Identification was incorrectly marked on Chain of Custody as Endpoint - "EP".

*** - Sample Identification was incorrectly marked on the Chain of Custody without "EP" - Endpoint.

Table No. 2A
HFBR & BOP STRUCTURES PA/SI
BNL SITE BACKGROUND LEVELS

Radiological Parameter	BNL Site Background Levels* (pCi/g)
Americium-241	ND
Barium-133	ND
Carbon-14	ND
Cesium-137	1.5
Cobalt-60	ND
Europium-152	ND
Europium-154	ND
Europium-155	ND
Iridium-192	ND
Neptunium-237	ND
Niobium-94	ND
Plutonium-238	ND
Plutonium-239/240	ND
Promethium-146	ND
Radium-224	1.0**
Radium-226	1.0
Strontium-90	0.3
Thorium-232	1.0
Technetium-99	ND
Uranium-234	1.8
Uranium-235	ND
Uranium-238	1.8

* Operable Unit I Radiologically Contaminated Soils Feasibility Study, CDM Federal Programs, 1999

** Based upon site specific information. Provided by BNL ES&H Division.

ND Not Detectable indicates isotope that is not naturally occurring therefore not expected in background.

NA Not Available

Table 3

HFBR & BOP Structures PA/SI

QA/QC Samples

DATE SAMPLED	SAMPLE ID	DESCRIPTION	SAMPLE DEPTH (ft)	MATRIX	QA/QC ANALYSES				SDG No.
					VOCS	METALS	RAD	PCB's	
8/9/2001	BLIND DUPLICATE	AOI 021-04B 88 - 92	88 - 92	W			G		47743W
8/13/2001	MS/MSD	AOI 021-01 88 - 92 MS/MSD	88 - 92	W			G		47743W
8/16/2001	GEOPROBE FIELD BLANK	AOI 019 FIELD BLANK	0	W			B		47743W
8/20/2001	HAND AUGER FIELD BLANK	AOI 011-01 FIELD BLANK	0	W				X	48053W
8/21/2001	TRIP BLANK	TRIP BLANK	0	W	X				48053W
8/24/2001	HAND AUGER FIELD BLANK	HAND AUGER FIELD BLANK	0	W	X	X	B		48076W
8/24/2001	TRIP BLANK	TRIP BLANK	0	W	X				48076W
8/24/2001	BLIND DUPLICATE	AOI 023-01B	0 - 0.5	W	X	X	B		48078S
8/27/2001	TRIP BLANK	TRIP BLANK	0	W	X				48223W
8/28/2001	TRIP BLANK	TRIP BLANK	0	W	X				48309W
8/28/2001	MS/MSD	AOI 046-01 0-2 MS/MSD	0-2	S	X	X	G		48310S
8/29/2001	TRIP BLANK	TRIP BLANK	0	W	X				48384W
8/31/2001	TRIP BLANK	TRIP BLANK	0	W	X				48418W
8/31/2001	GEOPROBE FIELD BLANK	FIELD BLANK GEOPROBE	0	W	X	X	B		48418W
9/5/2001	BLIND DUPLICATE	AOI 034-01B 18 - 20	18 - 20	S			H		48793S
9/7/2001	GEOPROBE FIELD BLANK	**AOI 041-01 FIELD BLANK	0	W			H	X	48795W
9/14/2001	TRIP BLANK	TRIP BLANK	0	W	X				49344W
9/25/2001	TRIP BLANK	TRIP BLANK	0	W	X				49708W
9/27/2001	GEOPROBE FIELD BLANK	*AOI 025 FIELD BLANK	0	W	X		G		49708W
10/11/2001	MS/MSD	GAMMA 12/13 MS/MSD	0.6 - 1	S			H		50921S

NOTES:

X - analyses performed

G - gross alpha/beta, gamma spec., strontium-90, and Tritium analyses.

H - HFBR list, gamma spec., tritium, & iron-55.

B - BGRR list: gamma spec., tritium, radium-226,american 241, plutonium 238/239/240/241, iodine-129, technecium-99, strontium-90, uranium-234/235/238.

W - GROUNDWATER

S - SOIL

* - Labeled incorrectly as a Rinsate Blank on Chain of Custody.

** - Sample temperature was too high upon arrival to laboratory; was not analyzed for PCBs.

Geoprobe Field Blank - deionized water poured over the accetate liner of the geoprobe soil sampler was collected and analyzed for contamination.

Hand Auger Field Blank - deionized water poured over the sampler of the hand auger was collected and submitted for analysis.

HFBR & BOP STRUCTURES PA/SI REPORT

Walkover Survey Gamma Points - Radiological Analysis

Initial Sample Results

Parameters	^PRG	Gamma 1 (5 - 6)				~Gamma 2				Gamma 4 (14 - 15)				~Gamma 5			
Units - pCi/g	50 YR	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim
Americium - 241(A)	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Berylium - 7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 137	67	NA	NA	NA	NA	NA	NA	NA	NA	0.487	NA	83.32	NA	NA	NA	NA	NA
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 60	3300	23200.0	NA	12.14	NA	24300.00	NA	12.26	NA	644.000	NA	11.77	NA	4990.00	NA	11.3	NA
Europium - 152	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium - 154	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium - 155	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 238	274	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.870	NA	30.15	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium - 90	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 232	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tritium	9.6E+15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235/236	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium - 48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc - 65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

( ) Depth In inches

NA - Not Available

U - Analyte was analyzed for but not detected.

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

I - Uncertain Identification or Interference

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

& - Samples submitted to GEL. Others initial samples submitted to ASL.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institutional controls.

HFBR & BQP STRUCTURES PA/SI REPQRT

Walkover Survey Gamma Points - Radiological Analysis

Initial Sample Results

Parameters	^PRG	~Gamma 6				~Gamma 7				~Gamma 7 - Post				~Gamma 8			
Units - pCi/g	50 YR	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim
Americium - 241(A)	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Berylium - 7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 137	67	NA	NA	NA	NA	NA	NA	NA	NA	0.15	NA	56.93	NA	NA	NA	NA	NA
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 60	3300	28400.00	NA	10.96	NA	1980.00	NA	11.03	NA	24.60	NA	11.32	NA	112000.00	NA	12.85	NA
Europium - 152	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium - 154	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium - 155	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.50	NA	28.07	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.34	NA	68.61	NA	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 238	274	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.18	NA	21.28	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium - 90	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.23	NA	40.05	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 232	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tritium	9.6E+15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235/236	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium - 48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc - 65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

( ) Depth In Inches

NA - Not Available

U - Analyte was analyzed for but not detected.

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

I - Uncertain Identification or Interference

-Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

& - Samples submitted to GEL. Others Initial samples submitted to ASL.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institiutional controls.

HFBR & BOP STRUCTURES PA/SI REPORT

Walkover Survey Gamma Points - Radiological Analysis

Initial Sample Results

Parameters	^PRG	~Gamma 9				~Gamma 10				Gamma 12 (2 - 4)				Gamma 12 (4 - 6)			
Units - pCi/g	50 YR	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim
Americium - 241(A)	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Berylium - 7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 137	67	2420.00	NA	13.72	NA	NA	NA	NA	NA	4.16	NA	26.19	NA	3.84	NA	32.11	NA
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 60	3300	618000.00	NA	13.72	NA	42300.00	NA	11.6	NA	1280.00	NA	12.04	NA	928.00	NA	11.61	NA
Europium - 152	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium - 154	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Europium - 155	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 238	274	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	736.00	NA	47.89	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium - 90	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 232	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tritium	9.6E+15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235/236	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium - 48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc - 65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

( ) Depth In inches

NA - Not Available

U - Analyte was analyzed for but not detected.

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

I - Uncertain Identification or Interference

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint).

& - Samples submitted to GEL. Others initial samples submitted to ASL.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institutional controls.

ble 4

HFBR & BOP STRUCTURES PA/SI REPORT

Walkover Survey Gamma Points - Radiological Analysis

Initial Sample Results

Parameters	^PRG	&*Gamma 12 EP (0 - 6)				&*Gamma 13 EP (0 - 6)				Gamma 15 (1 - 2)				Gamma 17 (13 - 14)			
Units - pCi/g	50 YR	Result	Qualifier	Error+/-	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim
Americium - 241(A)	160	0.0569	U	0.169	0.389	0.0359	U	0.14	0.338	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	160	-0.0984	U	0.338	0.283	0.121	J-I	0.169	0.0872	NA	NA	NA	NA	NA	NA	NA	NA
Berylium - 7	NA	1.32	UI	1.08	0.895	0.348	UI	0.389	0.34	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 134	NA	-0.16	DL	0.103	0.0872	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 137	67	2.76		0.268	0.108	1.34	J	0.181	0.0367	24.20	NA	16.93	NA	104.00	NA	19.36	NA
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	0.104	UI	0.0722	0.045	0.101	UI	0.0451	0.0203	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 60	3300	226		0.814	0.0675	11.9		1.32	0.0331	NA	NA	NA	NA	1.09	NA	18.13	NA
Europium - 152	NA	0.351	J	0.368	0.222	0.306	J	0.155	0.0772	NA	NA	NA	NA	1.23	NA	27.11	NA
Europium - 154	NA	-0.0429	U	0.252	0.204	0.126	J-I	0.103	0.091	NA	NA	NA	NA	NA	NA	NA	NA
Europium - 155	NA	0.113	U	0.195	0.173	0.0832	J-I	0.0718	0.0657	NA	NA	NA	NA	NA	NA	NA	NA
Iodine - 129	NA	-0.218	U	0.383	0.434	-0.413	U	0.427	0.449	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	-10.7	DL	8.19	11.5	-5.39	DL	6.3	8.77	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.18	NA	43.39	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.30	NA	54.56	NA	0.91	NA	55.37	NA
Manganese - 54	NA	-0.0179	DL	0.184	0.133	-0.0382	U	0.0536	0.0445	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 238	274	0.0224	U	0.0927	0.2	-0.00719	U	0.0823	0.198	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	170	0.0347	U	0.0706	0.145	0.268	J	0.136	0.161	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	3.81	U	4.22	7.08	2.01	U	4.61	7.84	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	5.15	J	1.05	0.472	NA	NA	NA	NA	5.51	NA	22.15	NA	7.92	NA	27.49	NA
Sodium - 22	NA	-0.0136	DL	0.0903	0.0731	0.0453	J-I	0.0367	0.0327	NA	NA	NA	NA	0.17	NA	64	NA
Strontium - 90	15	0.113	U	0.205	0.461	0.263	U	0.262	0.554	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	NA	-1.86	U	1.77	4.5	-1.42	U	1.56	3.95	NA	NA	NA	NA	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.39	NA	67.87	NA
Thorium - 228	NA	0.288	J	0.204	0.119	0.164	J	0.0897	0.0445	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 230	NA	0.202	J	0.205	0.183	0.166	J	0.109	0.0632	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 232	NA	0.282	J-I	0.2	0.119	0.161	J	0.0879	0.0437	NA	NA	NA	NA	NA	NA	NA	NA
Tritium	9.6E+15	-5.93	U	7.57	13.5	-12.2	U	7.44	13.7	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 233/234	NA	0.515	J	0.255	0.222	0.156	U	0.153	0.259	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234	NA	0.354	J	0.44	0.288	0.0851	U	0.129	0.108	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235	29	0.416	J-I	0.509	0.355	0.108	U	0.152	0.134	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 235/236	29	0.0418	U	0.0801	0.171	0.0502	U	0.0887	0.186	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	36	0.192	J	0.147	0.0822	0.111	U	0.112	0.153	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	36	1.64	DL	2.56	2.15	1.09		1.47	0.682	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium - 48	NA	-0.281	U	0.458	0.377	-0.0304	U	0.16	0.133	NA	NA	NA	NA	NA	NA	NA	NA
Zinc - 65	NA	0.507	UI	0.404	0.334	-0.067	U	0.144	0.117	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

( ) Depth in inches

NA - Not Available

U - Analyte was analyzed for but not detected.

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

I - Uncertain identification or Interference

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

& - Samples submitted to GEL. Others initial samples submitted to ASL.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institutional controls.

le 4

HFBR & BOP STRUCTURES PA/SI REPORT

Walkover Survey Gamma Points - Radiological Analysis

Initial Sample Results

Parameters	^PRG	&Gamma 18 (1 - 2)			
Units - pCi/g	50 YR	Result	Qualifier	Error	Det. Lim
Americium - 241(A)	160	26.9		5.1	1.7
Americium - 241 (G)	160	11.3		1.7	0.862
Berylium - 7	NA	1.66	DL	4.13	6.2
Cesium - 134	NA	-0.0967	DL	0.169	0.266
Cesium - 137	67	1480		218	0.267
Cobalt - 56	NA	NA	NA	NA	NA
Cobalt - 57	NA	0.356	UI	0.193	0.212
Cobalt - 60	3300	0.75		0.129	0.0721
Europium - 152	NA	0.497	U	0.756	1.15
Europium - 154	NA	0.623	JI	0.623	0.266
Europium - 155	NA	-0.235	DL	0.631	0.81
Iodine - 129	NA	15	UI	1.98	2.64
Iron - 55	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	NA	NA
Manganese - 54	NA	0.0205	DL	0.0401	0.0662
Plutonium - 238	274	2.79	J	1.73	2.29
Plutonium - 239/240	170	177		28.9	1.57
Plutonium - 241	NA	66.5		38.4	63.8
Potassium - 40	NA	NA	NA	NA	NA
Sodium - 22	NA	0.224	UI	0.0943	0.0596
Strontium - 90	15	1670		16.2	1.52
Technetium - 99	NA	-0.463	U	1.49	3.7
Thalium - 208	NA	NA	NA	NA	NA
Thorium - 228	NA	0.364	DL	0.5	0.555
Thorium - 230	NA	0.45	DL	0.458	0.557
Thorium - 232	NA	0.355	DL	0.486	0.54
Tritium	9.6E+15	NA	NA	NA	NA
Uranium - 233/234	NA	1.41		0.647	0.696
Uranium - 234	NA	0.0466	DL	0.915	1.4
Uranium - 235	29	0.628	DL	1.16	1.65
Uranium - 235/236	29	-0.097	U	0.315	0.78
Uranium - 238 (A)	36	1.49		0.639	0.599
Uranium - 238 (G)	36	-3.46	DL	5.01	7.1
Vanadium - 48	NA	0.0815	U	0.134	0.222
Zinc - 65	NA	-0.179	U	0.111	0.167

NOTES:

( ) Depth in inches

NA - Not Available

U - Analyte was analyzed for but not detected.

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

I - Uncertain Identification or Interference

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

& - Samples submitted to GEL. Others initial samples submitted to ASL.

PRG - BNL. Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instltiutional controls.

TABLE 5

HFBR & BOF[illegible]ctures PA/SI REPORT

Walkover Survey Gamma Points - Radiological

Endpoint Sample Results

Parameters	BNL Site	^PRG	^PRG	*Gamma 1 - Soil Area				Gamma 1EP (6 - 9)				*Gamma 2 - Soil Area				Gamma 2 EP (2 - 6)			
Units - pCi/g	Bkgrd*	0-Year	50 YR	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	Error +/-	Det. Lim
Actimium - 228	NA	NA	NA	0.560	NA	15.02	NA	NA	NA	NA	NA	0.576	NA	15.16	NA	NA	NA	NA	NA
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.148	U	0.191	0.376
Americium - 241 (G)	ND	36	160	NA	NA	NA	NA	0.000705	U	0.0196	0.0349	NA	NA	NA	NA	0.0193	U	0.0272	0.0236
Berylium - 7	NA	NA	NA	0.284	NA	73.53	NA	-0.0851	U	0.165	0.289	NA	NA	NA	NA	0.246	J-I	0.235	0.215
Bismuth - 212	NA	NA	NA	0.426	NA	42.27	NA	NA	NA	NA	NA	0.442	NA	35.98	NA	NA	NA	NA	NA
Bismuth - 214	NA	NA	NA	0.423	NA	15.92	NA	NA	NA	NA	NA	0.372	NA	17.32	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	NA	NA	NA	NA	-0.00931	U	0.0233	0.0158	NA	NA	NA	NA	-0.0126	U	0.022	0.0177
Cesium - 137	1.5	6.9	67	0.312	NA	20.62	NA	0.332	J	0.0553	0.0272	0.203	NA	24.25	NA	0.254	J	0.0651	0.0185
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	NA	NA	NA	NA	-0.00181	U	0.00787	0.0147	NA	NA	NA	NA	-0.00999	U	0.0133	0.0101
Cobalt - 60	ND	1.5	3300	NA	NA	NA	NA	-0.00044	U	0.0151	0.026	NA	NA	NA	NA	-0.0151	U	0.0237	0.0176
Europium - 152	ND	3.5	NA	NA	NA	NA	NA	-0.0132	U	0.0371	0.0627	NA	NA	NA	NA	0.00942	U	0.0547	0.0457
Europium - 154	ND	3.2	NA	NA	NA	NA	NA	-0.0235	U	0.0465	0.0775	NA	NA	NA	NA	0.0229	U	0.067	0.0579
Europium - 155	ND	1300	NA	NA	NA	NA	NA	0.0157	U	0.0302	0.0578	NA	NA	NA	NA	0.0206	U	0.0463	0.0386
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.135	U	0.202	0.287
Iron - 55	NA	NA	NA	NA	NA	NA	NA	-2.29	DL	7.16	7.76	NA	NA	NA	NA	0.74	DL	4.53	6.17
Lead - 212	NA	NA	NA	0.617	NA	14.95	NA	NA	NA	NA	NA	0.604	NA	15.34	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	0.454	NA	16.46	NA	NA	NA	NA	NA	0.413	NA	16.89	NA	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	NA	NA	NA	NA	0.0159	U	0.0206	0.0268	NA	NA	NA	NA	0.0357	J-I	0.0309	0.0182
Plutonium - 238	ND	44	274	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-0.0591	U	0.0361	0.099
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0268	U	0.0469	0.0822
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.02	U	3.68	6.13
Potassium - 40	NA	NA	NA	4.680	NA	18.2	NA	NA	NA	NA	NA	4.26	NA	18.98	NA	6.04	U	0.98	0.159
Promethium - 147	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 224	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 226	1	NA	^^5	1.560	NA	39.98	NA	NA	NA	NA	NA	0.877	NA	62.8	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	NA	NA	NA	NA	-0.00834	U	0.0168	0.0281	NA	NA	NA	NA	0.00837	U	0.0242	0.0209
Strontium - 90	0.3	9.3	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.175	U	0.261	0.576
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-0.738	U	1.46	3.7
Thalium - 208	NA	NA	NA	0.226	NA	20.91	NA	NA	NA	NA	NA	0.217	NA	20.62	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	NA	NA	NA	NA	0.7	U	0.0983	0.0359	NA	NA	NA	NA	0.812	U	0.138	0.0241
Thorium - 230	NA	NA	NA	NA	NA	NA	NA	0.441	J	0.0869	0.0467	NA	NA	NA	NA	0.524	U	0.12	0.0388
Thorium - 232	1	NA	NA	0.682	NA	38.03	NA	0.675	U	0.0948	0.0346	0.766	NA	31.73	NA	0.789	U	0.134	0.0234
Tritium	NA	NA	9.6E+15	NA	NA	NA	NA	2.04	U	4.05	6.92	NA	NA	NA	NA	-10.6	U	7.38	13.5
Uranium - 233/234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.518	J	0.234	0.177
Uranium - 234	1.8	200	NA	NA	NA	NA	NA	0.547	J	0.126	0.0777	NA	NA	NA	NA	0.623	J	0.155	0.0592
Uranium - 235	ND	28	29	NA	NA	NA	NA	0.13	U	0.134	0.133	NA	NA	NA	NA	0.00656	U	0.155	0.0949
Uranium - 235/236	NA	NA	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.172	J	0.136	0.164
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.552	J	0.239	0.146
Uranium - 238 (G)	1.8	97	36	NA	NA	NA	NA	1	U	0.496	0.334	NA	NA	NA	NA	0.916	U	0.637	0.221
Vanadium-48	NA	NA	NA	NA	NA	NA	NA	0.0539	U	0.0723	0.116	NA	NA	NA	NA	0.0544	U	0.0707	0.0572
Zinc - 65	NA	NA	NA	NA	NA	NA	NA	-0.0519	U	0.0372	0.0596	NA	NA	NA	NA	0.0101	U	0.0524	0.0396

Notes:

NA - Not Available

I - Uncertain Identification or Interference

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

U - Analyte was analyzed for but not detected.

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint).

( ) Depth in inches

ND-Not detectable.

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*. CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

^PRG - Preliminary remedialioin goals, industrial use with 50 years of institiutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also commonly used by EPA.

