

Brookhaven Graphite Research Reactor (BGRR) Decommissioning Project



FINAL

CHARACTERIZATION REPORT FOR BUILDING 701
ABOVE GROUND SURFACES, SYSTEMS, AND
STRUCTURES

May 2003

BROOKHAVEN NATIONAL LABORATORY
BROOKHAVEN SCIENCE ASSOCIATES

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY	6
2. INTRODUCTION	7
2.1. BGRR Facility Description and History.....	8
2.2. Decommissioning Plans and End State Selection.....	9
3. DATA QUALITY OBJECTIVES	10
3.1. State the Problem.....	10
3.2. Identify the decision.....	10
3.3. Identify the Inputs to the decision.....	10
3.4. Define the Study Boundaries	10
3.5. State the Decision Rules	11
3.6. Specify Limits on Decision Errors.....	11
3.7. Optimize the Design for Obtaining Data	11
4. OVERVIEW OF CHARACTERIZATION PLAN AND METHODS	11
4.1. Radiological Characterization Criteria.....	11
4.2. Hazardous Material Characterization Criteria	16
5. RESULTS	18
5.1. General Characterization Results.....	18
5.2. Building 701 - 110' Elevation, Reactor Building	19
5.3. Building 701 - 133' Elevation, Office Spaces	19
5.4. Building 701 - 133' Elevation, Reactor Building	20
5.5. Building 701 - 143' Elevation, Office Spaces	20
5.6. Building 701 - 143' Elevation, Reactor Building	20
5.7. Building 701 –Walls and Interior Structures	21
5.8. Building 702 –Reactor Pile.....	21
5.9. Systems	21
6. REFERENCES	28
7. ACRONYMS AND ABBREVIATIONS.....	29

APPENDICES

Appendix A. Building 701 –110’ Elevation, Reactor Building.....	36
Appendix B. Building 701 –133’ Elevation, Office Spaces	73
Appendix C. Building 701 –133’ Elevation, Reactor Building.....	88
Appendix D. Building 701 –143’ Elevation, Office Spaces	97
Appendix E. Building 701 –143’ Elevation, Reactor Building	110
Appendix F. Building 701 –Walls and Interior Structures	121
Appendix G. Building 702 –Reactor Pile	134
Appendix H. Systems.....	140

TABLES

Table 1. Radiological Surface Contamination Criteria	12
Table 2. Surface Soil Cleanup Goals for Radionuclides of Concern.....	14
Table 3. Alpha Isotope Surface Soil Cleanup Goals.....	15
Table 4. Screening Levels and Detection Limits for Inorganic COPCs.....	16
Table 5. Detection Limits for certain COPCs.....	17
Table 6. Summary of Characterization Results for BGRR Survey Units	18
Table 7. Survey Unit Number and Description	25
Table 8. Building 701 Above-Ground Survey Units Radiological and Hazardous Material Results	31
Table 9. Building 702 Pile Survey Units Radiological and Hazardous Material Results.....	34
Table 10. Building 701 – 702 Hazardous Materials Characterization of Wall / Floor Sealants, Coatings, and Paints	35

FIGURES

Figure 2-1	BGRR Site Looking North.....	9
Figure 5-1	Survey unit breakdown for Building 701 Characterization - 110’ Elevation.....	22
Figure 5-3	Survey unit breakdown for Building 701 Characterization - 133’ Elevation.....	23
Figure 5-5	Survey unit breakdown for Building 701 Characterization - 143’ Elevation.....	24
Figure A-1	Machine Shop	38
Figure A-2	Receiving Room.....	40
Figure A-3	Fuel Vault.....	42
Figure A-4	Reactor Building South General Area	44
Figure A-5	HP Office	46
Figure A-6	Main 701 Entrance Area	48
Figure A-7	Main 701 Entrance Area	48
Figure A-8	Reactor Building West, General Area.....	50
Figure A-9	West Air Intake Chamber (top surfaces).....	52
Figure A-10	North Supply Room	54

Figure A-11	Reactor Building North, General Area	56
Figure A-12	Reactor Building East, General Area	58
Figure A-13	East Air Intake Chamber (top surfaces)	60
Figure A-14	East CRDM Floor Surfaces from 701-04)	62
Figure A-15	East CRDM Floor Surfaces (from 701-11)	62
Figure A-16	West CRDM Floor Surfaces (from 701-04)	64
Figure A-17	West CRDM Floor Surfaces (from 701-07)	64
Figure A-18	East 701 Entryway and Main Stairwell	66
Figure A-19	Control Room Stairwell & Walkway.....	68
Figure A-20	East Pile Face 114' Balcony	70
Figure A-21	Pile Balcony Stairwell.....	72
Figure B-1	Office 103	75
Figure B-2	Men's Lavatory.....	77
Figure B-3	Women's Lavatory.....	77
Figure B-4	Office 104	79
Figure B-5	Office 105	79
Figure B-6	Office 106	80
Figure B-7	701-19 Hallway.....	80
Figure B-8	Office 107	82
Figure B-9	Office 108	82
Figure B-10	Office 109	83
Figure B-11	Office 110	83
Figure B-12	Office 111	85
Figure B-13	Office 112	85
Figure B-14	Office 114	86
Figure B-15	Office 115	86
Figure B-16	701-21 Hallway (facing SE)	87
Figure B-17	701-21 Hallway (facing SW)	87
Figure C-1	West CRDM Access Balconies (from crane stairwell).....	90
Figure C-2	Northwest 118' Pile Face Balconies	92
Figure C-3	Northwest 118' Pile Face Balconies	92
Figure C-4	East Pile Face 123' Balcony	94
Figure C-5	East CRDM Access Balconies	96
Figure D-1	Office 1	99
Figure D-2	Office 2	99
Figure D-3	Office 2A.....	100
Figure D-4	Office 3	100
Figure D-5	701-24 elevator annex.....	102
Figure D-6	Office 4	102
Figure D-7	Office 5	103
Figure D-8	Office 6	103
Figure D-9	701-25 Conference Room.....	105
Figure D-10	701-25 Hallway.....	105
Figure D-11	701-25 Hallway (facing NW)	106
Figure D-12	Kitchen.....	106
Figure D-13	Office 7	107

Figure D-14	Office 8	107
Figure D-15	Office 9	108
Figure D-16	Office 10	108
Figure D-17	Office 11	109
Figure D-18	Office 12	109
Figure E-1	Mechanical Equipment Room.....	112
Figure E-2	West 127' Pile Face Balcony	114
Figure E-3	Upper Northwest 137' Pile Face Balconies	116
Figure E-4	Upper Northwest 137' Pile Face Balconies	116
Figure E-5	702 10 Pile Top Access Stairways	118
Figure E-6	Charging Elevator Catwalk	120

1.0 EXECUTIVE SUMMARY

The Brookhaven Graphite Research Reactor (BGRR) has permanently ceased operations. In support of ongoing decommissioning activities at the BGRR, a characterization study of the facility has been completed. This report provides characterization information as described in Subpart “A” of the document, BGRR-052; “Sampling and Analysis Plan for the Building, 701 Below Ground Structure, 702 Pile, and Remaining Soils.” (BNL 2002a) This report documents the radiological and hazardous material conditions as of November 2002.

The characterization approach for the BGRR interior was selected to provide the radiological and hazardous data that is necessary to determine the end state of the facility. This BGRR characterization effort included the review of historical data, the conduct of surveys, and analysis of radiological and hazardous samples from 67 Survey Units within the BGRR complex.

This Subpart of the BGRR Characterization Project does not address internal reactor components, sub-surface systems or structures (below 110' elevation) or surrounding soils, all of which are addressed in BGRR-055, “Characterization Report for the 701 Below-Ground Structures, 702 Pile, and Remaining Soils” November 2002 (BNL 2002b)

The results of the hazardous material characterization indicate that asbestos, Polychlorinated Biphenyls (PCB's), and metals are present in many locations throughout the facility. Asbestos is present in floor tiles, insulation, ceiling tiles, and plasters. PCBs are present in locations where oil has contacted floor tiles under the Control Rod Drive Motor's (CRDM's), within the personnel elevator, the charging elevator, and the freight elevator. PCB's were also identified in scraping samples of interior wall coatings and paints. Lead and other heavy metals are present in original wall coatings and paints.