Walkover Survey Gamma Points - Radiological
Endpoint Sample Results

Parameters	BNL Site	^PRG	^PRG	*Gamma 4 (23 - 24)				*Gamma 5 - Soil Area				*Gamma 5 (1 - 6)				*Gamma 6 - Soil Area			
Units - pCi/g	Bkgrd*	0-Year	50 YR	Result	Qualifier	Error+/-	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	% Error	Det. Lim
Actimium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.57	NA	15.19	NA
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	NA	NA	NA	NA	0	U	2	0.0654	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	-0.00673	U	0.0467	0.0813	NA	NA	NA	NA	-0.033	U	0.107	0.065	NA	NA	NA	NA
Berylium - 7	NA	NA	NA	0.0446	U	0.098	0.182	NA	NA	NA	NA	0.0742	U	0.142	0.126	0.13	NA	88.84	NA
Bismuth - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth - 214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.443	NA	16.32	NA
Cesium - 134	NA	NA	NA	-0.00546	U	0.0104	0.0158	NA	NA	NA	NA	0.0141	JI	0.0151	0.0119	NA	NA	NA	NA
Cesium - 137	1.5	6.9	67	0.417	J	0.0294	0.0192	0.173	NA	26.69	NA	0.131	J	0.0352	0.0122	0.234	NA	22.93	NA
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	0.0016	U	0.00707	0.0133	NA	NA	NA	NA	0.00141	U	0.0102	0.00965	NA	NA	NA	NA
Cobalt - 60	ND	1.5	3300	0.499		0.0366	0.018	NA	NA	NA	NA	-0.00323	U	0.016	0.0108	NA	NA	NA	NA
Europium - 152	ND	3.5	NA	-0.0287	U	0.0266	0.048	NA	NA	NA	NA	0.0574	JI	0.0573	0.0341	NA	NA	NA	NA
Europium - 154	ND	3.2	NA	-0.0141	U	0.0291	0.0504	NA	NA	NA	NA	0.000415	U	0.0487	0.0346	NA	NA	NA	NA
Europium - 155	ND	1300	NA	0.0251	U	0.0292	0.0562	NA	NA	NA	NA	-0.0177	U	0.0396	0.0364	NA	NA	NA	NA
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-0.0537	U	0.232	0.282	NA	NA	NA	NA
Iron - 55	NA	NA	NA	-14.9	DL	7.02	7.89	NA	NA	NA	NA	-2.64	U	2.25	2.52	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA	0.441	NA	19.93	NA	NA	NA	NA	NA	0.64	NA	15.35	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	0.266	NA	68.67	NA	NA	NA	NA	NA	0.457	NA	16.03	NA
Manganese - 54	NA	NA	NA	0.00215	U	0.013	0.02	NA	NA	NA	NA	-0.0072	U	0.0154	0.0126	NA	NA	NA	NA
Plutonium - 238	ND	44	274	NA	NA	NA	NA	NA	NA	NA	NA	-0.0655	U	0.137	0.427	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	NA	NA	NA	NA	0.0806	U	0.103	0.154	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.113	U	6.04	10.4	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	3.76	NA	21.32	NA	5.41		0.548	0.117	4.76	NA	18.11	NA
Promethium - 147	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 224	1	NA	NA	NA	NA	NA	NA	0.88	NA	76.05	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 226	1	NA	^^5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00502	U	0.0105	0.0181	NA	NA	NA	NA	9.45E-05	U	0.0175	0.0124	NA	NA	NA	NA
Strontium - 90	0.3	9.3	15	NA	NA	NA	NA	NA	NA	NA	NA	0.258	U	0.539	1.22	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-1.23	U	1.57	4.07	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	0.198	NA	28.72	NA	NA	NA	NA	NA	0.192	NA	22.58	NA
Thorium - 228	NA	NA	NA	0.6		0.0378	0.0294	NA	NA	NA	NA	0.499	J	0.0537	0.0201	NA	NA	NA	NA
Thorium - 230	NA	NA	NA	0.413	J	0.0516	0.0327	NA	NA	NA	NA	0.319	J	0.0608	0.0219	NA	NA	NA	NA
Thorium - 232	1	NA	NA	0.586		0.0369	0.0287	NA	NA	NA	NA	0.488	J	0.0525	0.0196	0.714	NA	33.97	NA
Tritium	NA	NA	9.6E+15	4.82	U	3.85	6.33	NA	NA	NA	NA	-8.72	U	7.23	13.1	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.68	J	0.17	0.0619	NA	NA	NA	NA
Uranium - 234	1.8	200	NA	0.453	J	0.0719	0.0675	NA	NA	NA	NA	0.291	J	0.1	0.0494	NA	NA	NA	NA
Uranium - 235	ND	28	29	0.103	U	0.109	0.111	NA	NA	NA	NA	0.0273	U	0.0812	0.0757	NA	NA	NA	NA
Uranium - 235/236	NA	NA	29	NA	NA	NA	NA	NA	NA	NA	NA	0.0318	U	0.044	0.0767	NA	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	NA	NA	NA	NA	0.421	J	0.13	0.0619	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	0.779	J	0.667	0.663	NA	NA	NA	NA	0.179	U	0.916	0.535	NA	NA	NA	NA
Vanadium-48	NA	NA	NA	-0.0131	U	0.0281	0.05	NA	NA	NA	NA	-0.0331	U	0.035	0.026	NA	NA	NA	NA
Zinc - 65	NA	NA	NA	-0.00273	U	0.0292	0.0452	NA	NA	NA	NA	0.0104	U	0.0383	0.0288	NA	NA	NA	NA

Notes:

NA - Not Available

I - Uncertain Identification or Interference

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

U - Analyte was analyzed for but not detected.

~Sample depths were not noted on COC.

( ) Depth in inches

ND-Not detectable.

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

^PRG - Preliminary remediatioin goals, industrial use with 50 years of institiutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also commonly used by EPA.

Walkover Survey Gamma Points - Radiological
Endpoint Sample Results

Parameters	BNL Site	^PRG	^PRG	Gamma 6 EP (1 - 2)				*Gamma 7 - Soil Area				Gamma 7 EP (12 - 14)				*Gamma 8 - Soil Area			
Units - pCi/g	Bkgrd*	0-Year	50 YR	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	% Error	Det. Lim
Actimium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.864	NA	28.45	NA
Americium - 241 (A)	ND	36	160	0.072	U	0.206	0.475	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	0.0121	U	0.0437	0.0351	NA	NA	NA	NA	0.0392	U	0.0546	0.104	NA	NA	NA	NA
Beryllium - 7	NA	NA	NA	0.0337	U	0.282	0.246	NA	NA	NA	NA	-0.138	U	0.114	0.19	NA	NA	NA	NA
Bismuth - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth - 214	NA	NA	NA	NA	NA	NA	NA	0.632	NA	37.94	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	0.00162	U	0.0277	0.0206	NA	NA	NA	NA	-0.00476	U	0.0101	0.015	NA	NA	NA	NA
Cesium - 137	1.5	6.9	67	0.232	J	0.0653	0.0253	NA	NA	NA	NA	0.106	J	0.0262	0.0176	0.259	NA	37.01	NA
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	0.112	NA	59.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	-0.0122	U	0.0169	0.0142	NA	NA	NA	NA	0.00302	U	0.00708	0.013	NA	NA	NA	NA
Cobalt - 60	ND	1.5	3300	0.0516	J-I	0.0338	0.0326	0.301	NA	36.75	NA	0.332		0.0497	0.0169	NA	NA	NA	NA
Europium - 152	ND	3.5	NA	0.0124	U	0.0793	0.0584	NA	NA	NA	NA	-0.00763	U	0.0245	0.0443	NA	NA	NA	NA
Europium - 154	ND	3.2	NA	-0.0219	U	0.0771	0.0595	NA	NA	NA	NA	-0.0118	U	0.0287	0.0496	NA	NA	NA	NA
Europium - 155	ND	1300	NA	0.076	J-I	0.064	0.0584	NA	NA	NA	NA	0.0149	U	0.0285	0.0528	NA	NA	NA	NA
Iodine - 129	NA	NA	NA	-0.0703	U	0.207	0.246	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	-0.248	DL	4.57	6.26	NA	NA	NA	NA	-13.1	DL	7.61	8.39	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA	1.16	NA	30.91	NA	NA	NA	NA	NA	0.643	NA	28.34	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	0.931	NA	44.75	NA	NA	NA	NA	NA	0.486	NA	30.75	NA
Manganese - 54	NA	NA	NA	-0.00132	U	0.03	0.0249	0.137	NA	65.4	NA	0.00736	U	0.0129	0.0194	NA	NA	NA	NA
Plutonium - 238	ND	44	274	-0.00607	U	0.021	0.0581	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	0.0121	U	0.0664	0.124	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	3.75	U	3.43	5.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	5.71		0.93	0.163	7.57	NA	27.74	NA	NA	NA	NA	NA	4.72	NA	31.07	NA
Promethium - 147	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 224	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 226	1	NA	^^5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00796	U	0.0278	0.0214	NA	NA	NA	NA	-0.00438	U	0.0104	0.0179	NA	NA	NA	NA
Strontium - 90	0.3	9.3	15	0.195	U	0.313	0.698	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	-0.193	U	1.34	3.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	0.376	NA	37.05	NA	NA	NA	NA	NA	0.279	NA	39.19	NA
Thorium - 228	NA	NA	NA	0.808		0.157	0.032	NA	NA	NA	NA	0.555		0.07	0.0269	NA	NA	NA	NA
Thorium - 230	NA	NA	NA	0.508		0.146	0.0425	NA	NA	NA	NA	0.275	J	0.0556	0.0313	NA	NA	NA	NA
Thorium - 232	1	NA	NA	0.786		0.153	0.0311	NA	NA	NA	NA	0.536		0.0676	0.0259	NA	NA	NA	NA
Tritium	NA	NA	9.6E+15	-6.21	U	7.34	13.1	NA	NA	NA	NA	3.4	U	3.84	6.43	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	0.331	J	0.191	0.173	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234	1.8	200	NA	0.533	J	0.208	0.0791	NA	NA	NA	NA	0.326	J	0.0766	0.0631	NA	NA	NA	NA
Uranium - 235	ND	28	29	0.114	U	0.139	0.123	NA	NA	NA	NA	0.0626	U	0.0921	0.103	NA	NA	NA	NA
Uranium - 235/236	NA	NA	29	0.038	U	0.0728	0.155	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	0.368	J	0.198	0.131	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	1.16		1.03	0.329	NA	NA	NA	NA	0.144	U	0.789	0.759	NA	NA	NA	NA
Vanadium-48	NA	NA	NA	0.0688	U	0.0899	0.0802	NA	NA	NA	NA	-0.0231	U	0.0436	0.076	NA	NA	NA	NA
Zinc - 65	NA	NA	NA	0.000973	U	0.0682	0.0482	NA	NA	NA	NA	-0.0115	U	0.0275	0.0409	NA	NA	NA	NA

Notes:

NA - Not Available

I - Uncertain Identification or Interference

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

U - Analyte was analyzed for but not detected.

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

( ) Depth in inches

ND-Not detectable.

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

PRG - BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

^PRG - Preliminary remediatioin goals, industrial use with 50 years of institiutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also commonly used by EPA.

LE 5

HFBR & BOP ctures PA/SI REPORT

Walkover Survey Gamma Points - Radiological

Endpoint Sample Results

Parameters	BNL Site	^PRG	^PRG	Gamma 8 EP (1 - 2)				*Gamma 10 - Soil Area				*Gamma 12 - Soil Area				Gamma 12/13 EP (8 - 12)			
Units - pCi/g	Bkgrd*	0-Year	50 YR	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	Error +/-	Det. Lim
Actimium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (A)	ND	36	160	0.133	U	0.209	0.437	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	0.017	U	0.105	0.148	NA	NA	NA	NA	NA	NA	NA	NA	0.0094	U	0.0146	0.0278
Berylium - 7	NA	NA	NA	-0.132	U	0.179	0.29	0.811	NA	43.59	NA	0.481	NA	67.72	NA	0.26	U	0.242	0.29
Bismuth - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth - 214	NA	NA	NA	NA	NA	NA	NA	0.408	NA	21.48	NA	0.239	NA	25.66	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	0.00292	U	0.0156	0.0266	NA	NA	NA	NA	NA	NA	NA	NA	0.00107	U	0.0129	0.0202
Cesium - 137	1.5	6.9	67	0.208	J	0.0413	0.0293	1.95	NA	17.09	NA	2.05	NA	16.94	NA	1.59	J	0.207	0.0226
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	0.00437	DL	0.0116	0.0222	NA	NA	NA	NA	NA	NA	NA	NA	0.00885	U	0.0152	0.0137
Cobalt - 60	ND	1.5	3300	0.0312	U	0.0294	0.0445	1.58	NA	11.9		0.70	NA	12.55	NA	0.613		0.0749	0.0212
Europium - 152	ND	3.5	NA	0.0224	U	0.0433	0.0812	NA	NA	NA	NA	NA	NA	NA	NA	0.048	U	0.0492	0.0584
Europium - 154	ND	3.2	NA	0.0356	U	0.0558	0.111	NA	NA	NA	NA	NA	NA	NA	NA	0.0268	U	0.034	0.0623
Europium - 155	ND	1300	NA	0.0179	U	0.0481	0.0923	NA	NA	NA	NA	NA	NA	NA	NA	0.00303	U	0.0235	0.0468
Iodine - 129	NA	NA	NA	-0.0631	U	0.211	0.254	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	1.93	DL	4.51	6.19	NA	NA	NA	NA	NA	NA	NA	NA	-23.4	DL	9.42	9.89
Lead - 212	NA	NA	NA	NA	NA	NA	NA	0.582	NA	17.37	NA	0.306	NA	20.76	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	0.356	NA	25.86	NA	0.243	NA	28.08	NA	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	0.00858	U	0.0196	0.0374	NA	NA	NA	NA	NA	NA	NA	NA	0.0107	U	0.0127	0.0239
Plutonium - 238	ND	44	274	0.0254	U	0.0867	0.184	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	-0.0162	U	0.0411	0.124	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	1.89	U	3.41	5.77	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	4.77		0.794	0.236	3.85	NA	19.57	NA	4.02	NA	18.49	NA	NA	NA	NA	NA
Promethium - 147	NA	NA	NA	NA	NA	NA	NA	1.50	NA	56.62	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 224	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 226	1	NA	^^5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	0.0126	U	0.02	0.0399	NA	NA	NA	NA	NA	NA	NA	NA	0.00963	U	0.0123	0.0225
Strontium - 90	0.3	9.3	15	0.0169	U	0.305	0.721	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	0.511	U	1.29	3.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	0.20	NA	28.5	NA	0.118	NA	33.61	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	0.526		0.0813	0.0504	NA	NA	NA	NA	NA	NA	NA	NA	0.201	J	0.0389	0.0301
Thorium - 230	NA	NA	NA	0.42	J	0.0938	0.0573	NA	NA	NA	NA	NA	NA	NA	NA	0.15	J	0.063	0.0385
Thorium - 232	1	NA	NA	0.512		0.0792	0.0491	NA	NA	NA	NA	NA	NA	NA	NA	0.193	J	0.0375	0.029
Tritium	NA	NA	9.6E+15	-5.8	U	6.71	12	NA	NA	NA	NA	NA	NA	NA	NA	6.03	U	4.11	6.68
Uranium - 233/234	NA	NA	NA	0.174	J	0.114	0.166	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234	1.8	200	NA	0.362	J	0.129	0.117	NA	NA	NA	NA	NA	NA	NA	NA	0.13	J	0.0794	0.0732
Uranium - 235	ND	28	29	0.0873	U	0.0998	0.19	NA	NA	NA	NA	NA	NA	NA	NA	0.0668	U	0.111	0.109
Uranium - 235/236	NA	NA	29	0.0343	U	0.0792	0.186	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	0.169	U	0.156	0.241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	1.57		1.36	1.1	NA	NA	NA	NA	NA	NA	NA	NA	1.3		0.448	0.26
Vanadium-48	NA	NA	NA	0.00466	U	0.0579	0.107	NA	NA	NA	NA	NA	NA	NA	NA	0.00638	U	0.0637	0.115
Zinc - 65	NA	NA	NA	-0.0226	U	0.048	0.0815	NA	NA	NA	NA	NA	NA	NA	NA	0.0187	U	0.049	0.0527

Notes:

NA - Not Available

I - Uncertain Identification or Interference

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

U - Analyte was analyzed for but not detected.

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

( ) Depth in inches

ND-Not detectable.

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

^PRG - Preliminary remediatioin goals, industrial use with 50 years of institiutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also commonly used by EPA.

BLE 5

HFBR & BOP ctures PA/SI REPORT

Walkover Survey Gamma Points - Radiological

Endpoint Sample Results

Parameters	BNL Site	^PRG	^PRG	*Gamma 13 - Soil Area				*Gamma 15 (2 - 3)				Gamma 16 EP (2 - 3)				*Gamma 17 - Soil Area			
Units - pCi/g	Bkgrd*	0-Year	50 YR	Result	Qualifier	% Error	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	% Error	Det. Lim
Actimium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.894	NA	13.37	NA
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	0.157	J	0.142	0.0942	0	U	2	0.0716	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	NA	NA	NA	NA	0.0376	U	0.0237	0.0421	0.0187	U	0.0635	0.0715	NA	NA	NA	NA
Berylium - 7	NA	NA	NA	0.625	NA	45.72	NA	0.277	DL	0.346	0.471	0.0181	DL	0.237	0.435	NA	NA	NA	NA
Bismuth - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth - 214	NA	NA	NA	0.222	NA	23.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.63	NA	14.15	NA
Cesium - 134	NA	NA	NA	NA	NA	NA	NA	-0.0819	U	0.0196	0.0258	0.0029	U	0.019	0.0301	NA	NA	NA	NA
Cesium - 137	1.5	6.9	67	2.850	NA	17.01	NA	8.46		1.06	0.0257	3.79		0.453	0.0317	5.68	NA	17.15	NA
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	NA	NA	NA	NA	-0.000993	U	0.0102	0.0193	-0.00875	DL	0.0125	0.0232	NA	NA	NA	NA
Cobalt - 60	ND	1.5	3300	0.686	NA	12.32	NA	0.00627	U	0.0108	0.021	0.00822	U	0.0168	0.0282	0.0671	NA	24.41	NA
Europium - 152	ND	3.5	NA	NA	NA	NA	NA	0.0105	U	0.0516	0.0919	-0.014	U	0.0497	0.0926	NA	NA	NA	NA
Europium - 154	ND	3.2	NA	NA	NA	NA	NA	-0.000853	U	0.0364	0.0639	0.0201	U	0.0501	0.0935	NA	NA	NA	NA
Europium - 155	ND	1300	NA	NA	NA	NA	NA	0.0224	U	0.0365	0.0704	0.011	U	0.0469	0.0904	NA	NA	NA	NA
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	0.317	U	0.507	0.528	-0.0088	U	0.435	0.415	NA	NA	NA	NA
Iron - 55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	0.278	NA	19.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.869	NA	15.13	NA
Lead - 214	NA	NA	NA	0.228	NA	30.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.657	NA	16.42	NA
Manganese - 54	NA	NA	NA	NA	NA	NA	NA	0.000186	U	0.012	0.0217	-0.0038	U	0.0164	0.0289	NA	NA	NA	NA
Plutonium - 238	ND	44	274	NA	NA	NA	NA	0.0109	U	0.0442	0.13	0	U	2	0.0681	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	0.71	J	0.26	0.0627	0.193	J	0.139	0.141	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	-0.392	U	3.1	5.38	-1.87	U	3.44	6.07	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	2.030	NA	21.38	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.10	NA	16.79	NA
Promethium - 147	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 224	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 226	1	NA	^^5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.31	NA	38.69	NA
Sodium - 22	NA	NA	NA	NA	NA	NA	NA	-0.000414	U	0.0131	0.023	0.00714	U	0.018	0.0337	NA	NA	NA	NA
Strontium - 90	0.3	9.3	15	NA	NA	NA	NA	0.403	J	0.149	0.234	42.4		1.2	0.267	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	-0.726	U	1.14	2.94	-1.14	U	1.03	2.75	NA	NA	NA	NA
Thalium - 208	NA	NA	NA	0.081	NA	49.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.33	NA	20.38	NA
Thorium - 228	NA	NA	NA	NA	NA	NA	NA	0.415	J	0.104	0.0459	0.227	J	0.0701	0.0519	NA	NA	NA	NA
Thorium - 230	NA	NA	NA	NA	NA	NA	NA	0.188	J	0.0666	0.0541	0.274	J	0.089	0.0603	NA	NA	NA	NA
Thorium - 232	1	NA	NA	NA	NA	NA	NA	0.403	J	0.101	0.0447	0.221	J	0.0682	0.0505	1.10	NA	30.29	NA
Tritium	NA	NA	9.6E+15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	NA	NA	NA	NA	0.0481	U	0.0754	0.147	0.268	J	0.158	0.156	NA	NA	NA	NA
Uranium - 234	1.8	200	NA	NA	NA	NA	NA	0.289	J	0.138	0.116	0.325	J	0.155	0.122	NA	NA	NA	NA
Uranium - 235	ND	28	29	NA	NA	NA	NA	0.0254	U	0.0838	0.158	0.0534	U	0.097	0.184	NA	NA	NA	NA
Uranium - 235/236	NA	NA	29	NA	NA	NA	NA	0.0212	U	0.0424	0.0635	-0.00991	U	0.0141	0.128	NA	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	0.232	J	0.142	0.0633	0.361	J	0.18	0.128	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	NA	NA	NA	NA	0.338	U	0.434	0.395	0.365	U	0.795	0.656	NA	NA	NA	NA
Vanadium-48	NA	NA	NA	NA	NA	NA	NA	-0.0105	U	0.0374	0.0657	0.00912	U	0.0478	0.09	NA	NA	NA	NA
Zinc - 65	NA	NA	NA	NA	NA	NA	NA	-0.0229	U	0.034	0.0481	0.00565	U	0.0433	0.0691	NA	NA	NA	NA

Notes:

NA - Not Available

I - Uncertain Identification or Interference

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

U - Analyte was analyzed for but not detected.

~Sample depths were not noted on COC.

( ) Depth in inches

ND-Not detectable.

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

* - Sample ID incorrectly labeled with "EP" (Endpoint) .

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, residential use with 0 years of instiliutional controls.

^PRG - Preliminary remediatioin goals, industrial use with 50 years of instiliutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also commonly used by EPA.

Walkover Survey Gamma Points - Radiological
Endpoint Sample Results

Parameters	BNL Site	^PRG	^PRG	Gamma 17 EP (14 - 18)				Gamma 18 EP (2 - 3)				Gamma 19 EP (2 - 3)				*Gamma 20 (2 - 3)			
Units - pCi/g	Bkgrd*	0-Year	50 YR	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	Error +/-	Det. Lim	Result	Qualifier	Error +/-	Det. Lim
Actimium - 228	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (A)	ND	36	160	0.0986	U	0.106	0.138	0.0202	U	0.0546	0.14	0.0637	U	0.0905	0.0956	0.0487	U	0.086	0.18
Americium - 241 (G)	ND	36	160	0.06	U	0.0907	0.159	0.028	U	0.0456	0.0677	-0.039	U	0.114	0.197	0.0671	U	0.0592	0.111
Berylium - 7	NA	NA	NA	0.0853	DL	0.18	0.339	-0.0337	U	0.132	0.237	-0.195	DL	0.339	0.602	-0.199	DL	0.25	0.451
Bismuth - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bismuth - 214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	-0.00045	U	0.0114	0.0184	0.00325	U	0.0106	0.0167	-0.0519	U	0.0192	0.0302	0.00635	U	0.0132	0.0243
Cesium - 137	1.5	6.9	67	5.64		0.542	0.0208	3.07		0.326	0.017	24		2.36	0.0303	17.1		1.76	0.0243
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	0.00701	U	0.03	0.0178	-0.0000742	U	0.00691	0.0131	0.0132	DL	0.014	0.0261	-0.00282	DL	0.0106	0.0205
Cobalt - 60	ND	1.5	3300	0.0722	J	0.0302	0.0169	0.00286	U	0.00901	0.0165	0.00584	U	0.0107	0.0205	-0.00006	U	0.00939	0.0172
Europium - 152	ND	3.5	NA	0.0699	J-I	0.0621	0.0687	0.0159	U	0.029	0.055	0.00135	U	0.0745	0.128	0.00456	U	0.0622	0.0982
Europium - 154	ND	3.2	NA	0.0378	U	0.0288	0.0567	-0.00349	U	0.0288	0.0506	0.00168	U	0.0295	0.0547	-0.0157	U	0.0273	0.0476
Europium - 155	ND	1300	NA	0.0212	U	0.0362	0.0724	0.0108	U	0.0259	0.0503	-0.000567	U	0.0548	0.103	0.00624	U	0.0405	0.0797
Iodine - 129	NA	NA	NA	0.0451	U	0.301	0.306	0.0348	U	0.281	0.287	0.295	U	0.617	0.616	1.16	UI	0.763	0.836
Iron - 55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	-0.00071	U	0.00976	0.0175	0.000546	U	0.00885	0.0163	0.0041	U	0.00991	0.0182	-0.000547	U	0.00835	0.015
Plutonium - 238	ND	44	274	0.0147	U	0.0596	0.175	0.518	J	0.251	0.146	-0.0141	U	0.0201	0.183	-0.0593	U	0.0404	0.27
Plutonium - 239/240	ND	40	170	0.141	J	0.128	0.0846	0.353	J	0.214	0.223	0.258	J	0.181	0.155	0.0648	U	0.131	0.29
Plutonium - 241	NA	NA	NA	0	U	4.48	7.75	-0.821	U	3.16	5.52	-0.303	U	3.25	5.64	-1.9	U	3.79	6.68
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Promethium - 147	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 224	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium - 226	1	NA	^^5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	0.0137	U	0.0104	0.0205	-0.00124	U	0.0104	0.0182	0.000735	U	0.0106	0.0197	-0.00553	U	0.00981	0.0172
Strontium - 90	0.3	9.3	15	5.65		0.456	0.255	0.857	J	0.218	0.329	1	J	0.2	0.211	0.34	J	0.16	0.287
Technetium - 99	ND	NA	NA	0.382	U	1.22	2.9	-0.707	U	0.964	2.49	-1.36	U	1.07	2.89	0.0459	U	1.19	2.88
Thalium - 208	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	0.615		0.0782	0.0396	0.213	J	0.0385	0.0295	0.165	J	0.0595	0.0681	0.0641	J	0.0507	0.0526
Thorium - 230	NA	NA	NA	0.36	J	0.0661	0.038	0.241	J	0.0537	0.0321	0.246	J	0.0704	0.0612	0.178	J	0.0565	0.0506
Thorium - 232	1	NA	NA	0.595		0.0756	0.0383	0.208	J	0.0375	0.0287	0.161	J	0.0581	0.0665	0.0626	J	0.0494	0.0513
Tritium	NA	NA	9.6E+15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	0.576	J	0.239	0.167	0.331	J	0.199	0.187	0.377	J	0.21	0.266	0.231	J	0.165	0.193
Uranium - 234	1.8	200	NA	0.39	J	0.12	0.0921	0.225	J	0.0838	0.0725	0.209	J	0.175	0.162	0.19	J	0.132	0.127
Uranium - 235	ND	28	29	0.00742	U	0.122	0.136	0.053	U	0.0544	0.103	0.00427	U	0.11	0.202	0.0743	U	0.0853	0.164
Uranium - 235/236	NA	NA	29	0.00621	U	0.048	0.154	0.0216	U	0.0818	0.219	0.0335	U	0.0642	0.137	0.0522	U	0.0922	0.193
Uranium - 238 (A)	1.8	97	36	0.542	J	0.23	0.138	0.392	J	0.223	0.231	0.472	J	0.213	0.137	0.377	J	0.203	0.135
Uranium - 238 (G)	1.8	97	36	0.506	DL	1.03	1.09	1.21		0.738	0.54	0.797	DL	1.22	1.46	0.126	U	0.657	0.857
Vanadium-48	NA	NA	NA	0.0426	U	0.0551	0.0723	0.0176	U	0.026	0.0496	-0.00395	U	0.0263	0.0462	0.00579	U	0.0239	0.0435
Zinc - 65	NA	NA	NA	-0.0188	U	0.029	0.0411	0.0155	U	0.0219	0.0365	-0.00619	U	0.0295	0.0437	-0.0407	U	0.021	0.0325

Notes:

NA - Not Available

I - Uncertain Identification or Interference

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

U - Analyte was analyzed for but not detected.

~Sample depths were not noted on COC.

* - Sample ID incorrectly labeled with "EP" (Endpoint).

( ) Depth in inches

ND-Not deteclable.

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, residential use with 0 years of instiiutional controls.

^PRG - Preliminary remediatioin goals, industrial use with 50 years of instiiutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also commonly used by EPA.

TABLE 5

HFBR & BOP Closures PA/SI REPORT

Walkover Survey Gamma Points - Radiological
Endpoint Sample Results

Parameters	BNL Site	^PRG	^PRG	*Gamma 21 (2 - 3)			
Units - pCI/g	Bkgrd*	0-Year	50 YR	Result	Qualifier	Error +/-	Det. Lim
Actimium - 228	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (A)	ND	36	160	0	U	2	0.0854
Americium - 241 (G)	ND	36	160	0.00454	U	0.0108	0.021
Berylium - 7	NA	NA	NA	0.0212	U	0.138	0.259
Bismuth - 212	NA	NA	NA	NA	NA	NA	NA
Bismuth - 214	NA	NA	NA	NA	NA	NA	NA
Cesium - 134	NA	NA	NA	-0.00514	U	0.0101	0.0159
Cesium - 137	1.5	6.9	67	5.29		0.597	0.0174
Cobalt - 56	NA	NA	NA	NA	NA	NA	NA
Cobalt - 57	NA	NA	NA	0.000158	U	0.00623	0.0113
Cobalt - 60	ND	1.5	3300	0.00844	U	0.00716	0.0171
Europium - 152	ND	3.5	NA	-0.0081	U	0.0314	0.0562
Europium - 154	ND	3.2	NA	-0.0201	U	0.0318	0.0463
Europium - 155	ND	1300	NA	0.0196	U	0.0327	0.0393
Iodine - 129	NA	NA	NA	0.296	U	0.524	0.504
Iron - 55	NA	NA	NA	NA	NA	NA	NA
Lead - 212	NA	NA	NA	NA	NA	NA	NA
Lead - 214	NA	NA	NA	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	-0.00308	U	0.00888	0.0135
Plutonium - 238	ND	44	274	-0.0272	U	0.0245	0.183
Plutonium - 239/240	ND	40	170	0	U	2	0.0679
Plutonium - 241	NA	NA	NA	-0.536	U	3.24	5.64
Potassium - 40	NA	NA	NA	NA	NA	NA	NA
Promethium - 147	NA	NA	NA	NA	NA	NA	NA
Radium - 224	1	NA	NA	NA	NA	NA	NA
Radium - 226	1	NA	^^5	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00713	U	0.0114	0.0167
Strontium - 90	0.3	9.3	15	0.539	J	0.174	0.258
Technetium - 99	ND	NA	NA	-1.21	DL	2.04	5.21
Thalium - 208	NA	NA	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	0.123	J	0.0324	0.029
Thorium - 230	NA	NA	NA	0.237	J	0.0527	0.032
Thorium - 232	1	NA	NA	0.12	J	0.0316	0.0284
Tritium	NA	NA	9.6E+15	NA	NA	NA	NA
Uranium - 233/234	NA	NA	NA	0.321	J	0.189	0.203
Uranium - 234	1.8	200	NA	0.296	J	0.0998	0.0697
Uranium - 235	ND	28	29	0.101	J	0.0992	0.0978
Uranium - 235/236	NA	NA	29	-0.0171	U	0.0199	0.165
Uranium - 238 (A)	1.8	97	36	0.421	J	0.207	0.125
Uranium - 238 (G)	1.8	97	36	0.645	J	0.306	0.196
Vanadium-48	NA	NA	NA	-0.0156	U	0.0247	0.0414
Zinc - 65	NA	NA	NA	0.00574	U	0.0214	0.0351

Notes:

NA - Not Available

I - Uncertain Identification or Interference

J - The reported value is an estimated quantity

DL - Detection limit requirements not met

U - Analyte was analyzed for but not detected.

~Sample depths were not noted on COC.

* - Sample ID Incorrectly labeled with "EP" (Endpoint) .

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, residential use with 0 years of instiiiutional controls.

^PRG - Preliminary remediatioin goals, industrial use with 50 years of instiiiutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also commonly used by EPA.

( ) Depth in inches

ND-Not detectable.

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

TABLE 5A

HFBR & BOP STRUCTURES PA/SI REPORT

Radiological Results

(Samples collected by RDHP & Submitted to ASL)

Parameters	^PRG	AOI018-01 (1 ft)			AOI018-01 (3 ft)			AOI021-03 (0-2 inches)			AOI021-04 (0-2 inches)		
Units - pCi/g	50 YR	Result	% Error	DL	Result	% Error	DL	Result	% Error	DL	Result	% Error	DL
Actinium-228	NA	0.664	19.44	NA	NA	NA	NA	0.466	18	NA	NA	NA	NA
Bismuth-212	NA	NA	NA	NA	NA	NA	NA	0.443	42.63	NA	0.428	17.27	NA
Bismuth-214	NA	NA	NA	NA	NA	NA	NA	0.324	18.68	NA	0.38	16.87	NA
Cesium - 137	67	0.0988	43.01	NA	NA	NA	NA	0.409	19.2	NA	0.409	18.55	NA
Lead - 212	NA	0.56	18.32	NA	0.329	46.56	NA	0.488	17.28	NA	0.503	16.17	NA
Lead - 214	NA	0.395	23.09	NA	NA	NA	NA	0.391	17.57	NA	0.354	18.48	NA
Potassium - 40	NA	4.85	19.96	NA	NA	NA	NA	4.290	18.61	NA	4.580	18.05	NA
Radium-226	^^5	0.949	69.05	NA	NA	NA	NA	0.803	66.35	NA	NA	NA	NA
Thalium - 208	NA	0.198	31.31	NA	0.164	51.65	NA	0.168	21.62	NA	0.174	24	NA
Thorium - 232	NA	0.679	40.11	NA	NA	NA	NA	0.55	32.07	NA	0.47	47.4	NA

NOTES:

Samples analyzed by Analytical Services Laboratory, on-site.

( ) Depth in feet or inches

DL - Detection limit.

NA - Not Available

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study,* CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instiitutional controls.

^^ - DOE Order 5400.5 *Radiation Protection of the Public and the Environment*. Also, commonly used by EPA

le 6

HFBR & BOP Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 002-01 (0 - 0.5)				AOI 002-02 (0 - 0.5)				AOI 006-01 (0 - 0.5)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Llm	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	0.0699	U	0.157	0.352	0.0826	U	0.16	0.35	-0.0344	U	0.127	0.395
Americium - 241 (G)	ND	36	160	-0.0202	U	0.0775	0.0649	-0.0665	U	0.0992	0.0634	-0.017	U	0.0228	0.0198
Berylium - 7	NA	NA	NA	-0.188	U	0.257	0.202	-0.0246	U	0.214	0.187	0.233	DL	0.326	0.303
Cesium - 134	NA	NA	NA	0.0104	U	0.0201	0.0165	0.00639	U	0.0195	0.0156	0.0101	U	0.0193	0.0159
Cesium - 137	1.5	6.9	67	0.867	J	0.117	0.0162	0.412	J	0.0686	0.015	3.69	U	0.435	0.0161
Cobalt - 57	NA	47	NA	0.00464	U	0.014	0.0129	-0.00406	U	0.0119	0.0108	0.000922	U	0.0126	0.0109
Cobalt - 60	ND	1.5	3300	-0.00413	U	0.0204	0.0165	0.00549	U	0.0189	0.0169	0.00217	U	0.0191	0.0164
Europium - 152	ND	3.5	NA	0.0334	U	0.0502	0.0466	-0.0198	U	0.054	0.0442	0.0294	U	0.0617	0.055
Europium - 154	ND	3.2	NA	-0.0156	U	0.0725	0.0594	0.0297	U	0.0536	0.0501	-0.0112	U	0.0629	0.0516
Europium - 155	ND	1300	NA	-0.0257	U	0.056	0.0497	0.00313	U	0.0536	0.0503	0.0262	U	0.0461	0.0415
Iodine - 129	NA	NA	NA	0.0115	U	0.276	0.278	-0.0021	U	0.187	0.241	0.0521	U	0.263	0.275
Iron - 55	NA	NA	NA	5.09	DL	4.5	6.03	-1.28	DL	3.94	5.46	0.505	DL	4.28	5.9
Manganese - 54	NA	NA	NA	0.00416	U	0.0157	0.0139	-0.00759	U	0.0188	0.0147	0.00542	U	0.0184	0.0161
Plutonium - 238	ND	44	274	-0.0286	U	0.081	0.212	-0.0578	U	0.09	0.236	-0.0139	U	0.0506	0.149
Plutonium - 239/240	ND	40	170	0.00656	U	0.0571	0.143	0.0623	U	0.0712	0.12	0.0133	U	0.0426	0.103
Plutonium - 241	NA	NA	NA	2.56	U	3.61	6.09	1.43	U	3.41	5.8	-1.73	U	4.04	7.05
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00579	U	0.026	0.0215	0.0108	U	0.0194	0.0181	-0.00397	U	0.0228	0.0187
Strontium - 90	0.3	9.3	15	0.263	U	0.278	0.599	0.289	U	0.258	0.535	1.52	J	0.4	0.64
Technetium - 99	ND	NA	NA	-1.03	U	0.787	2.03	-0.765	U	0.641	1.664	-1.44	U	0.606	1.65
Thorium - 228	NA	NA	NA	0.438	J	0.0854	0.0262	0.472	J	0.0846	0.0284	0.31	J	0.0746	0.0293
Thorium - 230	NA	NA	NA	0.193	J	0.0926	0.034	0.319	J	0.0944	0.03	0.261	J	0.0951	0.0322
Thorium - 232	1	NA	NA	0.422	J	0.0823	0.0253	0.454	J	0.0815	0.0274	0.299	J	0.0719	0.0286
Tritium	NA	NA	9.6E+15	2.46	U	2.07	3.41	2.25	U	2.09	3.47	1.36	U	2.04	3.45
Uranium - 233/234 (A)	NA	NA	NA	-0.00912	U	0.0989	0.292	0.192	U	0.156	0.225	0.287	J	0.212	0.264
Uranium - 234 (G)	1.8	200	NA	0.182	J	0.131	0.0711	0.258	J	0.114	0.0553	0.369	J	0.179	0.0577
Uranium - 235 (G)	ND	28	29	0.0957	U	0.117	0.108	-0.0164	U	0.102	0.0919	-0.0356	U	0.0918	0.0843
Uranium - 235/236 (A)	NA	NA	29	0.0193	U	0.0523	0.134	-0.0115	U	0.0163	0.149	0.0328	U	0.0656	0.0983
Uranium - 238 (A)	1.8	97	36	0.146	J	0.126	0.134	0.214	J	0.145	0.0714	0.0418	U	0.0964	0.227
Uranium - 238 (G)	1.8	97	36	0.922		1.18	0.584	0.571	J-I	1.61	0.553	0.277	J	0.445	0.205
Vanadium - 48	NA	NA	NA	0.0985	U	0.106	0.0987	-0.0522	U	0.0849	0.0606	-0.0323	U	0.0984	0.0766
Zinc - 65	NA	NA	NA	0.0523	J-I	0.0507	0.045	-0.00932	U	0.0448	0.0317	0.0244	U	0.0437	0.0403