The results of the radiological characterization indicate that dispersible radioactive materials within Building 701 have previously been identified and contained through adequate radiological posting and controls. Fixed contamination, radiation areas, and radioactive material storage areas are controlled consistent with ongoing work. The characterization survey concludes:

- Office areas contained no fixed or removable contamination above normal operational release limits
- The external surfaces of the reactor and support structures contained no fixed or removable contamination above normal operational release limits outside of existing posted areas. Within posted contamination areas, sporadic removable contamination was identified between 1,000-5,000 dpm / 100 cm² and discrete locations exhibited fixed beta contamination levels ranging between 5,000-50,000 dpm/100 cm².
- Isolated areas of removable contamination were identified on the interior surface of the reactor building roof, “I” beams, and catwalks. Discrete locations exhibited fixed beta contamination levels ranging between 5,000-50,000 dpm/100 cm².
- Of the fifteen systems evaluated in this characterization report, seven are defined as radioactive, and seven are contained within a controlled area and must be suspected as radioactive. The remaining system, electrical distribution, is housed outside the confines of the building and is considered free of radioactivity.

2.0 INTRODUCTION

This report documents results of the radiological and hazardous material characterization effort for the Brookhaven Graphite Research Reactor (BGRR) located at the Brookhaven National Laboratory (BNL). The BGRR facility includes the Reactor Building (701), graphite pile (702) and ancillary support facilities.

The purpose of the BGRR Characterization Project is to assess the status of radiological and hazardous material conditions for each survey unit. This information is essential for effective decommissioning planning and consideration of appropriate decommissioning alternatives in the future. The characterization approach and overall scope of the characterization work is defined in “Sampling and Analysis Plan for the 701 Building, 701 Below Ground Structures, 702 Pile, and Remaining Soils, BGRR-052, Rev. 0” (BNL 2002a.)

The following list provides the anticipated uses of this BGRR characterization data:

- Decommissioning planning and engineering
- Determining remedial work scope
- Developing waste disposal strategies
- Determining decommissioning cost estimates and schedules
- Determining the extent of neutron activation
- Providing data to assess the impact of decommissioning on worker and general public health and safety
- Providing input for development or modification of health physics, safety, radioactive waste handling, and environmental monitoring procedures specific to a planned decommissioning program
- Providing input for the development of a final survey program, which will be used to demonstrate compliance with end-state criteria?
- Providing an indication of the current state of contamination in the facility

This report provides characterization information for those areas of the BGRR facility described by Subpart A of “Sampling and Analysis Plan for the 701 Building, 701 Below Ground Structures, 702 Pile, and Remaining Soils, BGRR-052, Rev. 0” (BNL 2002a.) Since there is work continuing at the BGRR, and future remediation work is planned, some redistribution of contamination may occur. This characterization was therefore designed to be a “snapshot” of contamination conditions at the BGRR and is subject to change as further decommissioning activities are performed.

The characterization approach for the BGRR interior was selected to provide the radiological and hazardous data necessary to determine the end state of the facility. A comprehensive feasibility study and engineering evaluation is being undertaken to determine safe and cost effective options for decommissioning the BGRR facility. The characterization results will be used in the engineering evaluations to provide up-to-date information on the status of the facility.

2.1. BGRR FACILITY DESCRIPTION AND HISTORY

2.1.1. Historical Overview

The BGRR at BNL was the first reactor built for the sole purpose of providing neutrons for research. During its years of operation, it was one of the principal research reactors in the United States. Construction on the BGRR was completed in August 1950, and initial criticality of the reactor was achieved the same month. The BGRR operated until September 28, 1969 when operation of the reactor was terminated and deactivation of the facility was initiated. In June of 1972, de-fueling and shipment of the fuel to the Department of Energy (DOE) Savannah River Site was completed. The BGRR complex was described as being in a safe shutdown condition by the U.S. Atomic Energy Commission and became a Surplus Facility within the DOE complex. From 1977 until 1997, portions of the facility were used as the BNL Science Museum.

2.1.2. Operational History

A review of historical records shows that there were incidents resulting in the release of contamination in Building 701. These incidents ranged from damaged or malfunctioning experiment containers, to ruptured fuel elements. Some of these incidents resulted in loose contamination several orders of magnitude above the contamination limits in Table 1, and resulted in the Health Physics department declaring the entire building a contamination area (CA.) Airborne radioactive contamination was also generated during these events.

2.1.3. Physical Descriptions

The BGRR was a heterogeneous, enriched uranium-fueled, graphite moderated and reflected, thermal neutron, air-cooled research reactor. During reactor operations, outside cooling air was drawn across the reactor pile through ductwork by fans after which it was cooled, filtered and eventually exited through the 100-meter tall exhaust stack. The primary air-cooling system utilized fans that were located in a Building (704). Two separate exhaust ducts, constructed of reinforced concrete, ran below the ground from the reactor exhaust plenums to the system cooler and filters. The individual cooling fans took suction through 48-inch diameter ducts, which penetrated the building roof and connected at the duct bottom. There was approximately 225 feet of above-grade ducting that carried the cooling air to the stack. These ducts have been removed as part of a previous BGRR remediation project. An aerial photograph of the BGRR site, with the above ground ducts intact, is shown in Figure 2-1.

The Reactor Building houses the reactor pile and experimental equipment on several working elevations. The 110' elevation is the main elevation and houses the fuel storage vault, receiving room, and machine shop. The 133' elevation historically contained restrooms, the instrument shop, an equipment room, and office spaces for BGRR personnel. Though the restrooms remain, the rest of this elevation has been converted to office space for BGRR personnel. The 143' elevation historically housed the reactor control room, office area, and an observation room. Currently this elevation is all office space for BGRR staff.



Figure 2-1 BGRR Site Looking North

Building (701) is a riveted steel frame building with a brick exterior. It is integral with the Laboratory Building (703) on the north side and the other three walls are exposed. It covers a ground area that is 123 feet 8 inches by 141 feet 10 inches (~ 16,800 ft²)

2.2. DECOMMISSIONING PLANS AND END STATE SELECTION

This Characterization Final Report is intended to support all decommissioning end-state alternatives. As such, the radiological and hazardous material data are reported against established or anticipated criteria that will determine if systems, equipment and structures within the BGRR are “contaminated” or “non-contaminated. Understanding that a particular component or structure is contaminated or non-contaminated will provide valuable input to project variables such as cost and schedule for all decommissioning alternatives.

3.0 DATA QUALITY OBJECTIVES

3.1. STATE THE PROBLEM

- The location, identity and concentration of radiological and hazardous contaminants within the interior of Building 701 must be determined such that a Feasibility Study (FS) and Comprehensive Risk Assessment (CRA) may be performed to support decommissioning alternatives and waste disposal efforts.

3.2. IDENTIFY THE DECISION

- Determine if existing data, process knowledge, and newly performed measurements can adequately specify the locations, type, and extent of contamination for decommissioning planning and waste characterization.
- Determine if radiological levels on structures and installed components exceed the release criteria defined in DOE Order 5400.5, applicable DOE Guidance (DOE 1995) and BNL procedure FS-SOP-1001, “Radiological Surface Contamination Criteria”.

3.3. IDENTIFY THE INPUTS TO THE DECISION

- Existing characterization data obtained during prior BGRR activities
- Facility and process knowledge germane to the construction, operation, and history of the BGRR including lessons learned from previous BGRR decommissioning investigations (BNL 2000a)
- New sample analysis information collected in selected areas to determine the presence of radiological and hazardous contaminants.
- Brookhaven National Laboratory procedures for release of radioactive materials.
- New York State Department of Environmental Conservation (NYSDEC) Technical Action Guidance Memoranda (TAGM) (NYSDEC 1994).
- 40 CFR 261, EPA Regulations, Hazardous Waste

3.4. DEFINE THE STUDY BOUNDARIES

- This study includes all interior and exterior surfaces and structures of Building 701, at or above the 110' elevation. It includes the roof surfaces, east and west air intake structures. The northern limit is at the boundary between Buildings 701 and 703.
- Systems internal to Building 701 (above 110') are included in this study.
- The internals of the reactor pile (Building 702) are excluded from this subpart of the characterization.
- There are constraints on data collection in that parts of the facility are being used for office space. In addition, there are non-permanent materials, tools, and supplies remaining on all elevations.
- The characterization took place in June – November 2002; facility changes and any activities after November 2002 are not included in this report.