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of instiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 006 - 01 (4.5 - 5.0)				AOI 006-02 (0 - 0.5)				AOI 006 - 02 (4.5 - 5.0)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	0.138	U	0.156	0.29	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	-0.0234	U	0.0277	0.0539	-0.0798	U	0.185	0.178	0.00396	U	0.0179	0.0332
Berylium - 7	NA	NA	NA	0.0259	U	0.109	0.192	-1.02	DL	1.2	1.04	0.000266	U	0.0431	0.0781
Cesium - 134	NA	NA	NA	-0.00581	U	0.00948	0.0147	0.0324	DL	0.0591	0.0443	0.00239	U	0.00605	0.00998
Cesium - 137	1.5	6.9	67	7.8		0.93	0.0137	**271**	U	28.3	0.041	0.0659	J	0.0163	0.00986
Cobalt - 57	NA	47	NA	0.00376	U	0.00676	0.0128	-0.016	DL	0.0407	0.0372	0.00303	U	0.00386	0.00755
Cobalt - 60	ND	1.5	3300	-0.000111	U	0.0082	0.0125	0.0576	J-I	0.0293	0.00841	0.000106	U	0.00605	0.0109
Europium - 152	ND	3.5	NA	0.0119	U	0.0299	0.0548	-0.0803	U	0.204	0.183	-0.0023	U	0.0149	0.0277
Europium - 154	ND	3.2	NA	-0.0165	U	0.0192	0.0323	0.00647	U	0.0312	0.0263	-0.00174	U	0.0175	0.0313
Europium - 155	ND	1300	NA	0.00973	U	0.0272	0.0518	-0.0256	U	0.149	0.138	0.0108	U	0.0261	0.0304
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	5.29	UI	1.02	1.4	NA	NA	NA	NA
Iron - 55	NA	NA	NA	NA	NA	NA	NA	3.08	DL	4.25	5.74	NA	NA	NA	NA
Manganese - 54	NA	NA	NA	0.00685	U	0.00872	0.0116	-0.00476	U	0.0103	0.00871	0.00323	U	0.00561	0.0093
Plutonium - 238	ND	44	274	NA	NA	NA	NA	-0.0146	U	0.0999	0.236	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	0.0927	U	0.0909	0.147	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	3.46	U	3.66	6.13	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00563	U	0.00681	0.0115	0.00236	U	0.0113	0.00954	-0.00106	U	0.00626	0.0112
Strontium - 90	0.3	9.3	15	2.72		0.341	0.347	**33.1**		1.47	0.594	5.2		0.442	0.32
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	-0.825	U	0.499	1.31	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	0.39	J	0.0525	0.0303	0.313	J	0.155	0.0951	0.207	J	0.0294	0.0158
Thorium - 230	NA	NA	NA	0.228	J	0.0526	0.03	0.245	J	0.156	0.0885	0.125	J	0.0306	0.0199
Thorium - 232	1	NA	NA	0.387	J	0.0522	0.0301	0.301	J	0.149	0.0918	0.206	J	0.0292	0.0157
Tritium	NA	NA	9.6E+15	NA	NA	NA	NA	2.69	U	2.1	3.46	NA	NA	NA	NA
Uranium - 233/234 (A)	NA	NA	NA	NA	NA	NA	NA	0.0864	U	0.143	0.299	NA	NA	NA	NA
Uranium - 234 (G)	1.8	200	NA	0.338	J	0.0896	0.0729	0.321	J	0.395	0.229	0.174	J	0.0498	0.0362
Uranium - 235 (G)	ND	28	29	0.0635	U	0.0828	0.108	-0.0647	U	0.314	0.284	0.0701	J	0.0649	0.0679
Uranium - 235/236 (A)	NA	NA	29	NA	NA	NA	NA	0.0159	U	0.0645	0.19	NA	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	0.206	J	0.163	0.161	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	0.21	U	0.513	0.47	0.0513	DL	1.47	1.41	0.809	J	0.402	0.288
Vanadium - 48	NA	NA	NA	-0.00456	U	0.00826	0.014	-0.00836	U	0.0456	0.0384	0.00687	U	0.00762	0.0142
Zinc - 65	NA	NA	NA	0.0115	U	0.0168	0.0273	-0.0208	U	0.0277	0.0186	0.00998	U	0.0147	0.0243

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instiiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of instiiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOP Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 018 - 01 (16 - 20)				AOI 019-01 (4 - 6)				AOI 019-SB-1 (5 - 6)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	0.0733	U	0.0554	0.0736	0.0488	U	0.0465	0.0668	0.0214	U	0.058	0.149
Americium - 241 (G)	ND	36	160	-0.048	U	0.0543	0.045	0.0152	U	0.018	0.0158	0.00149	U	0.0306	0.0297
Berylium - 7	NA	NA	NA	-0.0417	U	0.103	0.0781	0.0455	U	0.121	0.11	-0.272	DL	0.4	0.337
Cesium - 134	NA	NA	NA	0.00552	U	0.00899	0.00723	0.0108	J-I	0.0121	0.00984	0.00106	U	0.00913	0.0069
Cesium - 137	1.5	6.9	67	0.0211	J	0.0152	0.00696	-3.62E-05	U	0.0118	0.0103	-0.000777	U	0.00803	0.00676
Cobalt - 57	NA	47	NA	0.00661	J-I	0.00822	0.00539	-0.00399	U	0.00699	0.00637	-0.00124	U	0.00756	0.00695
Cobalt - 60	ND	1.5	3300	-0.00174	U	0.00894	0.00741	-0.00421	U	0.0123	0.0102	-0.00083	U	0.0094	0.0077
Europium - 152	ND	3.5	NA	-0.00183	U	0.0287	0.0216	-0.00519	U	0.0334	0.0251	-0.0135	U	0.022	0.0194
Europium - 154	ND	3.2	NA	0.0151	U	0.0291	0.0259	-0.00477	U	0.0348	0.0283	0.00134	U	0.0277	0.0231
Europium - 155	ND	1300	NA	0.0258	J-I	0.025	0.024	0.0458	J-I	0.0386	0.0251	0.0144	U	0.0234	0.0222
Iodine - 129	NA	NA	NA	0.0176	U	0.157	0.209	0.113	U	0.152	0.225	-0.0077	U	0.187	0.237
Iron - 55	NA	NA	NA	0.997	U	2.43	2.96	-1.77	U	2.34	2.88	0.256	U	2.08	2.28
Manganese - 54	NA	NA	NA	0.00706	J-I	0.0105	0.00473	-0.00228	U	0.0122	0.0103	0.00276	U	0.0108	0.00955
Plutonium - 238	ND	44	274	0.223	J	0.203	0.134	3.58	J	0.902	0.276	0.0494	U	0.122	0.277
Plutonium - 239/240	ND	40	170	0.201	U	0.204	0.277	0.109		0.127	0.109	-0.0381	U	0.0274	0.187
Plutonium - 241	NA	NA	NA	4.7	U	6.51	11	3.02	U	7.25	12.3	1.31	U	7.02	12
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	0.00732	U	0.0103	0.00933	-0.00167	U	0.0126	0.102	0.000568	U	0.0106	0.00887
Strontium - 90	0.3	9.3	15	0.162	U	0.525	1.21	-0.265	U	0.433	1.13	-0.414	U	0.605	1.54
Technetium - 99	ND	NA	NA	0.144	U	0.435	1.03	-0.172	U	0.341	0.88	0.403	U	1.64	3.91
Thorium - 228	NA	NA	NA	0.36	J	0.0574	0.012	0.395	J	0.0652	0.0138	0.41	J	0.0568	0.0124
Thorium - 230	NA	NA	NA	0.263	J	0.0595	0.0145	0.212	J	0.0686	0.0193	0.21	J	0.0496	0.0122
Thorium - 232	1	NA	NA	0.349	J	0.0558	0.0117	0.384	J	0.0634	0.0134	0.354	J	0.049	0.0107
Tritium	NA	NA	9.6E+15	2.06	U	2.54	4.28	-2.36	U	3.1	5.68	-3.12	U	7.85	13.8
Uranium - 233/234 (A)	NA	NA	NA	0.291	J	0.188	0.199	0.161	J	0.133	0.153	0.258	J	0.0839	0.0423
Uranium - 234 (G)	1.8	200	NA	0.246	J	0.0823	0.0293	0.223	J	0.0951	0.0343	0.215	J	0.0742	0.0252
Uranium - 235 (G)	ND	28	29	0.00353	U	0.0476	0.0436	0.000189	U	0.126	0.569	0.0338	U	0.0468	0.0433
Uranium - 235/236 (A)	NA	NA	29	-0.0127	U	0.018	0.165	0.0188	U	0.0508	0.13	0.00514	U	0.0261	0.0601
Uranium - 238 (A)	1.8	97	36	0.284	J	0.179	0.139	0.0187	U	0.0507	0.13	0.268	J	0.0846	0.0183
Uranium - 238 (G)	1.8	97	36	0.563	J	0.851	0.35	0.646	J	0.432	0.153	0.00167	U	0.51	0.249
Vanadium - 48	NA	NA	NA	-0.00158	U	0.0326	0.0269	0.02	U	0.0432	0.0377	0.151	J-I	4.96	0
Zinc - 65	NA	NA	NA	-0.012	U	0.0222	0.0155	0.0166	U	0.0285	0.022	0.00804	U	0.0325	0.0244

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instiiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of instiiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOP Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 019-SB-2 (5 - 6)				AOI 019-SB-3 (5 - 6)				AOI 020 - 01 (0 - 0.17)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	0	U	2	0.0596	0.0166	U	0.0294	0.0531	0.0485	U	0.093	0.198
Americium - 241 (G)	ND	36	160	-0.00145	U	0.0317	0.0273	-0.0065	U	0.0285	0.027	-0.0097	U	0.024	0.0461
Berylium - 7	NA	NA	NA	0.291	DL	0.499	0.344	0.393	UI	0.413	0.375	0.102	U	0.0741	0.134
Cesium - 134	NA	NA	NA	-0.0034	U	0.00924	0.00693	-0.00662	U	0.00976	0.000691	-0.00643	U	0.00829	0.0125
Cesium - 137	1.5	6.9	67	-0.00867	U	0.00792	0.00648	0.238	J	0.0352	0.007	1.43	J	0.174	0.0131
Cobalt - 57	NA	47	NA	0.00195	U	0.00766	0.007	0.000882	U	0.00747	0.00682	-0.00371	U	0.00558	0.0101
Cobalt - 60	ND	1.5	3300	-0.000568	U	0.00938	0.00787	0.000927	U	0.00898	0.00752	0.00638	U	0.00713	0.0134
Europium - 152	ND	3.5	NA	0.00399	U	0.0208	0.0186	0.00363	U	0.0211	0.0191	-0.00557	U	0.0224	0.0402
Europium - 154	ND	3.2	NA	-0.0042	U	0.0255	0.0213	-0.014	U	0.0244	0.0192	0.0137	U	0.0219	0.0402
Europium - 155	ND	1300	NA	0.0359	J-I	0.024	0.0227	0.0121	U	0.0232	0.0216	0.005	U	0.0226	0.0423
Iodine - 129	NA	NA	NA	0.124	U	0.174	0.251	0.0809	U	0.175	0.0244	-0.0572	U	0.225	0.273
Iron - 55	NA	NA	NA	-1.45	U	1.95	2.19	-1.08	U	1.94	2.13	3.82	J	2.88	3.63
Manganese - 54	NA	NA	NA	-0.00444	U	0.0104	0.00864	0.0133	J-I	0.0201	0.00876	0.0127	J-I	0.00963	0.0122
Plutonium - 238	ND	44	274	-0.0924	U	0.0762	0.336	-0.014	U	0.135	0.374	0.0267	U	0.0534	0.08
Plutonium - 239/240	ND	40	170	0.0197	U	0.0583	0.137	0.0203	U	0.0551	0.141	0.0638	U	0.0954	0.176
Plutonium - 241	NA	NA	NA	-0.455	U	6.05	10.4	-4.16	U	6.07	10.7	-0.965	U	5.21	9.07
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00156	U	0.00977	0.00817	-0.00534	U	0.00933	0.00735	0.00314	U	0.00789	0.0143
Strontium - 90	0.3	9.3	15	-0.0308	U	0.609	1.46	-0.281	U	0.538	1.37	0.606	J	0.205	0.353
Technetium - 99	ND	NA	NA	-0.92	U	1.72	4.37	-1.89	U	1.73	4.62	0.917	U	1.43	3.29
Thorium - 228	NA	NA	NA	0.436	J	0.0592	0.0118	0.37	J	0.0501	0.0124	0.473	J	0.058	0.0221
Thorium - 230	NA	NA	NA	0.225	J	0.0444	0.0129	0.257	J	0.0481	0.0125	0.262	J	0.0489	0.0262
Thorium - 232	1	NA	NA	0.376	J	0.0511	0.0102	0.32	J	0.0433	0.0107	0.469	J	0.0576	0.0219
Tritium	NA	NA	9.6E+15	-5.4	U	6.74	12	-10	U	5.66	10.5	5.09	J	2.9	4.66
Uranium - 233/234 (A)	NA	NA	NA	0.504	J	0.134	0.0891	0.614	J	0.174	0.0744	0.866	J	0.316	0.209
Uranium - 234 (G)	1.8	200	NA	0.225	J	0.0662	0.0255	0.253	J	0.0682	0.024	0.334	J	0.0776	0.0539
Uranium - 235 (G)	ND	28	29	0.0432	J	0.0851	0.0423	0.0628	J	0.083	0.0428	0.0613	U	0.0494	0.0901
Uranium - 235/236 (A)	NA	NA	29	0.0573	U	0.0513	0.0769	-0.00817	U	0.065	0.152	0.0332	U	0.105	0.258
Uranium - 238 (A)	1.8	97	36	0.438	J	0.119	0.0489	0.387	J	0.142	0.117	0.543	J	0.224	0.169
Uranium - 238 (G)	1.8	97	36	0.0405	U	0.506	0.231	0.446	J-I	0.262	0.245	0.501	J	0.458	0.406
Vanadium - 48	NA	NA	NA	2.65	UI	4.68	0	-2.11	U	4.42	0	0.00573	U	0.0106	0.0167
Zinc - 65	NA	NA	NA	0.0334	J-I	0.0298	0.0243	-0.0927	U	0.0344	0.023	0.0106	U	0.018	0.0291

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOP Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 020 - 02 (0 - 0.17)				AOI 023 - 01 (0 - 0.5)				AOI 027 - 01 (0 - 0.5)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	0.0701	U	0.0995	0.105	0.0275	U	0.0551	0.0825	0.0537	J	0.0483	0.0322
Americium - 241 (G)	ND	36	160	-0.00163	U	0.0196	0.0321	-0.00265	U	0.0379	0.0373	0.000564	U	0.0405	0.0691
Berylium - 7	NA	NA	NA	0.0736	U	0.182	0.21	0.0219	U	0.114	0.103	0.0404	U	0.113	0.202
Cesium - 134	NA	NA	NA	-0.00247	U	0.0143	0.0217	0.00158	U	0.012	0.00928	0.0025	U	0.012	0.0193
Cesium - 137	1.5	6.9	67	1.22	J	0.162	0.026	0.0986	J	0.0259	0.0115	0.145	J	0.0312	0.0192
Cobalt - 57	NA	47	NA	0.00567	U	0.00738	0.014	0.00378	U	0.00748	0.00716	0.00839	U	0.00849	0.0158
Cobalt - 60	ND	1.5	3300	0.0086	U	0.0146	0.0262	0.0938	J	0.0338	0.00982	0.0713	U	0.0126	0.025
Europium - 152	ND	3.5	NA	-0.0256	U	0.0355	0.0592	-0.00568	U	0.0283	0.0256	-0.0182	U	0.0292	0.0509
Europium - 154	ND	3.2	NA	-0.00455	U	0.0411	0.0706	0.0104	UJ-D	0.03	0.0266	0.000737	U	0.0338	0.0612
Europium - 155	ND	1300	NA	0.00539	U	0.0466	0.0548	-0.0145	UJ(-)-B	0.0311	0.0288	0.0986	J-I	0.0643	0.0604
Iodine - 129	NA	NA	NA	-0.119	U	0.222	0.238	-0.0265	U	0.216	0.274	-0.0817	U	0.216	0.255
Iron - 55	NA	NA	NA	1.55	U	2.89	3.7	-7.18	DL	4.59	5.46	-1.5	U	2.8	3.37
Manganese - 54	NA	NA	NA	0.00676	U	0.0136	0.0249	0.00636	UJ-D	0.022	0.0118	0.00295	U	0.0186	0.0185
Plutonium - 238	ND	44	274	-0.00902	U	0.0181	0.165	0.109	J-D	0.11	0.082	0.0892		0.104	0.0892
Plutonium - 239/240	ND	40	170	0.0117	U	0.0646	0.197	-0.00656	U	0.0131	0.144	0.0226	U	0.0612	0.157
Plutonium - 241	NA	NA	NA	0.358	U	4.59	7.93	2.91	U	5.93	10	3.54	U	8.1	13.7
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.0016	U	0.0147	0.0252	0.00366	U	0.0108	0.00953	-0.000197	U	0.0122	0.0221
Strontium - 90	0.3	9.3	15	0.704	J	0.209	0.328	0.146	U	0.477	1.1	0.27	U	0.456	1.02
Technetium - 99	ND	NA	NA	0.463	U	1.31	3.1	0.573	U	1.15	2.68	0.197	U	1.05	2.53
Thorium - 228	NA	NA	NA	0.477	J	0.0714	0.032	0.349	J	0.0545	0.0152	0.42	J	0.0593	0.0321
Thorium - 230	NA	NA	NA	0.31	J	0.0808	0.0444	0.195	J	0.0569	0.0193	0.311	J	0.0635	0.0389
Thorium - 232	1	NA	NA	0.473	J	0.0709	0.0318	0.342	J	0.0533	0.0149	0.411	J	0.0579	0.0313
Tritium	NA	NA	9.6E+15	3.8	U	2.87	4.7	4.8	J	2.48	3.93	2.33	U	2.44	4.07
Uranium - 233/234 (A)	NA	NA	NA	0.516	J	0.274	0.285	0.26	J	0.167	0.178	0.184	U	0.158	0.203
Uranium - 234 (G)	1.8	200	NA	0.357	J	0.0942	0.0779	0.105	J	0.072	0.0405	0.392	J	0.0954	0.0764
Uranium - 235 (G)	ND	28	29	0.0182	U	0.109	0.122	0.0258	U	0.0616	0.0579	0.11	U	0.125	0.136
Uranium - 235/236 (A)	NA	NA	29	0.0315	U	0.0906	0.229	0.0132	U	0.0724	0.203	0.0587	U	0.0834	0.0881
Uranium - 238 (A)	1.8	97	36	0.325	J	0.205	0.159	0.237	J	0.16	0.178	0.22	J	0.169	0.182
Uranium - 238 (G)	1.8	97	36	1.11		0.485	0.302	0.433	UJ(+)-B	0.698	0.324	0.402	U	0.719	0.591
Vanadium - 48	NA	NA	NA	0.0231	U	0.0188	0.0352	0.0105	U	0.0284	0.0255	-0.00563	U	0.0296	0.0514
Zinc - 65	NA	NA	NA	0.0345	U	0.0338	0.049	-0.0233	U	0.0294	0.023	0.00555	U	0.0291	0.0466

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instiliutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of instiliutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOP Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 034-01 (4 - 6)				AOI 034 - 02 (4 - 6)				AOI 034 - 03 (4 - 6)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	-0.0134	U	0.0507	0.0485	-0.0126	U	0.0456	0.091	0.0563	U	0.0719	0.0652
Berylium - 7	NA	NA	NA	0.0478	U	0.144	0.129	0.0802	U	0.147	0.282	-0.0176	U	0.114	0.1
Cesium - 134	NA	NA	NA	0.008	U	0.0133	0.0108	-0.00707	U	0.015	0.0234	-0.00864	U	0.0135	0.0094
Cesium - 137	1.5	6.9	67	0.0409	J	0.00305	0.0137	0.0122	U	0.0314	0.0246	-0.00645	U	0.0148	0.0122
Cobalt - 57	NA	47	NA	0.000439	U	0.00968	0.00893	0.00202	DL	0.0114	0.0219	-0.00261	U	0.00897	0.00723
Cobalt - 60	ND	1.5	3300	0.0209	J-I	0.0123	0.0126	0.0133	U	0.0147	0.0301	-0.0139	U	0.0126	0.00842
Europium - 152	ND	3.5	NA	-0.0179	U	0.0347	0.0302	-0.0165	U	0.0353	0.0647	0.0159	U	0.0392	0.0308
Europium - 154	ND	3.2	NA	0.013	U	0.04	0.0349	-0.00377	U	0.0488	0.0776	-0.00483	U	0.0393	0.0329
Europium - 155	ND	1300	NA	-0.00338	U	0.0376	0.0349	0.0207	U	0.0578	0.0847	-0.00609	U	0.034	0.0313
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	-1.37	U	1.98	2.22	0.899	U	2	2.14	-0.466	U	1.99	2.16
Manganese - 54	NA	NA	NA	0.00126	U	0.0137	0.0121	1.35E-06	U	0.0153	0.0281	0.0103	U	0.0131	0.0119
Plutonium - 238	ND	44	274	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	0.00468	U	0.0144	0.0126	-0.00141	U	0.0176	0.028	-0.000868	U	0.0139	0.0117
Strontium - 90	0.3	9.3	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	0.46	J	0.0723	0.0192	0.691		0.0955	0.0458	0.342	J	0.0634	0.0165
Thorium - 230	NA	NA	NA	0.254	J	0.0771	0.0225	0.352	J	0.0783	0.0476	0.241	J	0.0692	0.0192
Thorium - 232	1	NA	NA	0.447	J	0.0704	0.0187	0.669		0.0924	0.0444	0.337	J	0.0624	0.0163
Tritium	NA	NA	9.6E+15	-0.52	U	8.14	14.5	-3.34	U	7.69	13.6	3.28	U	3.4	5.67
Uranium - 233/234 (A)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234 (G)	1.8	200	NA	0.336	J	0.107	0.0425	0.5	J	0.135	0.105	0.181	J	0.113	0.0426
Uranium - 235 (G)	ND	28	29	0.0338	U	0.0802	0.0741	0.0731	U	0.0904	0.174	0.0214	U	0.0687	0.0633
Uranium - 235/236 (A)	NA	NA	29	NA	NA	NA	NA	NA	NA	NA	NA	NN	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	0.226	U	0.786	0.042	0.447	U	0.678	0.824	0.884	J	1.38	0.474
Vanadium - 48	NA	NA	NA	0.0088	U	0.039	0.0345	-0.0287	U	0.0602	0.104	-0.015	U	0.0236	0.0176
Zinc - 65	NA	NA	NA	-0.000727	U	0.0373	0.0272	0.0352	U	0.0406	0.0564	0.0155	U	0.0319	0.0259

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I. *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instiitutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of instiitutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOF Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 034 - 04 (4 - 6)				AOI 036 - 01 (12 - 14)				AOI 036 - 02 (4 - 6)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	-0.0256	U	0.0544	0.217	0.0624	U	0.0878	0.154
Americium - 241 (G)	ND	36	160	-0.00234	U	0.0302	0.0615	0.00757	U	0.0375	0.0734	-0.0374	U	0.0619	0.0981
Berylium - 7	NA	NA	NA	-0.0162	U	0.0853	0.154	0.0734	U	0.101	0.186	0.068	U	0.111	0.21
Cesium - 134	NA	NA	NA	0.00689	U	0.00976	0.0144	0.00524	U	0.0115	0.0189	-0.0024	U	0.0131	0.0213
Cesium - 137	1.5	6.9	67	0.00208	U	0.0094	0.0155	0.0601	J	0.0237	0.0216	0.04	J-I	0.0291	0.0253
Cobalt - 57	NA	47	NA	0.00231	U	0.00598	0.0116	0.00475	U	0.00837	0.0158	-0.00385	U	0.00777	0.0146
Cobalt - 60	ND	1.5	3300	-0.00917	U	0.00869	0.0143	0.00735	U	0.0157	0.0196	-0.00707	U	0.0117	0.0209
Europium - 152	ND	3.5	NA	-0.0157	U	0.0217	0.0395	-0.0189	U	0.0307	0.0546	-0.00787	U	0.0324	0.0577
Europium - 154	ND	3.2	NA	-0.0107	U	0.0263	0.0465	-0.011	U	0.0353	0.0619	0.0293	U	0.0422	0.083
Europium - 155	ND	1300	NA	0.035	U	0.0239	0.0479	0.056	U	0.0661	0.0654	-0.011	U	0.0321	0.0613
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	-0.109	U	0.194	0.224	0.0846	U	0.14	0.217
Iron - 55	NA	NA	NA	-9.85	DL	7.52	8.26	-2.4	U	2.78	3.36	-1.89	U	2.7	3.31
Manganese - 54	NA	NA	NA	0.0141	U	0.0103	0.0146	0.0105	U	0.013	0.0238	-0.00752	U	0.0113	0.02
Plutonium - 238	ND	44	274	NA	NA	NA	NA	0.0533	U	0.146	0.337	0.00978	U	0.11	0.287
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	0.0181	U	0.049	0.126	0.079	U	0.103	0.19
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	0.1	U	5.35	9.22	0.494	U	6.21	10.7
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00397	U	0.00947	0.0167	-0.00349	U	0.0126	0.0222	0.0105	U	0.0151	0.0298
Strontium - 90	0.3	9.3	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	-0.27	U	1.22	3.04	0.252	U	1.04	2.49
Thorium - 228	NA	NA	NA	0.48	J	0.0624	0.0238	0.805		0.0969	0.0338	0.323	J	0.0533	0.0313
Thorium - 230	NA	NA	NA	0.258	J	0.0504	0.0293	0.467	J	0.0827	0.0363	0.199	J	0.0633	0.0395
Thorium - 232	1	NA	NA	0.466	J	0.0607	0.0232	0.792		0.0953	0.0332	0.318	J	0.0523	0.0308
Tritium	NA	NA	9.6E+15	2.78	U	3.63	6.13	1.4	U	3.37	5.79	5.31	U	3.95	6.47
Uranium - 233/234 (A)	NA	NA	NA	NA	NA	NA	NA	0.395	J	0.121	0.0252	0.274	J	0.106	0.112
Uranium - 234 (G)	1.8	200	NA	0.319	J	0.0742	0.0537	0.631	J	0.107	0.0752	0.254	J	0.0815	0.0822
Uranium - 235 (G)	ND	28	29	0.181	J	0.114	0.0978	0.0862	U	0.0756	0.14	0.0804	U	0.0663	0.13
Uranium - 235/236 (A)	NA	NA	29	NA	NA	NA	NA	0.0492	U	0.0523	0.0829	0.055	U	0.0464	0.0624
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	0.27	J	0.106	0.0915	0.124	J	0.0692	0.079
Uranium - 238 (G)	1.8	97	36	1.01		0.712	0.504	0.686	J	0.668	0.625	0.134	U	0.442	0.805
Vanadium - 48	NA	NA	NA	-0.00647	U	0.032	0.0485	0.00639	U	0.0231	0.0409	0.00308	U	0.0224	0.043
Zinc - 65	NA	NA	NA	-0.0165	U	0.0231	0.034	0.0274	U	0.0297	0.0501	0.0311	U	0.0315	0.0585

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit 1, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOF Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 037 - 01 (14 - 16)				AOI 038 - 01 (6 - 8)				AOI 038 - 02 (4 - 6)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	0.00455	U	0.0471	0.0459	0.016	U	0.024	0.0218	-0.0387	U	0.0638	0.042
Berylium - 7	NA	NA	NA	-0.0197	U	0.128	0.112	0.0574	U	0.182	0.162	0.0567	U	0.12	0.107
Cesium - 134	NA	NA	NA	0.000207	U	0.013	0.00991	-0.0221	U	0.0182	0.0143	-0.0619	U	0.0163	0.0101
Cesium - 137	1.5	6.9	67	0.0105	U	0.0136	0.0108	0.0198	J	0.0238	0.0177	0.0977	J	0.0312	0.00981
Cobalt - 57	NA	47	NA	0.0049	U	0.00849	0.00806	-0.0019	U	0.00954	0.00879	0.0073	U	0.00846	0.00803
Cobalt - 60	ND	1.5	3300	0.0085	U	0.0143	0.013	-0.000803	U	0.0181	0.0148	0.0108	U	0.0138	0.0127
Europium - 152	ND	3.5	NA	0.0683	J-I	0.0658	0.0329	-0.0102	U	0.0436	0.0362	0.00546	U	0.0337	0.0304
Europium - 154	ND	3.2	NA	-0.0106	U	0.0406	0.0332	-0.0276	U	0.0594	0.0469	0.0493	J-I	0.0396	0.0348
Europium - 155	ND	1300	NA	0.0158	U	0.0355	0.0339	-0.0021	U	0.0372	0.0349	0.0165	U	0.0352	0.0333
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	-0.736	U	2.27	2.76	-4.47	U	2.88	3.63	-0.906	U	2.94	3.59
Manganese - 54	NA	NA	NA	0.00676	U	0.0149	0.013	-0.0165	U	0.0194	0.0159	0.00821	U	0.0139	0.0111
Piutonium - 238	ND	44	274	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	-0.00385	U	0.0146	0.0119	-0.01	U	0.0214	0.0169	0.0177	J-I	0.0142	0.0126
Strontium - 90	0.3	9.3	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	0.467	J	0.0687	0.0179	0.505		0.0812	0.0205	0.332	J	0.0549	0.0174
Thorium - 230	NA	NA	NA	0.253	J	0.071	0.0191	0.358	J	0.0946	0.0304	0.232	J	0.0547	0.021
Thorium - 232	1	NA	NA	0.456	J	0.0671	0.0175	0.492	J	0.079	0.02	0.325	J	0.0536	0.017
Tritium	NA	NA	9.6E+15	3.54	U	2.55	4.16	1.81	U	2.47	4.17	3.06	U	2.45	4.03
Uranium - 233/234 (A)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234 (G)	1.8	200	NA	0.255	J	0.107	0.0442	0.371	J	0.121	0.0514	0.266	J	0.102	0.0371
Uranium - 235 (G)	ND	28	29	0.0141	U	0.073	0.0673	0.0663	U	0.147	0.0816	0.0342	U	0.0725	0.0667
Uranium - 235/236 (A)	NA	NA	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	0.182	U	0.412	0.404	1.29		0.584	0.199	1.08		1.08	0.352
Vanadium - 48	NA	NA	NA	0.0157	U	0.0392	0.0311	-0.0298	U	0.0595	0.0487	-0.00394	U	0.0341	0.0282
Zinc - 65	NA	NA	NA	-0.0401	U	0.0356	0.027	-0.0287	U	0.0517	0.0351	0.0154	U	0.0345	0.0273

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOF Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 039 - 01 (0 - 0.5)				AOI 041-01 (16 - 18)				AOI 043 - 01 (0 - 0.5)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	0.0915		0.106	0.0915	NA	NA	NA	NA	NA	NA	NA	NA
Americium - 241 (G)	ND	36	160	0.0384	U	0.0607	0.105	0.0305	U	0.0388	0.0332	-0.00173	U	0.018	0.0157
Berylium - 7	NA	NA	NA	0.0378	U	0.123	0.225	0.151	U	0.247	0.226	0.339		0.273	0.117
Cesium - 134	NA	NA	NA	-0.00258	U	0.0121	0.0196	-0.00642	U	0.0254	0.0187	-0.00205	U	0.0151	0.0112
Cesium - 137	1.5	6.9	67	0.135	J	0.0302	0.0231	-0.0133	U	0.0257	0.0212	0.0806	J	0.0318	0.0135
Cobalt - 57	NA	47	NA	-0.00252	U	0.00834	0.0159	0.00193	U	0.0141	0.0128	0.000611	U	0.00865	0.00722
Cobalt - 60	ND	1.5	3300	0.000476	U	0.0129	0.0251	-0.000567	U	0.0266	0.0226	0.0566	J-I	0.0267	0.0172
Europium - 152	ND	3.5	NA	0.0295	U	0.032	0.062	-0.0485	U	0.0613	0.0494	-0.00858	U	0.0362	0.03
Europium - 154	ND	3.2	NA	0.0207	UJ-D	0.0409	0.0789	-0.00348	U	0.0783	0.0637	-0.0192	UJ-D	0.0421	0.0328
Europium - 155	ND	1300	NA	0.00218	UJ(-)-B	0.0339	0.0663	-0.0113	U	0.0562	0.0509	0.0272	UJ(-)-B	0.0324	0.0283
Iodine - 129	NA	NA	NA	0.0214	U	0.174	0.229	NA	NA	NA	NA	NA	NA	NA	NA
Iron - 55	NA	NA	NA	-1.67	U	3.17	3.78	0.434	U	2.35	2.74	-4.03	U	2.69	3.42
Manganese - 54	NA	NA	NA	-0.00512	UJ-D	0.0118	0.021	-0.00238	U	0.0256	0.0215	0.00603	UJ-D	0.0168	0.0143
Plutonium - 238	ND	44	274	0.0894	UJ-D	0.114	0.171	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 239/240	ND	40	170	0.057	U	0.0932	0.171	NA	NA	NA	NA	NA	NA	NA	NA
Plutonium - 241	NA	NA	NA	7.17	U	8.41	14.1	NA	NA	NA	NA	NA	NA	NA	NA
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	6.59	J	1.09	0.155	NA	NA	NA	NA
Sodium - 22	NA	NA	NA	0.00748	U	0.0147	0.0283	-0.000929	U	0.0283	0.023	-0.00682	U	0.0151	0.0118
Strontium - 90	0.3	9.3	15	0.572	U	0.604	1.3	NA	NA	NA	NA	NA	NA	NA	NA
Technetium - 99	ND	NA	NA	-0.127	U	0.883	2.2	NA	NA	NA	NA	NA	NA	NA	NA
Thorium - 228	NA	NA	NA	0.385	J	0.0598	0.0362	0.79		0.126	0.0322	0.516		0.0897	0.0179
Thorium - 230	NA	NA	NA	0.211	J	0.0686	0.0365	0.545		0.128	0.0376	0.382	J	0.0874	0.0241
Thorium - 232	1	NA	NA	0.377	J	0.0586	0.0354	0.768		0.122	0.0313	0.505		0.0879	0.0184
Tritium	NA	NA	9.6E+15	3.02	U	2.34	3.84	-3.87	U	7.45	13.2	NA	NA	NA	NA
Uranium - 233/234 (A)	NA	NA	NA	0.291	J	0.197	0.219	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 234 (G)	1.8	200	NA	0.338	J	0.103	0.0814	0.719	J	0.207	0.0695	0.394	J	0.114	0.0414
Uranium - 235 (G)	ND	28	29	0.112	U	0.146	0.135	0.0522	U	0.153	0.105	0.0885	J	0.116	0.0663
Uranium - 235/236 (A)	NA	NA	29	0.00116	U	0.0645	0.22	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (A)	1.8	97	36	0.124	U	0.133	0.201	NA	NA	NA	NA	NA	NA	NA	NA
Uranium - 238 (G)	1.8	97	36	0.283	U	0.437	0.812	0.75	J	0.74	0.32	0.507	UJ(+)-B	0.4	0.154
Vanadium - 48	NA	NA	NA	-0.0369	U	0.0296	0.0453	0.021	U	0.0858	0.0734	-0.00689	U	0.039	0.031
Zinc - 65	NA	NA	NA	-0.014	U	0.0343	0.0507	0.00802	U	0.0588	0.0429	0.023	U	0.0398	0.0317

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of institiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of institiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

HFBR & BOF Structures PA/SI

Radiological Analysis - Soil Sample Results

Parameters	BNL Site	^PRG	^PRG	AOI 046-01 (0 - 2)				AOI 046 - 02 (0 - 2)				AOI 047 - 01 (0 - 2)			
Units - pCi/g	Bkgrd*	0-Year	50-Year	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim	Result	Qualifier	Error	Det. Lim
Americium - 241 (A)	ND	36	160	NA	NA	NA	NA	NA	NA	NA	NA	0.0469	U	0.0673	0.137
Americium - 241 (G)	ND	36	160	-0.0047	U	0.044	0.0719	0.0373	U	0.0713	0.124	0.000333	U	0.0416	0.074
Berylium - 7	NA	NA	NA	-0.0131	U	0.0772	0.134	0.0397	U	0.108	0.2	0.0978	U	0.133	0.232
Cesium - 134	NA	NA	NA	0.00151	U	0.00845	0.0157	-0.000737	U	0.012	0.0186	-0.00185	U	0.0137	0.0208
Cesium - 137	1.5	6.9	67	0.0386	J	0.0178	0.0147	0.114	J	0.0272	0.0203	0.158	J	0.0297	0.0226
Cobalt - 57	NA	47	NA	-0.00185	U	0.00562	0.0106	0.000813	U	0.00811	0.0149	-0.00402	U	0.00989	0.0167
Cobalt - 60	ND	1.5	3300	0.00513	U	0.00932	0.0182	-0.00926	U	0.0122	0.0203	-0.000333	U	0.0148	0.0257
Europium - 152	ND	3.5	NA	0.00212	U	0.0269	0.043	0.0139	U	0.0281	0.0535	0.000878	U	0.0393	0.0599
Europium - 154	ND	3.2	NA	-0.0329	U	0.0288	0.0441	-0.00549	U	0.0347	0.0622	0.0313	U	0.0448	0.0808
Europium - 155	ND	1300	NA	0.0157	U	0.0238	0.0465	0.0514	U	0.0343	0.066	0.0184	U	0.0391	0.0684
Iodine - 129	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-0.0356	U	0.215	0.263
Iron - 55	NA	NA	NA	-3.05	U	2.52	3.08	-2.73	U	1.81	2.02	-0.462	U	1.59	1.73
Manganese - 54	NA	NA	NA	0.0055	U	0.00877	0.0166	0.00114	U	0.0111	0.0207	-0.00993	U	0.0132	0.0216
Plutonium - 238	ND	44	274	NA	NA	NA	NA	NA	NA	NA	NA	-0.00223	U	0.00446	0.049
Plutonium - 239/240	ND	40	170	NA	NA	NA	NA	NA	NA	NA	NA	0	U	2	0.0278
Plutonium - 241	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.48	U	6.11	10.2
Potassium - 40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20.4		2.31	0.204
Sodium - 22	NA	NA	NA	-0.0118	U	0.0103	0.0158	-0.00197	U	0.0124	0.0223	0.0108	U	0.0161	0.0291
Strontium - 90	0.3	9.3	15	NA	NA	NA	NA	NA	NA	NA	NA	0.435	U	0.555	1.21
Technetium - 99	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-1.57	U	1.04	2.86
Thorium - 228	NA	NA	NA	0.364	J	0.0504	0.0234	0.554		0.0735	0.0316	0.695		0.0867	0.0355
Thorium - 230	NA	NA	NA	0.232	J	0.0504	0.0306	0.313	J	0.0645	0.0387	0.41	J	0.0782	0.042
Thorium - 232	1	NA	NA	0.358	J	0.0496	0.023	0.544		0.0722	0.031	0.678		0.0845	0.0346
Tritium	NA	NA	9.6E+15	2.68	U	3.39	5.71	1.65	U	3.35	5.74	6.23	J	3.26	5.19
Uranium - 233/234 (A)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.247	J	0.115	0.0888
Uranium - 234 (G)	1.8	200	NA	0.241	J	0.0704	0.0566	0.422	J	0.0947	0.0736	0.532	J	0.113	0.0827
Uranium - 235 (G)	ND	28	29	0.0583	U	0.0496	0.0947	0.0172	U	0.0989	0.124	0.00602	U	0.122	0.141
Uranium - 235/236 (A)	NA	NA	29	NA	NA	NA	NA	NA	NA	NA	NA	0.0358	U	0.0487	0.0891
Uranium - 238 (A)	1.8	97	36	NA	NA	NA	NA	NA	NA	NA	NA	0.191	J	0.1	0.0817
Uranium - 238 (G)	1.8	97	36	0.585	J	0.637	0.57	0.622	DL	0.921	0.94	1.03		0.693	0.61
Vanadium - 48	NA	NA	NA	0.00209	U	0.0172	0.0313	0.0533	J-I	0.0376	0.0402	-0.0317	U	0.0404	0.065
Zinc - 65	NA	NA	NA	-0.00465	U	0.0209	0.0364	0.00992	U	0.0273	0.0455	0.01557	U	0.0403	0.0623

Notes:

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

DL - Detection limit requirements not met

(A) - Rad Alpha Spec.

(G) - Rad Gamma Spec.

ND-Not detected.

* BNL Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs, 1999.

PRG - BNL, Operable Unit I, *Radiologically Contaminated Soils Feasibility Study*, CDM Federal Programs 3/99.

^PRG - Preliminary remediation goals, industrial use with 50 years of instiutional controls.

^PRG - Preliminary remediation goals, residential use with 0 years of instiutional controls.

Bold - Sample result detected above PRG 50 YR.