3.5. STATE THE DECISION RULES

- Survey units will be characterized based on historical information, random and biased sampling, and professional judgment.
- If hazardous materials are detected above the levels identified in Tables 4 & 5, then the area is considered contaminated for the purposes of this characterization. Specific cleanup levels will be developed and adopted as part of a Record of Decision (ROD).
- If radioactive materials are detected above the criteria in SOP-1001 (Table 1), then the area is considered contaminated for the purposes of this characterization. Specific cleanup levels will be developed and adopted as part of a ROD.
- “Release” of a survey unit will not be accomplished, as additional activities may occur between the time of the survey and the time of remediation and final release.

3.6. SPECIFY LIMITS ON DECISION ERRORS

- Constraints on decision error are not necessary because a statistical sampling plan is not required at this stage of the project.

3.7. OPTIMIZE THE DESIGN FOR OBTAINING DATA

- Use historical information; including surveys, incident reports, logbooks, monthly reports, and interviews with BGRR experienced personnel.
- Survey using a combination of scans, smears, and samples of material to characterize survey units where historical information is not adequate to define an area.

4.0 OVERVIEW OF CHARACTERIZATION PLAN AND METHODS

4.1. RADIOLOGICAL CHARACTERIZATION CRITERIA

The BGRR building surfaces, structures, and systems were divided into 67 survey units, subdivided by reactor elevation (e.g. 110') or survey unit location assignment (e.g. 701, 702, or SYS). A master list of all survey units is provided in Table 7.

Survey units were characterized using historical BGRR survey data, “new” survey data obtained during the characterization efforts, and laboratory analysis results of samples and facility components for hazardous materials. Each survey unit was investigated with regard to the past and present use of each survey unit, from a radiological and hazardous perspective, to ensure that all aspects of an area are considered.

The results of each survey unit were placed in a master survey file. Each Survey Unit Report serves as a “snapshot” of the current state of the area and includes the following detailed information:

- Survey unit description
- Current and previous uses
- List of materials/equipment present during the characterization
- Summary of radiological and hazardous survey data collected

- Recommendations for future sampling efforts
- Photographs of the survey unit taken during this characterization effort

4.1.1. Contamination Criteria

Radiological characterization surveys were conducted to the survey criteria stated in Table 1, “Radiological Surface Contamination Criteria”. (FS-SOP-1001)

Table 1. Radiological Surface Contamination Criteria

Summary of Surface Contamination Values¹ - Allowable Total Residual Surface Contamination from FS-SOP-1001.

NUCLIDE	REMOVABLE (dpm/100 cm ²) (See Note 2,4,6)	TOTAL(FIXED + REMOVABLE) (dpm/100 cm ²) (See Note 2,3,6)
U-natural, U-235, U-238 and associated decay products	1,000 alpha	5,000 alpha
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	20	500
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above. Includes mixed fission products containing Sr-90. ⁵	1,000 beta-gamma	5,000 beta-gamma
Tritium organic compounds, surfaces contaminated by HT, HTO and metal tritide aerosols	10,000	10,000

Notes:

1. These values apply to radioactive contamination deposited on, but not incorporated into the interior of the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for the alpha- and beta-gamma-emitting nuclides apply independently. Volume/bulk activated materials are not included in these limits.
2. As noted, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
3. The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm² is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the activity guide G if:

- From measurements of a representative number n of sections it is determined that
 - $1/n \sum S_i \geq G$, where S_i is the dpm/min-100 cm² determined from measurement of section i ;
or
 - It is determined that the sum of the activity of all isolated spots or particles in any 100 cm² area exceeds $3G$.
4. The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with any appropriate instrument of known efficiency. (Note - the use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and Ra-228, Ac-227, Th-228, Th-230, and Pa-231 alpha emitters, it is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.
5. This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

For surveys of small items covering less than 100 cm², the results shall be reported in units of dpm per area surveyed

4.1.2. Radionuclides of Concern

The Radionuclides of Concern (ROCs) identified for this subpart are common to other BNL Environmental Management (EM) decommissioning projects. A complete list is provided in the Tables 2 and 3.

Table 2. Surface Soil Cleanup Goals for Radionuclides of Concern

Radionuclide	Preliminary Cleanup Goals (pCi/g)	Reference	Target Goal ¹ (pCi/g)
Americium-241	39 (OU I/VI)	CDM (1996), Table 6.2-10	39
Americium-241	40 (OU II/VII), 39 (OU IV)	CDM (1999), Table 1-3	
Carbon-14	NL		31 ²
Cesium-137	23 (OU I/VI)	CDM (1996), Table 6.2-10	23
Cesium-137	23 (OU II/VII, IV)	CDM (1999), Table 1-3	
Cobalt-60	1100 (OU I/VI)	CDM (1996), Table 6.2-10	1100
Cobalt-60	NL	CDM (1997), page D-6	
Cobalt-60	1300 (OU II/VII), 1160 (OU IV)	CDM (1999), Table 1-3	
Europium-152	49 (OU IV)	CDM (1999), Table 1-8	49
Europium-154	170 (OU IV)	CDM (1999), Table 1-8	170
Europium-155	150,000 (OU IV)	CDM (1999), Table 1-8	1.50 E+05
Iodine-129	NL		2.4 ²
Nickel-63	NL		2.9 E+05 ²
Plutonium-238	65 (OU I/VI)	CDM (1996), Table 6.2-10	65
Plutonium-238	66 (OU II/VII, IV)	CDM (1999), Table 1-3	
Plutonium-239	40 (OU I/VI)	CDM (1996), Table 6.2-10	40
Plutonium-239	40 (OU II/VII, IV)	CDM (1999), Table 1-3	
Plutonium-240	40 (OU I/VI)	CDM (1996), Table 6.2-10	40
Plutonium-240	40 (OU II/VII, IV)	CDM (1999), Table 1-3	
Radium-226	5 (OU II/VII, IV)	CDM (1999), page ES-5 and Table 1-3, per DOE Order 5400.5	5
Samarium-151	NL		4.0 E+06 ²
Strontium-90	15 (OU I)	CDM (1997), page D-7 groundwater protection	15
Strontium-90	33 (OU I/VI)	CDM (1996), Table 6.2-10	
Strontium-90	15 (OU II/VII, IV)	CDM (1999), Table 1-3	
Technetium-99	NL		44 ²
Thorium-232	5 (OU II/VII, IV)	CDM (1999), Appendix B page B-2, per DOE Order 5400.5	5
Tritium	9.6 E+15 (OU I/VI)	CDM (1996), Table 6.2-10	1010 ²
Tritium	NA	CDM (1999), Table 1-3	
Uranium-234	13	CDM (1999), Table 1-8	9 ³
Uranium-235	11 (OU I/VI)	CDM (1996)	9
Uranium-235	9 (OU II/VII), 10 (OU IV)	CDM (1999), Table 1-3	
Uranium-238	11	CDM (1997), page D-7 groundwater protection	9
Uranium-238	14 (OU I/VI)	CDM (1996)	
Uranium-238	9 (OU II/VII), 11 (OU IV)	CDM (1999), Table 1-3	

¹ The numbers in this column are generally chosen as the lowest that have been used in the other referenced Operable Units (OUs). For radionuclides that have not been considered in the other OUs, see footnote 2.

² The goals for radionuclides that were not previously estimated for a residential scenario were estimated as the soil concentration which could cause a hypothetical onsite resident to receive no more than 15 mrem/yr using the regulator specified scenario.

³ This goal was chosen to be consistent with the other uranium isotopes. The dose to source ratio (mrem/yr per pCi/g) for uranium-234 will be essentially identical to uranium-238 under the scenarios used in previous OUs.

Table 3. Alpha Isotope Surface Soil Cleanup Goals

Radionuclide	Preliminary Cleanup Goal	Reference	Target Goal ¹ (pCi/g)
Americium-241	39 (OU I/VI)	CDM (1996), Table 6.2-10	39
Americium-241	40 (OU II/VII), 39 (OU IV)	CDM (1999), Table 1-3	
Plutonium-238	65 (OU I/VI)	CDM (1996), Table 6.2-10	65
Plutonium-238	66 (OU II/VII, IV)	CDM (1999), Table 1-3	
Plutonium-239	40 (OU I/VI)	CDM (1996), Table 6.2-10	40
Plutonium-239	40 (OU II/VII, IV)	CDM (1999), Table 1-3	
Plutonium-240	40 (OU I/VI)	CDM (1996), Table 6.2-10	40
Plutonium-240	40 (OU II/VII, IV)	CDM (1999), Table 1-3	
Radium-226	5 (OU II/VII, IV)	CDM (1999), page ES-5 and Table 1-3, per DOE Order 5400.5	5
Thorium-232	5 (OU II/VII, IV)	CDM (1999), Appendix B page B-2, per DOE Order 5400.5	5
Uranium-234	13	CDM (1999), Table 1-8	9 ³
Uranium-235	11 (OU I/VI)	CDM (1996)	9
Uranium-235	9 (OU II/VII), 10 (OU IV)	CDM (1999), Table 1-3	
Uranium-238	11	CDM (1997), page D-7 groundwater protection	9
Uranium-238	14 (OU I/VI)	CDM (1996)	
Uranium-238	9 (OU II/VII), 11 (OU IV)	CDM (1999), Table 1-3	

¹ The numbers in this column are generally chosen as the lowest that have been used in the other referenced Operable Units (OUs). For radionuclides that have not been considered in the other OUs, see footnote 2.
² The goals for radionuclides that were not previously estimated for a residential scenario were estimated as the soil concentration which could cause a hypothetical onsite resident to receive no more than 15 mrem/yr using the specified scenario.
³ This goal was chosen to be consistent with the other uranium isotopes. The dose to source ratio (mrem/yr per pCi/g) for uranium-234 will be essentially identical to uranium-238 under the scenarios used in previous OUs.

4.1.3. Exposure Rate Criteria

Radiological exposure rate measurements were conducted to ensure an exposure rate sensitivity of 5 micro R/hr above background in accordance with Procedure FS-SOP-1000. Exposure rate measurements were performed using approved procedures and taken at established points that can be duplicated. Exposure rate measurements were obtained at contact and in the general area (30 cm from surface) using established reference points.

4.1.4. Volumetric Release Criteria

FS-SOP-1005 was used as the criteria to evaluate if potentially contaminated volumetric material could be classified as non-contaminated.

The current BNL administrative limit of 10,000 pCi/l (10 pCi/cc) was used as the volumetric release criteria for tritium.

There is currently a moratorium of release of scrap metals for recycling. This does not prevent BNL from releasing metal products using FS-SOP-1005 if the material is not going to a recycling firm. At the time of remediation, the Radiological Control Division will provide guidance on the current BNL and DOE policies on volumetric release.

4.2. HAZARDOUS MATERIAL CHARACTERIZATION CRITERIA

Hazardous material surveys were performed by the collection of samples from building materials, drain and trap sediments and sludge, and direct sampling methods. The samples were submitted to a qualified laboratory for analyses. Analytical detection limits were determined by laboratory analytical techniques and standard methodologies. BGRR characterization samples submitted for laboratory analyses were subject to the screening limits in Table and Table .

Table 4. Screening Levels and Detection Limits for Inorganic COPCs

Analyte	Clean-up Action Limit TAGM (mg/kg)	CRDL Low Soil Contract Laboratory Program (CLP) ^a (mg/kg)
Aluminum	16,491 ^b	2.0
Antimony	13.1 ^b	0.6
Arsenic	7.5	0.1
Barium	300	2.0
Beryllium	0.43 ^b	0.05
Cadmium	1.5 ^b	0.05
Calcium	434 ^b	50
Chromium	14.2 ^b	0.1
Cobalt	30 ^b	0.5
Copper	25 ^b	0.025
Chromium VI	14.2 ^b	NA
Cyanide	ND	0.1
Iron	14,429 ^b	1.0
Lead	400 ^c	0.03
Magnesium	2122 ^b	50
Manganese	148 ^b	0.15
Mercury	1.84 ^c	0.002
Nickel	13	0.4
Potassium	628 ^b	50
Selenium	2	0.05
Silver	2 ^b	0.1
Sodium	196 ^b	50

Analyte	Clean-up Action Limit TAGM (mg/kg)	CRDL Low Soil Contract Laboratory Program (CLP) ^a (mg/kg)
Thallium	0.35 ^b	0.1
Vanadium	150	0.5
Zinc	22.4 ^b	0.2
^a CRDL is contract required detection limit, the soil CRDL is approximately 10 times the CRDL for water. ^b Site background: 97.72 percentile of available results for background soil samples. Operable Unit 1 ROD(BNL 1999a) ^c . Operable Unit I ROD ND = not determined NA = not available		

Table 5. Detection Limits for certain COPCs

Analyses	Detection Limit
Asbestos	1%
Mercury	<0.2 ppm
Elemental Lead	<5.0 ppm
PCB's	<1.0 ppm
Zinc	<100 ppm
Beryllium	<10 ppm
Cadmium	<5.0 ppm

5.0 RESULTS

A total of 67 Survey Units were characterized using the Data Quality Objectives outlined in Section 3. Summary results of the survey units are outlined in Tables 6, 8, 9, 10 and Appendices A – H. Detailed characterization information for each is presented in the BGRR Individual Survey Unit Reports found in Volume II of this report.

All survey units were categorized into any single (or combination) of the following:

- Radiologically contaminated (based on the criteria in Table 1);
- Radioactive material storage area;
- Hazardously contaminated (based on the screening criteria in Table and Table)

Table 6. Summary of Characterization Results for BGRR Survey Units

BGRR Elevation / Area	Survey Units	Radiological Contamination	Radioactive Material Storage Areas	Hazardous Material Contamination
701 – 110’ Rx Bldg	18	8	4	18
701 – 133’ Offices	5	0	1	5
701 – 133’ Rx Bldg	4	1	0	4
701 – 143’ Offices	3	0	0	3
701 – 143’ Rx Bldg	5	2	1	5
701 – Walls & Interior	12	1	0	7
702 – Reactor Pile	5	3	2	5
Systems	15	3	0	5
Totals	67	18	8	52
% Impacted	-	27%	12%	78%

5.1. GENERAL CHARACTERIZATION RESULTS

In addition to specific survey unit results, general statements or cautions can be presented for the BGRR and its support facilities based on a review of the characterization data. These general statements are applicable to both hazardous material and radioactive material. Specific data regarding the individual survey units is available in Tables 8 – 10, appendices A – H, and volume II of this report.

5.1.1. Asbestos Containing Material (ACM)

Asbestos containing material (ACM) is found throughout the BGRR on original floor and ceiling

surfaces. Composite samples were collected from a limited number of areas. General statements caution that floor and ceiling tiles are ACM. Floors throughout the BGRR use ACM tiles and adhesives. Piping and valves contain Garlock gaskets with ACM. All piping insulation is also considered ACM. In preparation for decommissioning the BGRR, asbestos abatement technologies will be required.

5.1.2. Lead

Lead is present in many products throughout the BGRR. All paint coatings and sealants are assumed to be lead based. Samples and scrapings taken throughout the facility indicate lead above reportable levels. Appropriate precautions should be taken throughout the complex when conducting any remediation activities on painted or coated surfaces.

5.1.3. Heavy Metals

Floor and wall coatings were analyzed for several heavy metals. All heavy metals were detected above minimum detection levels in a majority of samples. Lead and Zinc were detected above the reporting limits in all samples while Cadmium and Beryllium were sporadically identified above reporting limits.

5.1.4. PCBs

Polychlorinated Biphenyl's (PCB's) were identified in all hazardous materials samples analyzed from the BGRR (See Table 10) PCBs were used as an additive to paints for corrosion protection. PCB's were also present in lubricating greases and oils. PCB-paint (chlorinated rubber paint) was a common paint used in the period 1955-1975 for metal constructions and on pipelines.

5.2. BUILDING 701 - 110' ELEVATION, REACTOR BUILDING

This elevation contains general access passageways as well as rooms and spaces formerly utilized to support BGRR operation. These areas contain some posted contamination and radioactive material areas. Radioactive material is adequately packaged to contain contamination. Higher contamination and dose rates were identified in the areas surrounding the CRDM's. Fixed contamination was identified in the Fuel storage vault, CRDM areas, and the east general area. A small source vault is currently located in the Health physics office on this elevation.