Table 6

le 7

HFBR 8 uctures PA/SI

VOC Analysi l Sample Results

Parameters / Depth	NYSDEC TAGM Cleanup Obj.[1]	SCDHS Action Level[2]	AOI 006-01 (0 - 0.5)	AOI 006-02 (0 - 0.5)	AOI 023-01 (0 - 0.5)	AOI 027-01 (0 - 0.5)	AOI 036-01 (12 - 14)	AOI 036-02 (4 - 6)	AOI 037-01 (14 - 16)	AOI 038-02 (4 - 6)	AOI 043-01 (0 - 0.5)	AOI 046-01 (0 - 2)	AOI 046-02 (0 - 2)	AOI 047-01 (0 - 2)
1,1,1,2-Tetrachloroethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1,1-Trichloroethane	800	1600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1,2,2-Tetrachloroethane	600	1200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1,2-Trichloroethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1-Dichloroethane	200	200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1-Dichloroethylene	400	800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1-Dichloropropene	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,3-Trichlorobenzene	NA	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,3-Trichloropropane	400	800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,4-Trichlorobenzene	3400	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,4-Trimethylbenzene	NA	4800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dibromo-3-chloropropane	NA	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dibromoethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dichlorobenzene	7900	15000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dichloroethane	100	200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dichloropropane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,3,5-Trimethylbenzene	NA	5200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,3-Dichlorobenzene	1600	3200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,3-Dichloropropane	300	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,4-Dichlorobenzene	8500	15000	1 U	0.95 JB	0.51 J	1 U	0.52 J	1.4	1 U	1 U	1.1 U	1.1 U	0.49 J	1.6 U
2,2-Dichloropropane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
2-Butanone	300	600	5 U	5 U	5.3 U	5.3 U	5.3 U	5.2 U	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
2-Chlorotoluene	NA	3600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
4-Chlorotoluene	NA	3600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
4-Isopropyltoluene	NA	7800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
4-Methyl-2-pentanone	1000	2000	5 U	5 U	5.3 U	5.3 U	5.3 U	5.2 U	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
Acetone	200	@	5.7 B	6.4 B	5.3 U	5.3 U	5.3 U	4.9 J	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
Benzene	60	120	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromobenzene	NA	1600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromochloromethane	NA	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromodichloromethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromoform	NA	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Carbon tetrachloride	600	1200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Chlorobezene	1700	3400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Chloroethane	1900	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Chloroform	300	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	0.93 J
cis-1,2-Dichloroethylene	250	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
cis-1,3-Dichloropropylene	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Dibromochloromethane	NA	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Dibromomethane	NA	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Dichlorodifluoromethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Ethylbenzene	5500	11000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Hexachlorobutadiene	NA	15000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Isopropylbenzene	NA	5200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Methylene chloride	100	200	1.9 J	0.73 JB	3.3 U	1.8 J	1.9 JB	2.2 JB	0.53 J	2.2 J	5.5 U	1.8 JB	2.8 JB	1.6 JB
Naphthalene	NA	15000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
n-Butylbenzene	NA	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
n-Propylbenzene	NA	5000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
sec-Butylbenzene	NA	10000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Styrene	NA	2000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
tert-Butyl methyl ether	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
tert-Butylbenzene	NA	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Tetrachloroethylene	1400	2800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Toluene	1500	3000	1 U	1 U	1 U	1 U	1 U	0.65 J	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
trans-1,2-Dichloroethylene	300	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
trans-1,3-Dichloropropylene	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Trichloroethylene	700	1400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Trichlorofluoromethane	NA	1600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Trichlorotrifluoroethane	6000	12000	5 U	5 U	5.3 U	5.3 U	5.3 U	5.2 U	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
Vinyl chloride	200	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Xylenes (total)	1200	2400	3 U	3 U	3.2 U	3.2 U	3.2 U	3.1 U	3.1 U	3.2 U	3.3 U	3.2 U	3.2 U	4.8 U
TOTAL			7.6	7.13	0.51	1.8	2.42	9.15	0.53	2.2		1.8	3.29	2.53

NOTES: Units - ug/Kg

( ) indicates sample depth in feet

U - Compound analyzed for but not detected.

J - This flag indicates an estimated value.

B - Analyte was detected in the associated method blank as well as in the sample.

NA - Not Available

Conc. - Concentration

Qual. - Analytical Qualifier

MDL - Method Detection Limit

* - NYSDEC, Technical & Administrative Guidance Memorandum: *Determination of Soil Cleanup Objectives & Cleanup Levels,* HWR 4046, February 3, 1995.

[redacted]e 7

HFBR & [redacted]uctures PA/SI

VOC Analysis [redacted]il Sample Results

Parameters / Depth	NYSDEC TAGM Cleanup Obj.[1]	SCDHS Action Level[2]	AOI 006-01 (0 - 0.5)	AOI 006-02 (0 - 0.5)	AOI 023-01 (0 - 0.5)	AOI 027-01 (0 - 0.5)	AOI 036-01 (12 - 14)	AOI 036-02 (4 - 6)	AOI 037-01 (14 - 16)	AOI 038-02 (4 - 6)	AOI 043-01 (0 - 0.5)	AOI 046-01 (0 - 2)	AOI 046-02 (0 - 2)	AOI 047-01 (0 - 2)
1,1,1,2-Tetrachloroethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1,1-Trichloroethane	800	1600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1,2,2-Tetrachloroethane	600	1200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1,2-Trichloroethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1-Dichloroethane	200	200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1-Dichloroethylene	400	800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,1-Dichloropropene	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,3-Trichlorobenzene	NA	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,3-Trichloropropane	400	800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,4-Trichlorobenzene	3400	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2,4-Trimethylbenzene	NA	4800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dibromo-3-chloropropane	NA	1000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dibromoethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dichlorobenzene	7900	15000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dichloroethane	100	200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,2-Dichloropropane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,3,5-Trimethylbenzene	NA	5200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,3-Dichlorobenzene	1600	3200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,3-Dichloropropane	300	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
1,4-Dichlorobenzene	8500	15000	1 U	0.95 JB	0.51 J	1 U	0.52 J	1.4	1 U	1 U	1.1 U	1.1 U	0.49 J	1.6 U
2,2-Dichloropropane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
2-Butanone	300	600	5 U	5 U	5.3 U	5.3 U	5.3 U	5.2 U	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
2-Chlorotoluene	NA	3600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
4-Chlorotoluene	NA	3600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
4-Isopropyltoluene	NA	7800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
4-Methyl-2-pentanone	1000	2000	5 U	5 U	5.3 U	5.3 U	5.3 U	5.2 U	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
Acetone	200	@	5.7 B	6.4 B	5.3 U	5.3 U	5.3 U	4.9 J	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
Benzene	60	120	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromobenzene	NA	1600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromochloromethane	NA	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromodichloromethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Bromoform	NA	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Carbon tetrachloride	600	1200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Chlorobezene	1700	3400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Chloroethane	1900	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Chloroform	300	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	0.93 J
cis-1,2-Dichloroethylene	250	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
cis-1,3-Dichloropropylene	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Dibromochloromethane	NA	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Dibromomethane	NA	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Dichlorodifluoromethane	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Ethylbenzene	5500	11000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Hexachlorobutadiene	NA	15000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Isopropylbenzene	NA	5200	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Methylene chloride	100	200	1.9 J	0.73 JB	3.3 U	1.8 J	1.9 JB	2.2 JB	0.53 J	2.2 J	5.5 U	1.8 JB	2.8 JB	1.6 JB
Naphthalene	NA	15000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
n-Butylbenzene	NA	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
n-Propylbenzene	NA	5000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
sec-Butylbenzene	NA	10000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Styrene	NA	2000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
tert-Butyl methyl ether	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
tert-Butylbenzene	NA	6800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Tetrachloroethylene	1400	2800	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Toluene	1500	3000	1 U	1 U	1 U	1 U	1 U	0.65 J	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
trans-1,2-Dichloroethylene	300	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
trans-1,3-Dichloropropylene	NA	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Trichloroethylene	700	1400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Trichlorofluoromethane	NA	1600	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Trichlorotrifluoroethane	6000	12000	5 U	5 U	5.3 U	5.3 U	5.3 U	5.2 U	5.1 U	5.3 U	5.5 U	5.4 U	5.4 U	8 U
Vinyl chloride	200	400	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1 U	1.1 U	1.1 U	1.6 U
Xylenes (total)	1200	2400	3 U	3 U	3.2 U	3.2 U	3.2 U	3.1 U	3.1 U	3.2 U	3.3 U	3.2 U	3.2 U	4.8 U
TOTAL			*7.6*	*7.13*	*0.51*	*1.8*	*2.42*	*9.15*	*0.53*	*2.2*		*1.8*	*3.29*	*2.53*

NOTES: Units - ug/Kg

( ) indicates sample depth in feet

U - Compound analyzed for but not detected.

J - This flag indicates an estimated value.

B - Analyte was detected in the associated method blank as well as in the sample.

NA - Not Available

Conc. - Concentration

Qual. - Analytical Qualifier

MDL - Method Detection Limit

* - NYSDEC, Technical & Administrative Guidance Memorandum: *Determination of Soil Cleanup Objectives & Cleanup Levels*, HWR 4046, February 3, 1995.

HFBR & BOP Structures PA/SI

Metals Analysis - Soil Sample Results

Parameters / Depth	NYSDEC TAGM Cleanup Obj.[1]	Eastern USA Background[1]	SCDHS Action Level[2]	AOI 023-01 (0 - 0.5)	AOI 026-01 (0 - 0.17)	AOI 027-01 (0 - 0.5)	AOI 030-01 (0 - 0.5)	AOI 030-02 (0 - 0.5)	AOI 030-03 (0 - 0.5)	AOI 030-04 (0 - 0.5)	AOI 036-01 (12 - 14)	AOI 036-02 (4 - 6)	AOI 037-01 (14 - 16)	AOI 043-01 (0 - 0.5)	AOI 046-01 (0 - 2)	AOI 046-02 (0 - 2)	AOI 047-01 (0 - 2)
Aluminum	SB	33,000	N/A	2870	3490	3090	3020	5920	1910	3490	3110	2540	2060	4570	2510	3020	4010
Antimony	SB	N/A	N/A	0.51 J-S	0.3 U	4.07	0.32 U	0.32 U	0.3 U	0.3 U	0.519 U	0.486 U	0.515 U	0.54 U	0.52 U	0.542 U	0.745 U
Arsenic	7.5 or SB	3 - 12 **	25	2.24	2.46	1.31	1.3	2.36	0.96	2.46	0.899	0.569	1.22	1.85	0.59	1.07	1.75
Barium	300 or SB	15 - 600	N/A	10.1	7.45	45.7	11.8	13.6	5.23	7.45	8.38	6.07	5.6	17.8	7.18	7.77	28.9
Beryllium	0.16 (HEAST)/SB	0 - 1.75	8.0	0.078 B	0.05 B	0.081 B	0.04 B	0.1 B	0.03 U	0.05 B	0.103 B	0.102 B	0.092 B	0.17 B	0.09 B	0.101 B	0.126 B
Cadmium	10	0.1 - 1	10	2.45	0.03 U	2.82	0.04 B	0.03 U	0.03 U	0.03 U	0.081 B	0.101 B	0.063 B	0.808	0.11 B	0.072 B	0.384 B
Calcium	SB	130 - 35,000	N/A	281 J-S	3370	4370	672	2080	293	3370	563	143	123	619	237	263	7680
Chromium	50	1.5 - 40 **	100	18.4	5.53	7.16	5.65	18.2	3.95	5.53	7.23	3.25	7.84	8.14	4.31	5.03	5.48
Cobalt	30 or SB	2.5 - 60 **	N/A	3.17	1.6	1.07	1.64	3.86	1.02	1.6	1.27	1.24	0.907	1.75	0.98	1.04	1.64
Copper	25 or SB	1 - 50	500	17.8	6.01	**91.3**	16.3	18.9	5.09	6.01	4.62	2.39	4.97	13.8	3.47	2.96	28.6
Iron	2000 or SB	2,000 - 550,000	N/A	27800	4340	4160	3780	9980	2440	4340	3290	2850	3100	5460	3390	3230	5120
Lead	200 - 500***	****	400	23.9 J-S	15.8	397	8.95	58	11.1	15.8	6.57	2.12	3.5	41.6	5.04	6.08	38.4
Magnesium	SB	100 - 5,000	N/A	638 J-S	1050	698	584	1260	392	1050	645	462	370	620	395	409	1050
Manganese	SB	50 - 5,000	N/A	269	51	81.2	53.7	115	38.4	51	63.9	50.1	47.7	69.2	47.7	49.5	179
Mercury	0.1	0.001 - 0.2	2	0.007 B	0.003 U	**1.22**	0.003 U	**0.361**	0.004 B	0.003 U	0.046	0.011	0.003 U	0.013	0.012	0.008 B	0.063
Nickel	13 or SB	0.5 - 25	1000	18.9	2.91	4.34	3.33	4.96	2.3	2.91	3.76	2.2	1.91	5.61	2.43	2.56	6.73
Potassium	SB	8,500 - 43,000 **	N/A	379 J-S	128	576	161	197	101	128	179	147	144	232	165	165	1120
Selenium	2 or SB	0.1 - 3.9	N/A	0.776	0.19 U	0.368 U	0.2 U	0.2 U	0.19 U	0.19 U	0.357 U	0.333 U	0.354 U	0.371 U	0.354 U	0.372 U	0.511 U
Silver	SB	N/A	100	0.067 U	0.48 B	0.179 B	0.46 B	0.54 B	0.42 B	0.48 B	0.068 U	0.064 U	0.068 U	0.1 B	0.068 U	0.071 U	0.324 B
Sodium	SB	6,000 - 8,000	N/A	17.9	59.5	3340	72.4	271	21.2	59.5	14.9	9.63	7.97 B	18.5	15.6	11.1	77.5
Thallium	SB	N/A	N/A	2.47 U	0.24 U	0.52 U	0.26 U	0.7 B	0.24 U	0.24 U	0.503 U	0.471 U	0.5 U	0.523 U	0.5 U	0.525 U	0.722 U
Vanadium	150 or SB	1 - 300	N/A	8	8.74	6.33	7.69	28.1	4.49	8.74	6.64	5.08	5.15	13.5	6	7.14	14.7
Zinc	20 or SB	9 - 50	N/A	46.1 J-S	22.7	**365**	**139**	**206**	33.8	22.7	27.1	6.41	5.53	**75.7**	**159**	21.5	**72.5**

NOTES:

Units - mg/Kg

( ) indicates sample depth in feet

[1] NYSDEC, Technical & Administrative Guidance Memorandum: *Determination of Soil Cleanup Objectives & Cleanup Levels,* HWR 4046, February 3, 1995.

[2] Suffolk County Department Of Health Services: *Article 12 - SOP NO. .9-95, Pumpout And Soil Cleanup Criteria,* January 7, 1999.

N/A is not available

** New York State background

*** Industrial Use

**** Background levels for lead vary widely. Average levels in rural areas may range from 4-61 ppm. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200-500 ppm.

***** Recommended soil cleanup objectives are average background concentrations as reported in a 1984 survey of reference material by E. Carol McGovern, NYSDEC.

SB - Site Backround

U - Analyte analyzed for but not detected.

B - Reported value is less than the Contract Required Detection Limit.

J - Detected, estimated value.

S - Qualified due to accuracy problems.

- Indicated concentration in excess of NYSDEC TAGM Cleanup Objective & Eastern Background Range.

Table 9

HFBR & BOP Structures PA/SI

PCB Analysis - Soil Sample Results

Parameters Depth	TAGM*	AOI 011-01 (0.17 - 0.33)	AOI 026-01 (0.17 - 0.33)	AOI 041-01 (14 - 16)
Aroclor - 1016	1000	3.6 U	21 U	3.5 U
Aroclor - 1221	1000	3.6 U	21 U	3.5 U
Aroclor - 1232	1000	3.6 U	21 U	3.5 U
Aroclor - 1242	1000	3.6 U	21 U	3.5 U
Aroclor - 1248	1000	3.6 U	21 U	5.4 P
Aroclor - 1254	1000	3.6 U	21 U	3.5 U
Aroclor - 1260	1000	12.6	273	3.5 U

NOTES:

Units - ug/Kg

( ) indicates sample depth in feet

P - Greater than 25% difference between two GC columns.

U - Compound analyzed for but not detected.

* - NYSDEC, Technical & Administrative Guidance Memorandum: *Determination of Soil Cleanup Objectives & Cleanup Levels*, HWR 4046, February 3, 1995.

Table 10

HFBR & BOP Structures PA/SI

Radiological Analysis - Groundwater Sample Results

Parameters	STDS*	AOI 021 - 01 (88 - 92)				AOI 021 - 02 (90 - 94)				AOI 021 - 03 (88 - 92)				AOI 021 - 04 (88 - 92)			
Units - pCi/L		Result	Q	Error	Det. Lim	Result	Q	Error	Det. Lim	Result	Q	Error	Det. Lim	Result	Q	Error	Det. Lim
Americium - 241	NA	-0.467	U	8.75	7.44	2.26	U	7.3	6.29	1.8	U	8.1	6.33	-29.4	U	5.28	2.92
Berylium - 7	NA	-4.13	U	20.8	17	6.64	U	20.7	17.5	0.693	U	20.1	16.9	2.12	U	26.2	22.1
Cesium - 134	NA	-1.43	U	1.73	1.34	2.26	J-I	2.19	1.37	-2.18	U	1.64	1.25	0.699	U	2.64	1.94
Cesium - 137	NA	2.27	J-I	2.83	1.41	0.924	U	1.79	1.5	0.256	U	1.69	1.41	-0.162	U	2.97	2.14
Cobalt - 57	NA	0.307	U	1.44	1.2	1.13	U	1.38	1.17	-0.242	U	1.33	1.11	-0.53	U	1.47	1.21
Cobalt - 60	NA	0.466	U	1.89	1.56	-0.668	U	1.81	1.42	1.79	J-I	1.88	1.68	0.476	U	2.52	2.14
Europium - 152	NA	-3.06	U	4.63	3.8	1.98	U	4.52	3.9	4.42	J-I	6.26	4.09	-0.501	U	5.87	4.72
Europium - 154	NA	3.35	U	5.31	4.53	0.258	U	5.29	4.36	-0.76	U	4.61	3.77	0.836	U	7.03	5.71
Europium - 155	NA	-0.331	U	5.65	4.7	-2.7	U	5.28	4.36	3.19	U	5.1	4.37	-0.682	U	5.6	4.65
Gross Alpha	15	0.614	U	0.935	1.82	-19.7	U	1.9	0.984	0.576	U	1.04	1.61	-2.72	U	1.92	1.94
Gross Beta	1000	2.99	J	1.02	1.52	688		4.35	0.565	24.3		1.35	1.24	142		1.98	0.446
Manganese - 54	NA	-0.136	U	1.8	1.5	-2.25	U	1.87	1.35	-0.74	U	1.93	1.31	0.392	U	2.57	2.13
Sodium - 22	NA	1.21	U	1.92	1.64	0.103	U	1.92	1.58	-0.299	U	1.67	1.36	0.281	U	2.54	2.06
Strontium - 90	8	0.413	J	0.204	0.33	392		2.09	0.277	11.9		0.41	0.295	75.5		0.946	0.292
Tritium	20000	57.5	U	258	448	572	J	287	452	2660		373	445	5000		455	449
Zinc - 65	NA	-2.86	U	4.02	3.12	-2.92	U	4.31	3.4	-1.2	U	3.64	2.97	-4.84	U	5.92	4.53

Notes:

STDS - NYSDEC's, Class GA, *Ambient Water Quality Standards and Guidance Values*, June 1998.

Q-Laboratory Qualifier

( ) indicates sample depth in feet

NA - Not Available/Not Analyzed

U - Analyte was analyzed for but not detected

J - The reported value is an estimated quantity

I - Uncertain identification or interference

* - NYSDEC, Division of Water, Technical and Operations (1.1.1), Ambient Water Quality Standards and Guidance Values And Groundwater Effluent Limitations, 6/98

Table 11

HFBR & BOP Structures PA/SI

VOC Analysis Groundwater Sample Results

Parameters	STDS*	AOI 012A-01 (84'-88')	AOI 025-01 (74'-78')
Dichlorodifluoromethane	5**	1 U	1 U
Vinyl chloride	2	1 U	1 U
Chloroethane	5**	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U
1,1-Dichloroethylene	0.7**	1 U	1 U
Acetone	50**	4.4 J	1.5 J
Trichlorotrifluoroethane	5	5 U	5 U
Methylene chloride	5	5 U	5 U
tert-Butyl methyl ehter	NA	5 U	5 U
trans-1,2-Dichloroethylene	5	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U
2-Butanone	50**	5 U	5 U
cis-1,2-Dichloroethylene	5	1 U	1 U
2,2-Dichloropropane	5	1 U	1 U
Bromochloromethane	5	1 U	1 U
Chloroform	7	1 U	1 U
1,1,1-Trichloroethane	5	1 U	1 U
1,1-Dichloropropene	5	1 U	1 U
Carbon tetrachloride	5	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U
Benzene	0.7	1 U	1 U
Trichloroethylene	NA	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U
Dibromomethane	5**	1 U	1 U
Bromodichloromethane	50**	1 U	1 U
cis-1,3-Dichloropropylene	NA	1 U	1 U
Toluene	5**	1 U	1 U
trans-1,3-Dichloropropylene	NA	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U
1,3-Dichloropropane	5	1 U	1 U
2-Hexanone	50**	5 U	5 U
Tetrachloroethylene	0.7	1 U	1 U
Dibromochloromethane	50**	1 U	1 U
1,2-Dibromoethane	NA	1 U	1 U
Chlorobezene	5	1 U	1 U
1,1,1,2-Tetrachloroethane	5	1 U	1 U
Ethylbenzene	5	1 U	1 U
Xylenes (total)	5	3 U	3 U
Styrene	5**	1 U	1 U
Bromoform	50**	1 U	1 U
Isopropylbenzene	5**	1 U	1 U
1,1,2,2-Tetrachloroethane	0.2**	1 U	1 U
1,2,3-Trichloropropane	0.04	1 U	1 U
Bromobenzene	5**	1 U	1 U
n-Propylbenzene	5	1 U	1 U
2-Chlorotoluene	5	1 U	1 U
1,3,5-Trimethylbenzene	5	1 U	1 U
1,2,4-Trimethylbenzene	5	1 U	1 U
4-Chlorotoluene	5	1 U	1 U
tert-Butylbenzene	5	1 U	1 U
sec-Butylbenzene	5	1 U	1 U
4-Isopropyltoluene	5	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U
n-Butylbenzene	5	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U
1,2-Dibromo-3-chloropropane	0.04	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U
Hexachlorobutadiene	0.5	1 U	1 U
Naphthalene	10**	1 U	1 U
1,2,3-Trichlorobenzene	5	1 U	1 U

NOTES: Units: ug/L

*STDS - NYSDEC's, Class GA, *Ambient Water Quality Standards and Guidance Values*, June 1998.