Most of the hazardous material contamination is in the form of heavy metals detected in scrapings of sealants and coatings. In many areas, asbestos tiles and adhesives are common. Sampling indicates that paints used within the facility are lead based.

Additional information regarding the survey units on this elevation can be found in Appendix A.

5.3. BUILDING 701 - 133' ELEVATION, OFFICE SPACES

This elevation contains office spaces and passageways for personnel supporting current BGRR activities. Access between these spaces and the Reactor Building for normal passage is secured.

These areas contain one posted radioactive material area used to support a smear counting lab. There was no radiological contamination identified in these areas.

Hazardous materials include asbestos floor tiles, ACM piping insulation, and adhesives. All coated surfaces are covered with lead based paints.

Additional information regarding the survey units on this elevation can be found in Appendix B.

5.4. BUILDING 701 - 133' ELEVATION, REACTOR BUILDING

This elevation contains platforms and passage to support BGRR operation, maintenance, and provide access to BGRR experimental ports. The areas surrounding the CRDM's are posted contamination areas in order to control personnel access. Though posted, no contamination above the limits of Table 1 were detected. Additionally, no fixed contamination was identified.

Heavy metals have been identified in scrapings of sealants and coatings. In many areas, asbestos tiles and adhesives are present. All piping insulation is considered ACM and painted / coated surfaces are assumed to contain lead. PCB contamination has also been identified in CRDM areas.

Additional information regarding the survey units on this elevation can be found in Appendix C.

5.5. BUILDING 701 - 143' ELEVATION, OFFICE SPACES

This elevation contains office spaces and passageways for personnel supporting current BGRR activities. Access between these spaces and the Reactor Building for normal passage is secured. There was no radiological contamination identified in these areas.

Hazardous materials include asbestos floor tiles, ACM piping insulation, and adhesives. All coated surfaces are covered with lead based paints.

Additional information regarding the survey units on this elevation can be found in Appendix D.

5.6. BUILDING 701 - 143' ELEVATION, REACTOR BUILDING

This elevation contains platforms on the faces of the reactor pile, and a mechanical equipment room. The pile platforms were used for accessing pile experimental ports and maintenance and access to reactor support systems. The platform areas contain posted contamination areas and radioactive material areas (RMA.) The contamination areas are posted in order to control personnel access. The RMA is currently used for radioactive component storage. Though posted, no removable contamination above the limits of Table 1 were detected.

Heavy metals have been identified in scrapings of sealant and coatings. In many areas, asbestos tiles and adhesives are common. All piping insulation is considered ACM and painted / coated surfaces contain lead.

Additional information regarding the survey units on this elevation can be found in Appendix E.

5.7. BUILDING 701 –WALLS AND INTERIOR STRUCTURES

The walls and structural members contained in this survey unit are the principal construction elements that make up Building 701. One survey unit contained loose beta contamination above the limits specified in Table 1. Five survey units contained loose alpha contamination in excess of Table 1 limits. Three survey units contained areas of fixed beta contamination.

All paint and coatings on structural members contain lead. Heavy metals have been identified in scrapings of sealant and coatings. Piping insulation is considered ACM.

Additional information regarding the survey units on this elevation can be found in Appendix F.

5.8. BUILDING 702 –REACTOR PILE

The faces and top of the reactor pile contain areas of fixed and loose contamination. Experimental ports and gutters along the west pile face are the principle areas of concern.

The principal hazardous component in these survey units is the lead present in the paint of stairway handrails. Heavy metals have also been identified in paint and coating samples.

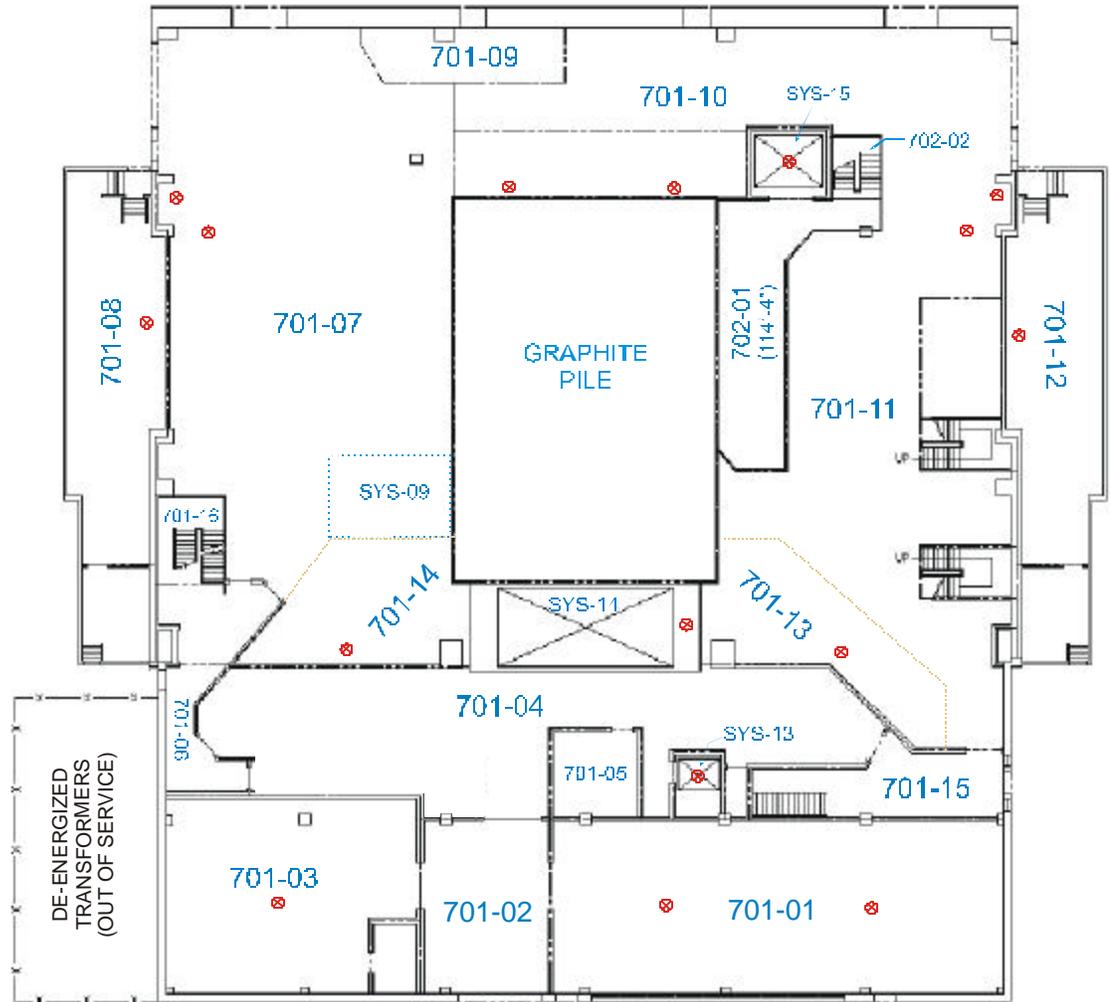
Additional information regarding the survey units on this elevation can be found in Appendix G.

5.9. SYSTEMS

Systems may be broadly divided into two categories; Building systems, and Reactor systems. Many building systems are still operational servicing the building on a daily basis (e.g. Sewage; Heating, Ventilation, & Air Conditioning (HVAC), etc.). The reactor systems have been secured and retired in place (e.g. CRDM's, Helium). Some systems indicated contamination above Minimum Detectable Activity (MDA) but below Table 1 limits.

The principle hazardous component in these survey units is lead used in the paintings and coatings. Heavy metals have also been identified in paint and coating samples. PCB's were identified in some oils and greases, and on some floor areas where spills had previously occurred.