( ) Depths in feet

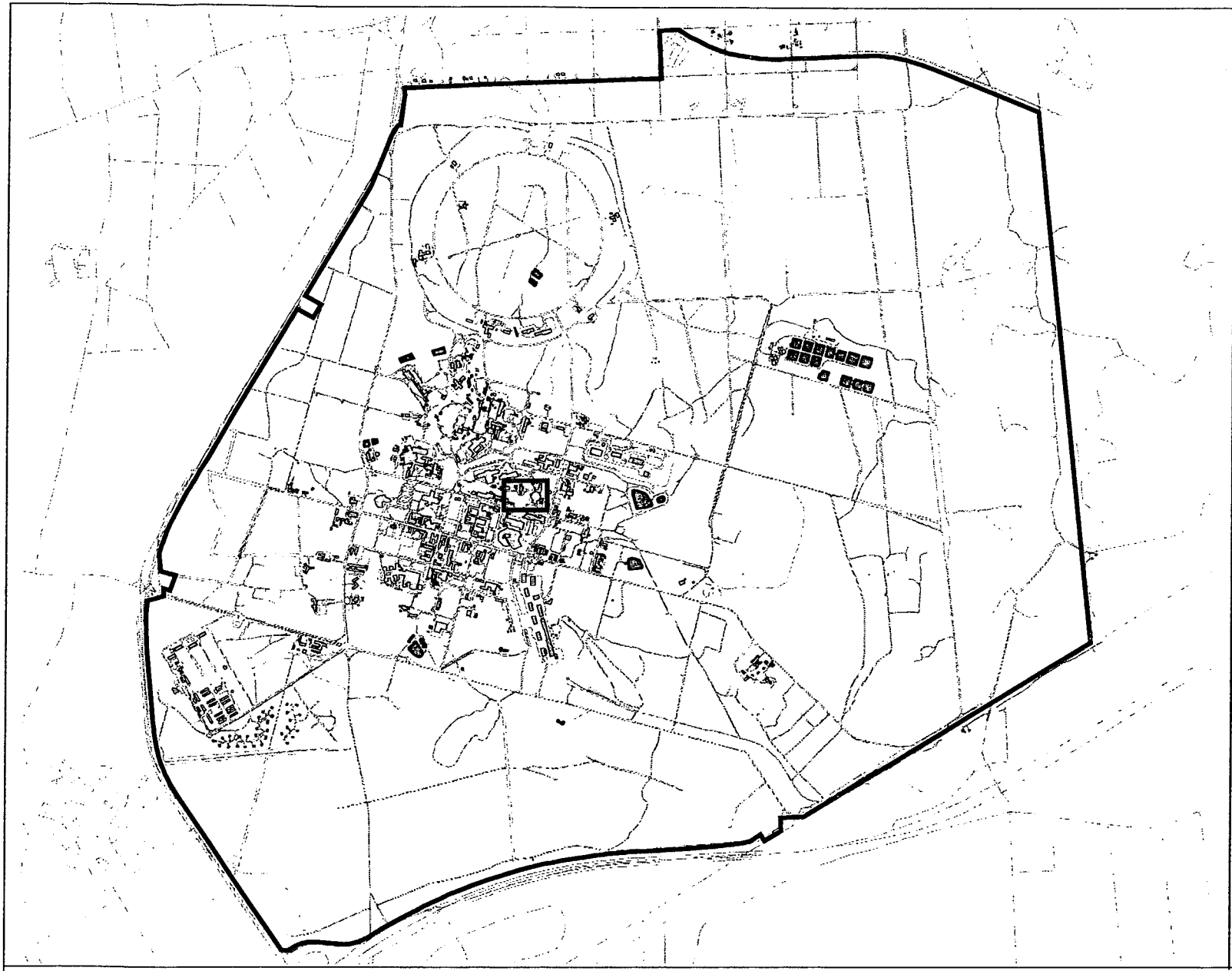
U - Compound analyzed for but not detected.

J - Indicates an estimated value.

B - Analyte was detected in the associated method blank sample as well as in the sample

NA - Not avaliable

** Guidance Value provided where no standard exists.



N
W E
S

Legend

- Buildings
- BNL Site Boundary
- Recharge Basins
- Roads
- Study Area

0 9001800 Feet

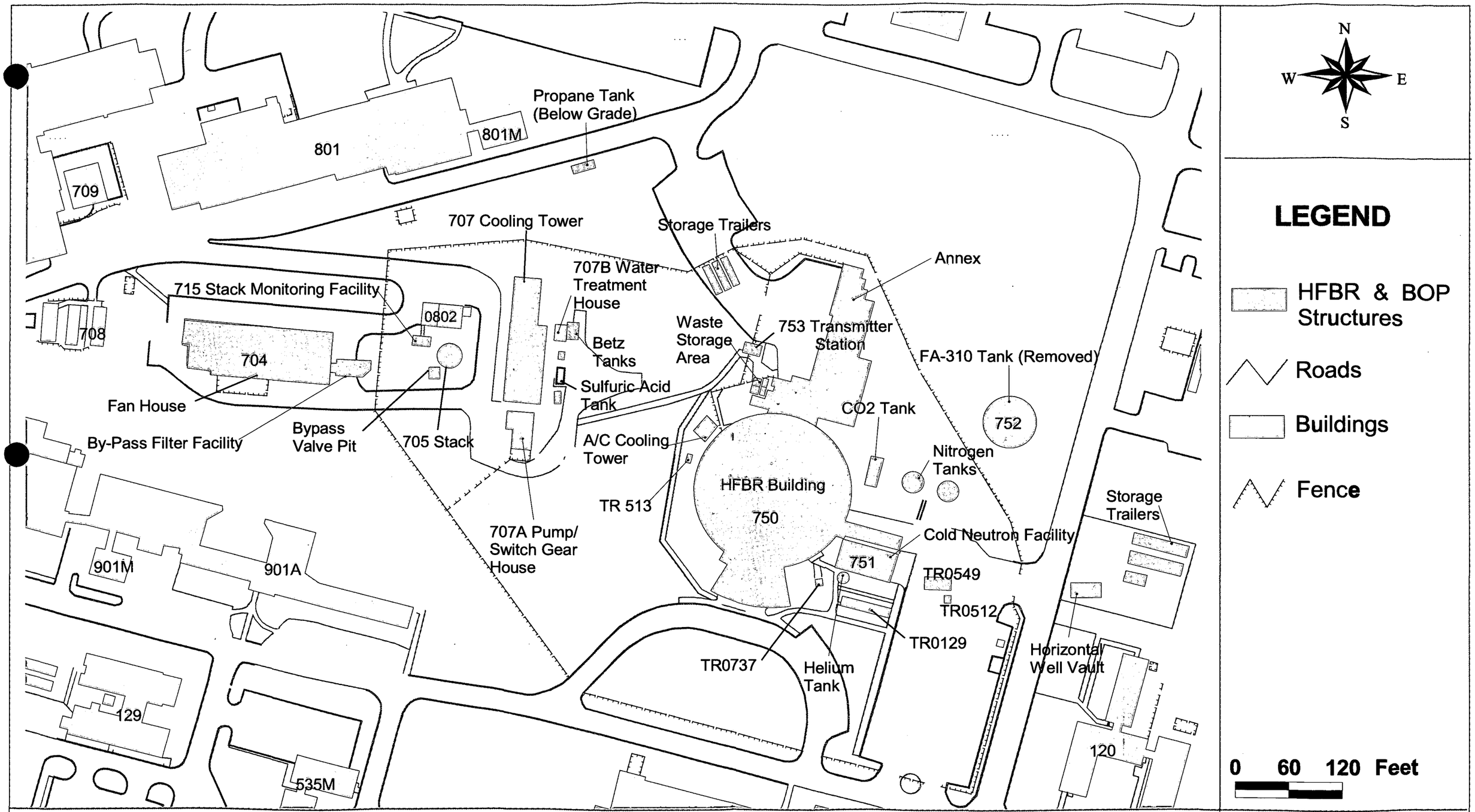
BROOKHAVEN NATIONAL LABORATORY

Environmental Information Management System

Brookhaven National Laboratory Vicinity Map

Figure # 1

JLH - 02-04-02
[GIS on OERNT]/avprojects/
hfbr/hfbr_aoi/sitemap.ai

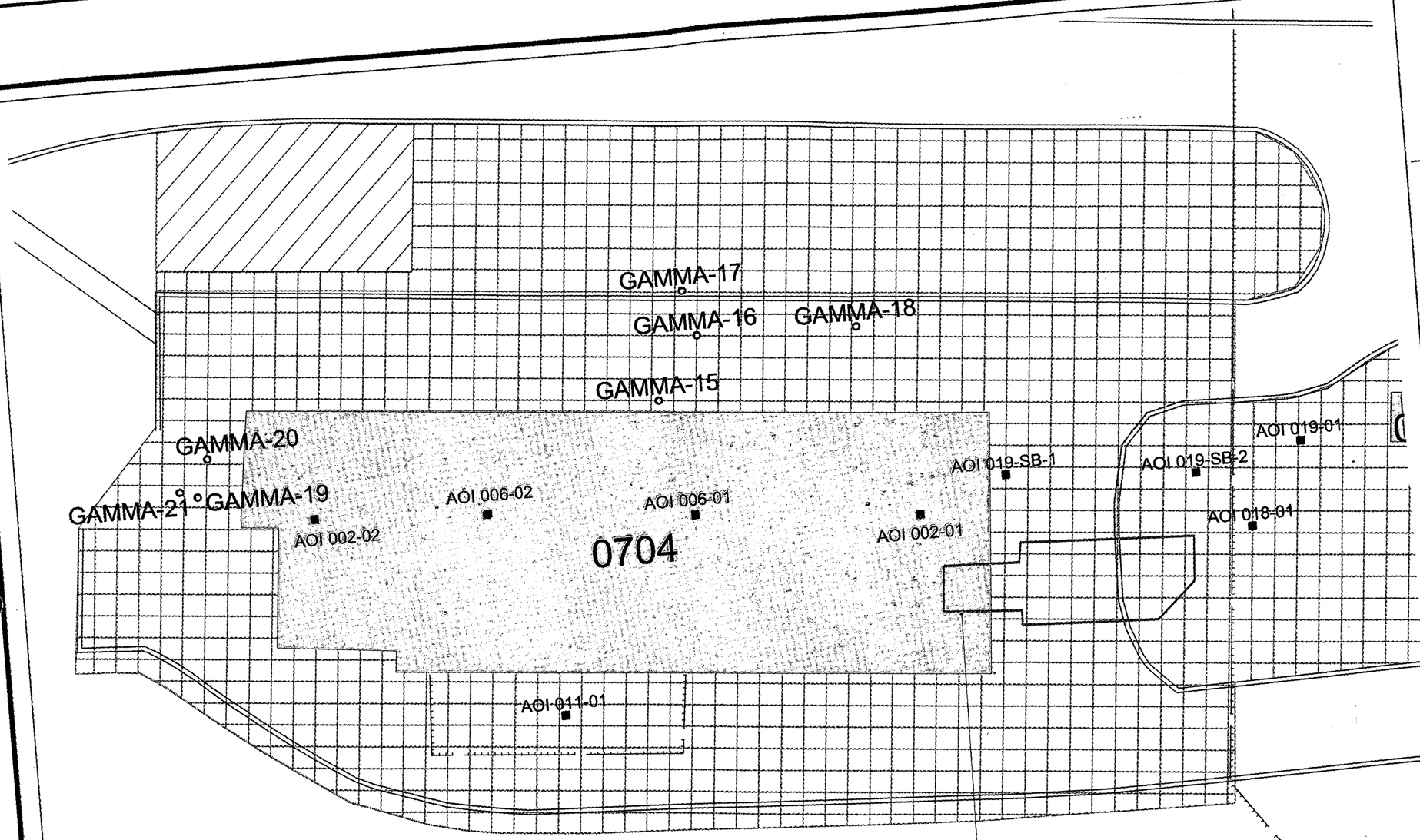


BROOKHAVEN NATIONAL LABORATORY

Environmental Information Management System

Figure 2
High Flux Beam Reactor and Balance of Plant Structures Site Plan

JLH - 4/26/01
r:/av_projects/hfbr/hfbr_aoi/hfbr_closeout.apr
General Overview



N
W E
S

Legend

- Fence
- Roads
- HFBR & BOP Structures
- Bldg 704 Walkover Survey Grid
- Area not accessible due to slope instability
- Gamma Points Activity > 5,000 cpm
- AOI Sample Locations

0 9 18 Feet

Working Copy
Not for Official Use

BROOKHAVEN NATIONAL LABORATORY
Environmental Management Directorate

Figure 3
Building 704

ALR - 01/25/02
Figure3_closeout
r:/evprojects/hfbr/hfbr_aoi/hfbr_closeout.apr

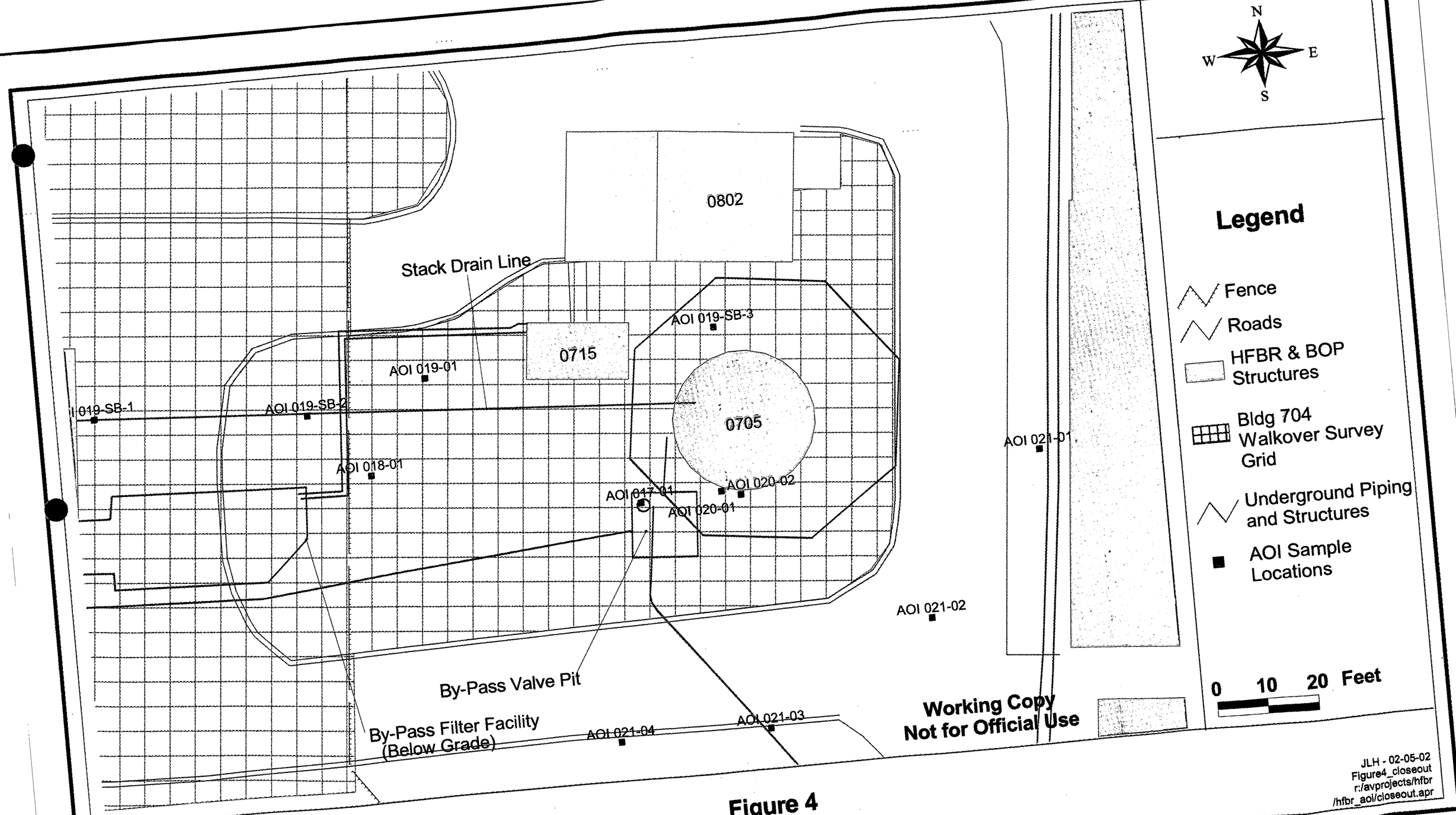
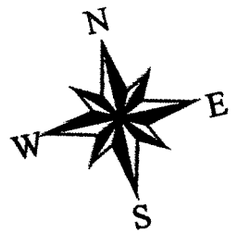
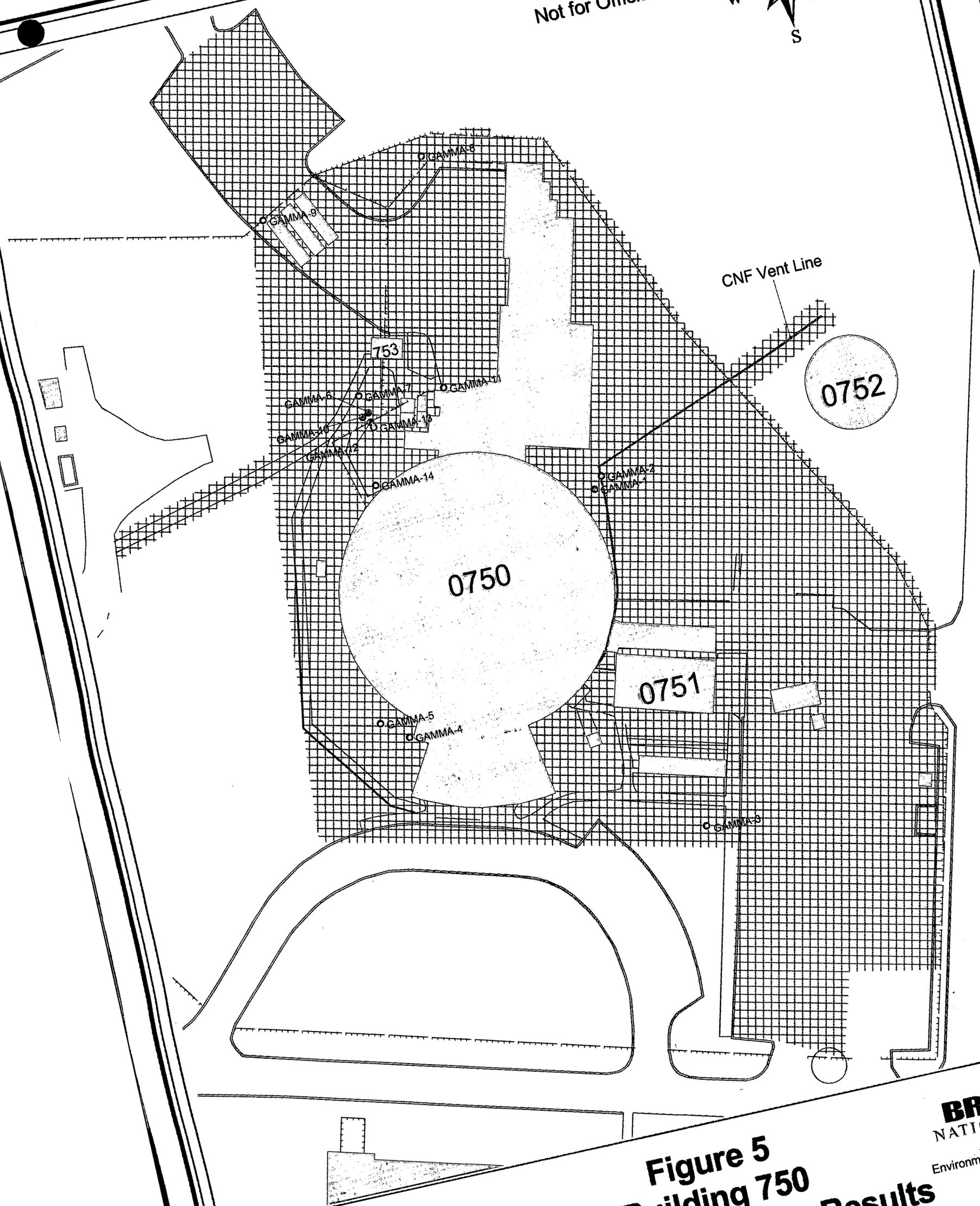