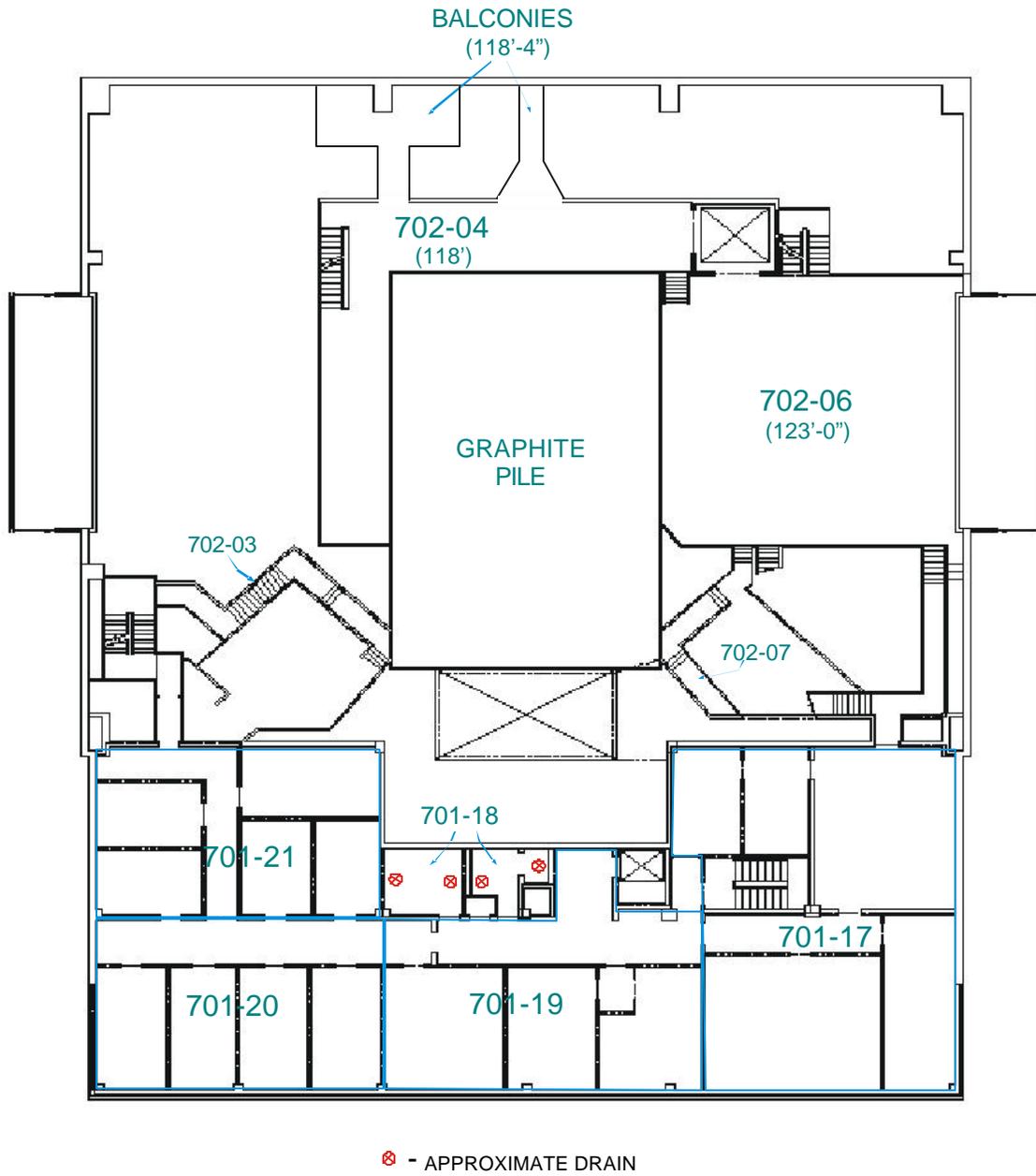
Additional information regarding these survey units can be found in Appendix H.



⊗ - APPROXIMATE DRAIN LOCATIONS

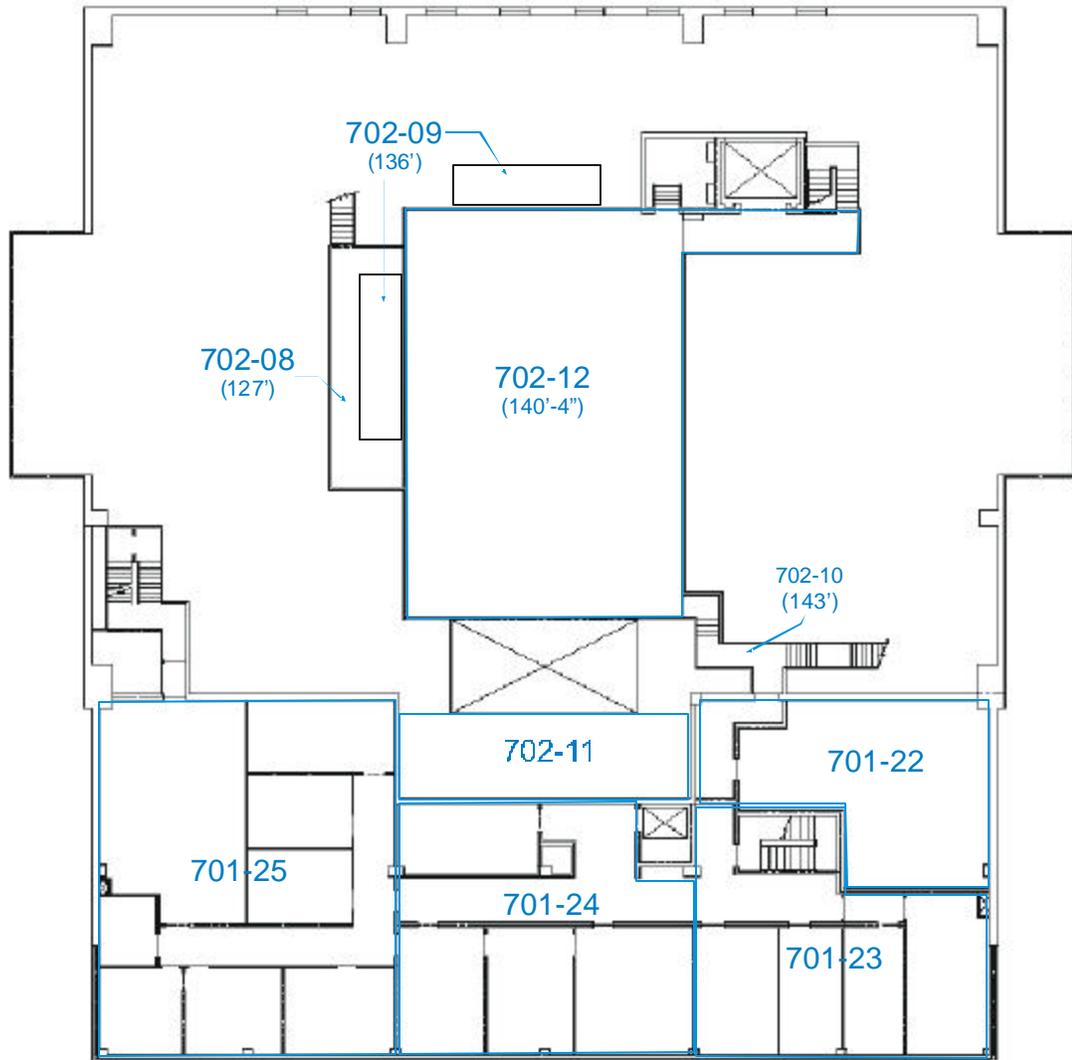
MAIN LEVEL - 110' ELEVATION

Figure 5-1 Survey unit breakdown for Building 701 Characterization - 110' Elevation



133' ELEVATION

Figure 5-3 Survey unit breakdown for Building 701 Characterization - 133' Elevation



143' ELEVATION

Figure 5-5 Survey unit breakdown for Building 701 Characterization - 143' Elevation

Table 7. Survey Unit Number and Description

Survey Unit Number	Elevation / Area	Survey Area Description
701-01	110'	Machine Shop
701-02	110'	Receiving Room
701-03	110'	Fuel Storage Vault
701-04	110'	Reactor Building South General Area.
701-05	110'	HP Office
701-06	110'	Main 701 Entrance Area
701-07	110'	Reactor Building West General Area
701-08	110'	West Air Intake Chamber (top surfaces)
701-09	110'	North Supply Room
701-10	110'	Reactor Building North General Area
701-11	110'	Reactor Building East General Area.
701-12	110'	East Air Intake Chamber (top surfaces)
701-13	110'	East CRDM Floor Surfaces
701-14	110'	West CRDM Floor Surfaces
701-15	110' (All)	East 701 entryway and main stairwell
701-16	All	Control Room Stairwell and walkway
701-17	133'	Offices 101A, 101B, 101C, 102, 103
701-18	133'	Foyer, Offices 104, 105, 106, and associated Corridor
701-19	133'	Men's and Ladies Rooms
701-20	133'	Offices 107, 108, 109, 110 and associated Corridor
701-21	133'	Offices 111, 112, 113, 114, 115 and associated Corridor
701-22	140'4"	Mechanical Equipment Room
701-23	143'	Offices 1, 2A, 2, 3, and associated corridor
701-24	143'	Offices 4, 5, 6, lobby, storeroom, and associated corridor

Survey Unit Number	Elevation / Area	Survey Area Description
701-25	143'	Offices 7, 8, 9, 10, 11, 12, and conference room
701-26	All	701 South wall interior structures (including surfaces of block walls, corrugated metal, I-beams, etc.)
701-27	All	701 West wall interior structures
701-28	All	701 North wall interior structures
701-29	All	701 East wall interior structures
701-30	All	701 South face exterior surfaces & structure
701-31	All	701 West face exterior surfaces & structure
701-32	All	701 North face exterior surfaces & structure
701-33	All	701 East face exterior surfaces & structure
701-34	N/A	Lower Roof Section – Interior
701-35	N/A	Lower Roof Section – Exterior
701-36	N/A	Reactor Building Roof - Interior
701-37	N/A	Reactor Building Roof – Exterior
702-1	114'4"	Lower East Pile Balcony
702-2	All	Stairwell next to freight elevator.
702-3	133'	West CRDM walkways
702-4	118'	West and North pile balconies; including balconies on north wall facing 703.
702-5	N/A	-Reserved for Future Use-
702-6	123'	East Pile balcony
702-7	133'	East CRDM walkways
702-8	127'	West Pile Balcony
702-9	136'	West/North Pile Top balconies
702-10	143'	Pile top access stairwell from 123' balcony
702-11	140'4"	Charging elevator catwalk area
702-12	140'4"	Pile/Bioshield top and associated walkways

Survey Unit Number	Elevation / Area	Survey Area Description
702-13	All	Bioshield East Face
702-14	All	Bioshield South Face
702-15	All	Bioshield West Face
702-16	All	Bioshield North Face
SYS-01	All	Control Rod Drive Mechanisms
SYS-02	All	Sanitary Sewer
SYS-03	All	Instrument Air
SYS-04	All	701 Building HVAC
SYS-05	All	Building Steam
SYS-06	All	Building Natural Gas
SYS-07	All	Building Drains
SYS-08	All	Pneumatic Sample Transfer System (including sample line trenches)
SYS-09	All	Chemo-Nuclear Loop
SYS-10	All	Building Crane
SYS-11	All	Electrical
SYS-12	All	Helium System
SYS-13	All	Personnel Elevator and machinery room
SYS-14	All	Charging Elevator
SYS-15	All	Freight Elevator

6.0 REFERENCES

40CFR261- 262 *Hazardous Waste*

40 CFR 761 *Polychlorinated Biphenyls (PCBs)*

(BNL 1999a) *Brookhaven National Laboratory for US Department of Energy, Record of Decision: Operable Unit I and Radiologically Contaminated Soils*, Brookhaven National Laboratory, October 1999.

(BNL 2000a) *Brookhaven Graphite Research Reactor Decommissioning Project, Removal Action Alternatives Study*, BGRR-0015, Rev. 0, Brookhaven National Laboratory, April 2000.

(BNL 2002a) *Sampling and Analysis Plan for the 701 Building, 701 Below Ground Structures, 702 Pile, and Remaining Soils*, BGRR-052, Rev. 0, Brookhaven National Laboratory, September 2002.

(BNL 2002b) *Characterization Report for the 701 Below-Ground Structures, 702 Pile, and Remaining Soils*, BGRR-055, Rev. 0, Brookhaven National Laboratory, November 2002.

(CDM 1999) *Brookhaven National Laboratory Final Feasibility Study Report, Operable Unit I and Radiologically Contaminated Soils*, 5109-020-FR-BCVJ, CDM Federal Programs Corporation, NY, 1999.

Brookhaven National Laboratory Procedures:

FS-SOP-1000 Radiation Survey Techniques

FS-SOP-1001 Contamination Survey Techniques

FS-SOP-1005 Release of Materials from Areas, Controlled for Radiological Purposes

7.0 ACRONYMS AND ABBREVIATIONS

μR/hr	Micro rem per hour
Ac-227	Actinium 227
ACM	Asbestos Containing Material
BGRR	Brookhaven Graphite Research Reactor
BNL	Brookhaven National Laboratory
CA	Contamination Area
CAS #	Chemical Abstract Services number
COPC	Contaminants of Potential Concern
CRDL	Contractor required detection limit
CRDM	Control Rod Drive Motor
CLP	Contract Laboratory Program
DOE	U.S. Department of Energy
dpm	Disintegrations per minute
DQO	Data Quality Objectives
EM	Environmental Management
HVAC	Heating, ventilation, and air conditioning
I-125	Iodine 125
I-126	Iodine 126
I-129	Iodine 129
I-131	Iodine 131
I-133	Iodine 133
ISOCS	<i>In-Situ</i> Object Counting System®
MDA	Minimum detectable activity
MDC	Minimum Detectable Concentration
MDL	method detection limit
mg/Kg	milligram per kilogram
mrem/yr	millirem per year
NA	Not available
Na-I	Sodium Iodide
ND	Not determined
NL	no limit
NYSDEC	New York State Department of Environmental Conservation
OU	operable unit
Pa-231	Protactinium 231
PCB	polychlorinated biphenyl
pCi/g	picoCuries per gram
pCi/l	picoCuries per liter
Ra-223	Radium-223
Ra-224	Radium-224
Ra-226	Radium-226
Ra-228	Radium-228
RMA	Radioactive Materials Area
ROCs	Radionuclides of Concern

ROD	Record of Decision
Sr-90	Strontium-90
SU	Survey Unit
TAGM	Technical and Administrative Guidance Memorandum (NYSDEC)
Th-228	Thorium 228
Th-230	Thorium 230
Th-232	Thorium 232
U-234	Uranium-232
VOCs	volatile organic compounds
yr	year(s)

Table 8. Building 701 Above-Ground Survey Units Radiological and Hazardous Material Results
(3 Pages)