Figure 4
705 Stack

BROOKHAVEN NATIONAL LABORATORY
Environmental Management Directorate

Working Copy
Not for Official Use





BROOKHAVEN
NATIONAL LABORATORY
Environmental Information Management System

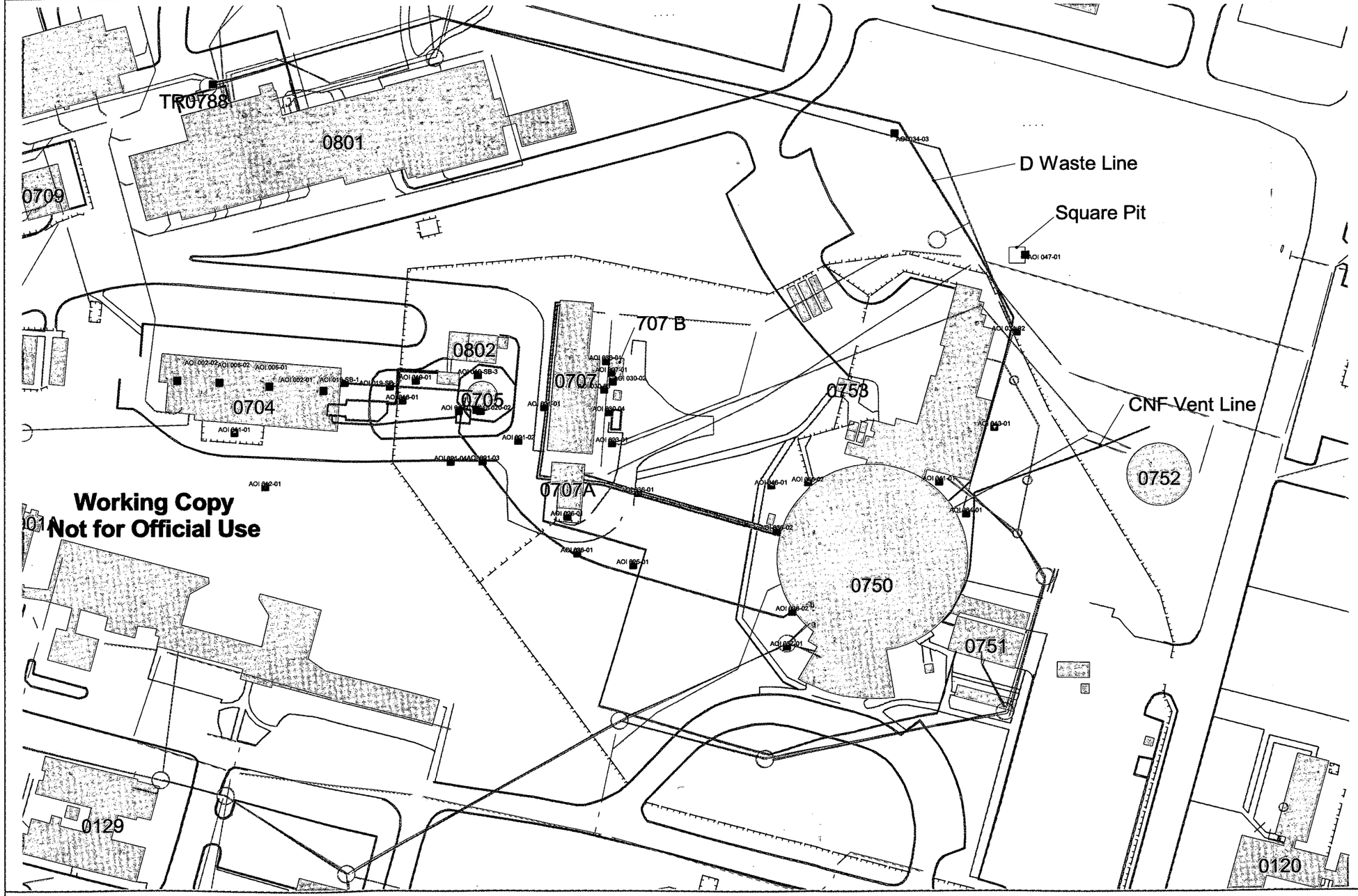
Figure 5
Building 750
Radiological Survey Results

0 40 80 Feet

Legend

- Gamma Points Activity > 5,000 cpm
- Bldg 750 Walkover Survey Grid
- CNF Vent Line
- Fence
- Roads
- Buildings

JLH - 02-08-02
[GIS on OERNT]/av_projects/
hfbr/hfbr_aol/hfbr_closeout.apr
Figure5_closeout



Legend

- Storm Water Lines
- Sanitary Lines
- AOI Sample Locations
- Underground Structures and Piping
- Fence
- Roads
- Buildings

0 60 120 Feet

BROOKHAVEN NATIONAL LABORATORY

Environmental Information Management System

Figure # 6

Building 750

JLH - 02-11-02
figure 6_closeout
[GIS on OERNT]/av_projects/
hfbr/hfbr_aoi/hfbr_closeout.apr

APPENDIX A

APPENDIX A

November 14, 2001

Ms. Lisa Santoro
Brookhaven National Laboratory, ERD
50 Brookhaven Avenue
Building 51M
Upton, NY 11973-5000

Dear Ms. Santoro:

The data reported by GEL Laboratories under SDG 48078, (HFBR) has been reviewed for quality assurance validation. Data was reported for gamma scan, technicium-99, tritium, iodine-129, americium, plutonium, uranium, thorium, plutonium-241, iron-55 and strontium-90 for 32 analyses of 4 samples as requested by BNL. The data in this report has either been approved for use or approved with qualification. The following bulleted items summarize additional comments where data has not been qualified but it is recommended that additional communication with the laboratory be conducted to further assess/qualify the data.

- This data package was validated using the BNL Radiochemical Data Validation procedure EM-SOP-209.
- The detection limits for Fe-55, I-129, and Pu-241 could not be checked because BNL does not have CRDL's for these analytes. Based on the labs required limits all are acceptable.
- MDC calculations were provided but a hand calculation was not as is required in the validation report data deliverable checklist.
- The results of the field blank analyses listed on the chain of custody were not provided in this data package and therefore were not validated.
- The original EDD's from the lab were sent directly to BNL. The lab's EDD printouts were not sent to the validator and thus are not included in this report. The EDD with MJW qualifiers added is included in this report.

If you have any questions concerning this data validation report, please contact me at 716-344-7197.

Very truly yours,

MJW Corporation Inc.

Annette Guilds

Annette Guilds
Senior Scientist

Approved by:

David A. Dooley

David A. Dooley, Ph.D., CHP
Project Manager, MJW Corporation Inc.

Data Validation Report

HFBR
Volatile and Metals

SDG No. 48076 and 48078

Sampling Date: August 24, 2001

Submitted to:

Brookhaven National Laboratory
Upton, NY

Submitted by:

the i group SM

IT Corporation
2200 Cottontail Lane
Somerset, NJ 08873

December 20, 2001

Site:	Brookhaven National Laboratory (BNL), Upton, New York
Client:	Brookhaven National Laboratory
Analytical Laboratories:	General Engineering Laboratories (GEL) P.O. Box 30712 Charleston, SC. 29417
Project:	HFBR
Sample Delivery Group (SDG):	48076 and 48078
Sampling Date:	August 24, 2001
Analyses:	VOA and Metals
Analytical Methods:	SW846B 8260B and 6010/7471A

Summary of Data Validation:

The adherence of laboratory analytical performance to the above methods was evaluated during the data validation process. Data Validation Checklists and the National Functional Guidelines for Organic Data Review (February 1994) and the National Functional Guidelines for Inorganic Data Review (1996) were used as guidelines for data qualifications.

SDG 48076
All results are acceptable.

SDG 48078
Method blank reported methylene chloride contamination and this resulted all methylene chloride results being qualified as non-detects at CRDL. Recovery for antimony was below the required QC limits of 75-125%. Recoveries for calcium, lead, magnesium, manganese, potassium and zinc were above the required 75-125% QC limits. All results for these compounds were qualified as estimated "UJ-S/J-S".

The sample qualifiers applied by the data validator are tabulated in Section 15.0. The detailed discussions can be found in the report.

Signatures:

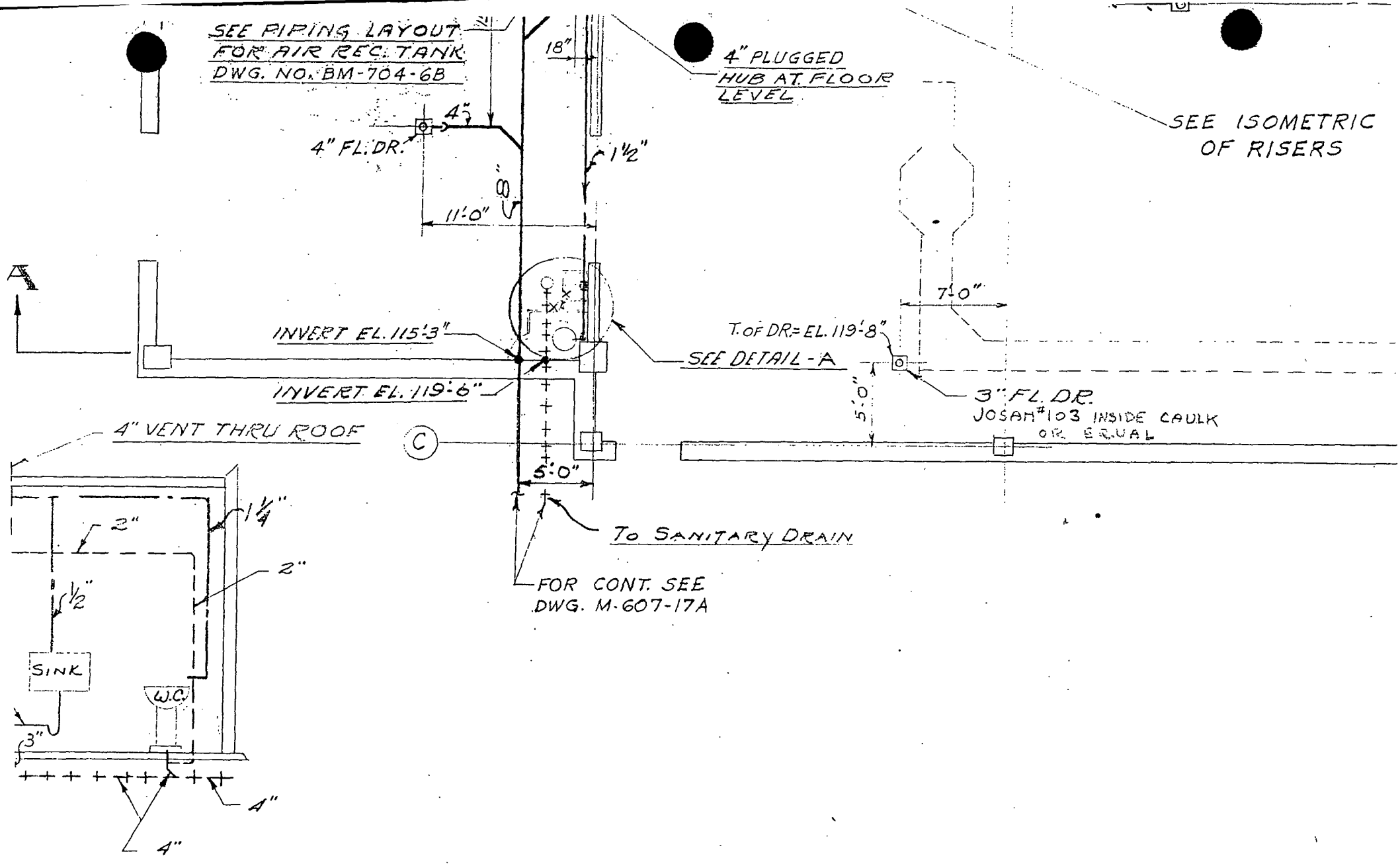
Data Reviewer: M Vincent Date: 12/19/01

QA/QC Reviewer: [signature] Date: 12/20/01

Second Level Reviewer: [signature] Date: 12/20/01

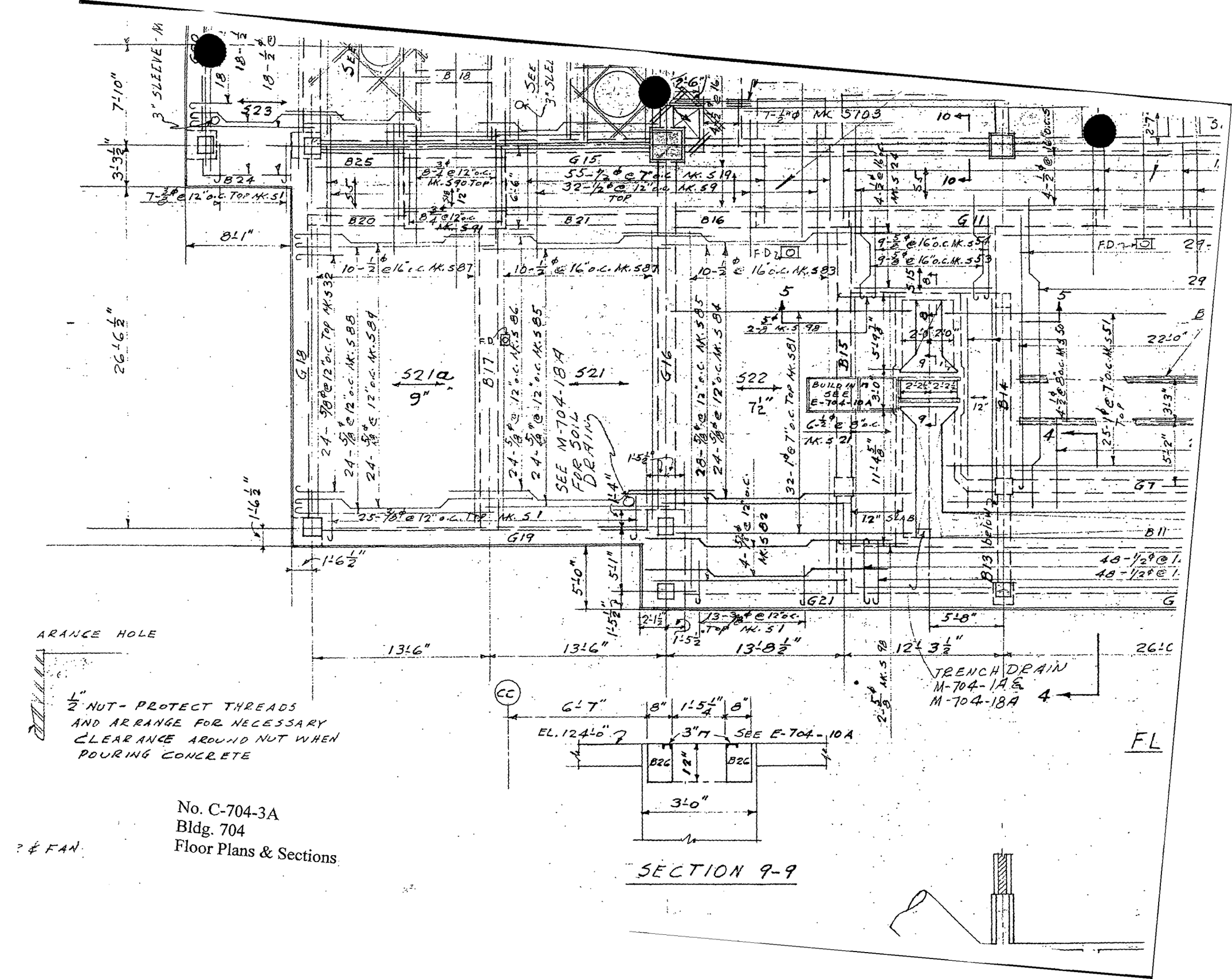
APPENDIX B

APPENDIX B

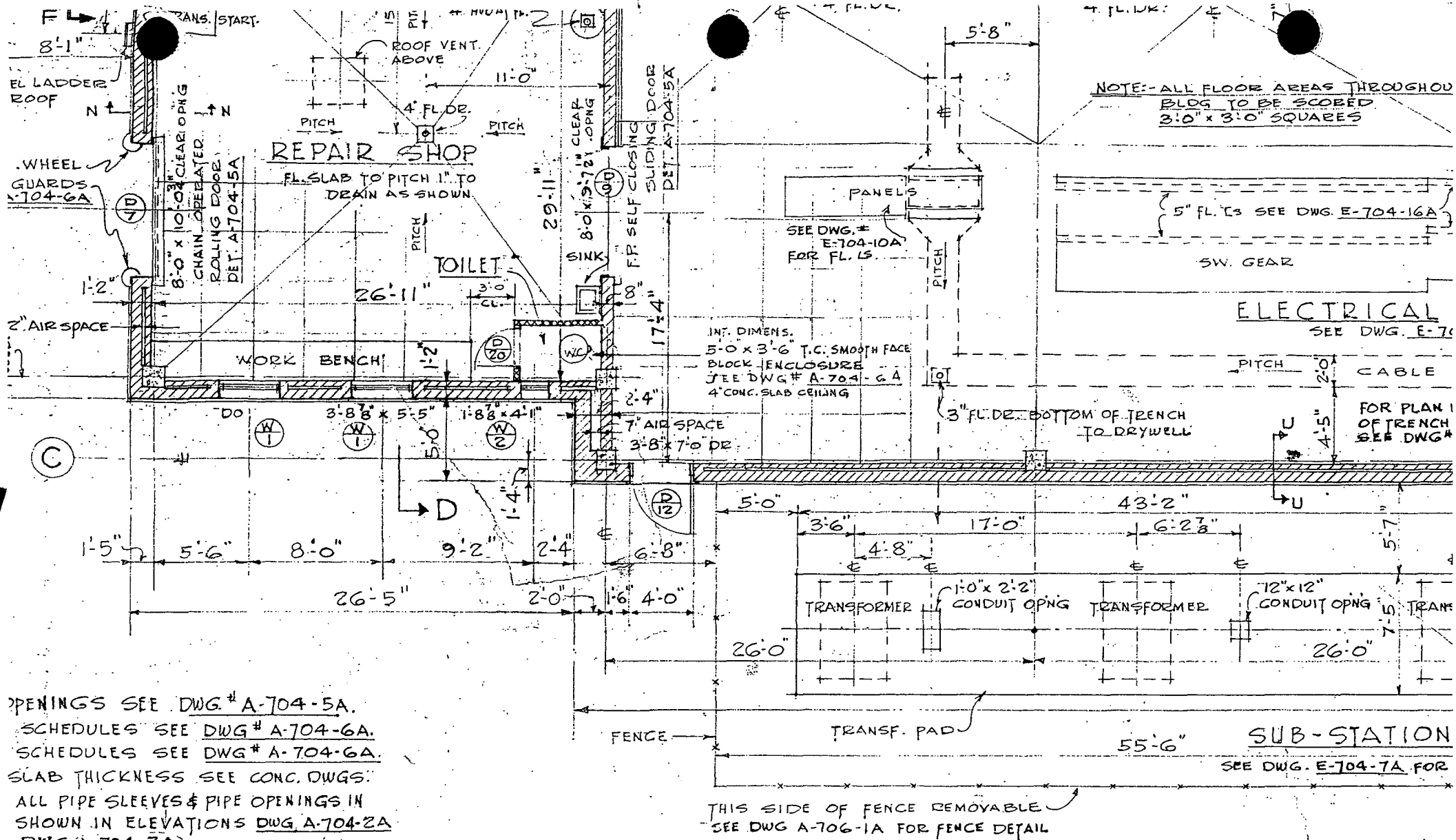


SANITARY RISER DIAGRAM

No. M-704-18A
Fan House Bldg. 704
Service and Drainage Systems



No. C-704-3A
Bldg. 704
Floor Plans & Sections



No. A-704-1A
Bldg. 704
Plans & Details