701 Above Ground Structures and Surfaces				General Information			Scan Survey Results					Removable Contamination Results	
Survey Unit Number	Area / Elevation	Survey Unit Name	Description, Current Conditions, and Special Considerations	Number of Existing Radioactive Material Areas	Number of Existing Posted Contamination Areas	Highest General Area Dose Rate (μR/hr)	Floor Surface Scan Area (Ft ²)	Highest Floor Surface Scan Result (ncpm)	Wall / Ceiling Scan Area (Ft ²)	Highest Wall / Ceiling Scan Result (dpm/100cm ²)	1 min. Static Count Results (ndpm/100cm ²)	Smears Collected	Highest Smear Result (dpm)
701													
701-01	110'	Machine Shop	ISOCS / Beta Scint counting area.	4	1	8	700	<MDCR ⁽¹⁾	581	2860 ⁽²⁾	1690 ⁽²⁾	21	35.49
701-02	110'	Receiving Room	Entryway at south side roll-up door.	None	None	5	125	<MDCR ⁽¹⁾	388	<MDA ⁽²⁾	47 ⁽²⁾	21	<MDA
701-03	110'	Fuel Storage Vault	Plugged floor drain contained here.	1	2	40	950	8,000 ⁽¹⁾	466	17,600 ⁽²⁾	43,500 ⁽²⁾	21	263.48
701-04	110'	Reactor Building South General Area.	Extends from secondary doors next to each CRDM boundary. Includes storage closet directly outside of receiving Room.	None	None	5	1,100	<MDCR ⁽¹⁾	N/A	N/A	<MDA ⁽²⁾	21	35.64
701-05	110'	HP Office		1	None	10	80	<MDCR ⁽¹⁾	50	<MDA ⁽²⁾	<MDA ⁽²⁾	21	355.34
701-06	110'	Main 701 Entrance Area	West side entryway	None	None	5	600	<MDCR ⁽¹⁾	N/A	N/A	<MDA ⁽²⁾	21	79.78
701-07	110'	Reactor Building West General Area	Reactor Building floor areas west of pile from 703 wall to double-doors leading to main entryway. Used as rad material storage area. Chemo-Nuclear Loop located in this SU. Area between CNL and CRDM posted C.A. Several floor drains located here. Portion of east-west pneumatic trench located here.	None	2	15	2500	<MDCR ⁽¹⁾	N/A	N/A	326 ⁽²⁾	21	24.61
701-08	110'	West Air Intake Chamber (top surfaces)	Tile floor surface. Formerly used as operating floor for chemo-nuclear loop.	None	None	5	250	<MDCR ⁽¹⁾	N/A	N/A	<MDA ⁽²⁾	20	85.3
701-09	110'	North Supply Room		None	1	13	300	<MDCR ⁽¹⁾	127	<MDA ⁽²⁾	<MDA ⁽²⁾	20	35.64
701-10	110'	Reactor Building North General Area	Extends from western pneumatic trench to freight elevator stairwell. Includes all floor areas underneath balconies. Rad & hazardous drums were stored here. North-south pneumatic trenches leading to 703 located here. Pile gutter drain included here.	1	None	1200	875	<MDCR ⁽¹⁾	N/A	N/A	<MDA ⁽²⁾	20	27.37
701-11	110'	Reactor Building East General Area.	Extends from NE roll-up door to stairwell leading to 123' balcony. Deep Drain Sump and several floor drains located in this SU. Portion of east-west pneumatic trench located here.	None	1	40	875	3,000 ⁽¹⁾	80 (underside of balcony)	7500 ⁽²⁾ (underside of balcony)	700 ⁽²⁾	26	244.68
701-12	110'	East Air Intake Chamber (top surfaces)	Tile floor surface.	None	None	12	250	<MDCR ⁽¹⁾	N/A	N/A	<MDA ⁽²⁾	21	52.19
701-13	110'	East CRDM Floor Surfaces	Posted C.A. Floor drain located here. However, drain has been plugged with concrete. Also see SYS-01	None	1	30	77	<MDA	N/A	N/A	31,500 ⁽²⁾ (in pile drain trough)	21	658.96
701-14	110'	West CRDM Floor Surfaces	Posted C.A. Also see SYS-01	None	1	5	186	<MDA	N/A	N/A	16,500 ⁽²⁾	21	603.63
701-15	110' (All)	East 701 entryway and main stairwell	Area between east outside access door and double door to south general area.	None	None	5	168	<MDA	497	<MDA ⁽²⁾	<MDA ⁽²⁾	21	41.16
701-16	All	Control Room Stairwell and walkway	Posted fixed C.A. southwest corner stairwell.	None	1	6	268	38,000 ⁽¹⁾	186	<MDA ⁽²⁾	9,000 ⁽²⁾ 7,500 ⁽²⁾	23	85.14

Notes: 1 - Gas Flow Proportional Counter, Ludlum Floorwalker
2 - Hand Held Alpha/Beta Scintillation Detector, Eberline Model E-600
3 - Ludlum Model 3 GM Frisker

701 Above Ground Structures and Surfaces				General Information			Scan Survey Results					Removable Contamination Results	
Survey Unit Number	Area / Elevation	Survey Unit Name	Description, Current Conditions, and Special Considerations	Number of Existing Radioactive Material Areas	Number of Existing Posted Contamination Areas	Highest General Area Dose Rate (μR/hr)	Floor Surface Scan Area (Ft ²)	Highest Floor Surface Scan Result (ncpm)	Wall / Ceiling Scan Area (Ft ²)	Highest Wall / Ceiling Scan Result (dpm/100cm ²)	1 min. Static Count Results (ndpm/100cm ²)	Smears Collected	Highest Smear Result (dpm)
701-17	133'	Offices 101, 102, 103	133' elevation office spaces. Small smear sample-counting lab and annex spaces- controlled area and RAM area.	1	None	5	0	N/A	615	<MDA ⁽²⁾	<MDA ⁽²⁾	11	30.12
701-18	133'	Men's and Ladies Rooms	Men's and Lady's restrooms on 133' elevation.	None	None	5	0	N/A	78	<MDA ⁽²⁾	<MDA ⁽²⁾	11	<MDA
701-19	133'	Foyer, Offices 104, 105, 106 and associated Corridor	133' elevation office spaces, general access hallway. Isolated from Reactor Building.	None	None	4	0	N/A	357	<MDA ⁽²⁾	<MDA ⁽²⁾	11	<MDA
701-20	133'	Offices 107, 108, 109, 110 and associated Corridor	133' elevation office spaces, general access hallway.	None	None	4	0	N/A	381	<MDA ⁽²⁾	<MDA ⁽²⁾	11	35.64
701-21	133'	Offices 111, 112, 113, 114, 115 and associated Corridor	133' elevation office spaces, general access hallway.	None	None	5	0	N/A	353	<MDA ⁽²⁾	<MDA ⁽²⁾	11	30.12
701-22	140'4"	Mechanical Equipment Room	Entry must be made from Controlled Area.	None	None	6	125	2000 ⁽¹⁾	NA	NA	12,700 ⁽²⁾	21	<MDA
701-23	143'	Offices 1, 2A, 2, 3, and associated corridor	143' elevation office spaces, adjacent corridor on eastern corner.	None	None	4	0	N/A	413	<MDA ⁽²⁾	<MDA ⁽²⁾	11	<MDA
701-24	143'	Offices 4, 5, 6, lobby, storeroom, and associated corridor	143' elevation office spaces, adjacent corridor on southeast face.	None	None	5	0	N/A	477	<MDA ⁽²⁾	<MDA ⁽²⁾	11	<MDA
701-25	143'	Offices 7, 8, 9, 10, 11, 12, and conference room	143' elevation office spaces, adjacent corridor on south corner.	None	None	5	0	N/A	719	<MDA ⁽²⁾	<MDA ⁽²⁾	11	<MDA
701-26	All	701 South wall interior structures	South wall interior structures including surfaces of block walls, corrugated metal, I-beams, etc.	None	None	5	0	N/A	1,250	100,000 ⁽¹⁾ (On Catwalk Surface)	40,000 ⁽²⁾	36	801.32 beta 28.75 alpha (removed)
701-27	All	701 West wall interior structures	West interior wall. Glass pane windows	None	None	8	0	N/A	590	12,500 ⁽²⁾	8,000 ⁽²⁾	22	542.78
701-28	All	701 North wall interior structures	North interior wall.	None	None	7	0	N/A	910	8,000 ⁽²⁾	3,200 ⁽²⁾	35	802.10
701-29	All	701 East wall interior structures	East interior wall.	None	None	8	0	N/A	653	10,500 ⁽²⁾	7,780 ⁽²⁾	19	515.50 beta 63.02 alpha
701-30	All	701 South face exterior surfaces & structure	South Exterior wall with decorative brick surfaces.	None	None	6	0	N/A	1,095	1,800 ⁽²⁾	1,600 ⁽²⁾	21	30.12
701-31	All	701 West face exterior surfaces & structure	Survey includes fixed louvers on outside of west air intake chamber	None	None	10	0	N/A	1,095	2,000 ⁽²⁾	761 ⁽²⁾	21	41.16
701-32	All	701 North face exterior surfaces & structure	North exterior wall with decorative brick surfaces.	None	None	2	0	N/A	779	1,800 ⁽²⁾	635 ⁽²⁾	21	41.16
701-33	All	701 East face exterior surfaces & structure	Survey includes fixed louvers on outside of east air intake chamber	None	None	45	0	N/A	960	2,000 ⁽²⁾	<MDA ⁽²⁾	20	30.12
701-34	N/A	Lower Roof Section – Interior	South roof over offices (Samples obtained in SU-701 23 – 25 on suspended plaster ceiling)	None	None	4	0	NA	195	<MDA ⁽²⁾	None	8	<MDA

Notes: 1 - Gas Flow Proportional Counter, Ludlum Floorwalker
2 - Hand Held Alpha/Beta Scintillation Detector, Eberline Model E-600
3 - Ludlum Model 3 GM Frisker

		701 Above Ground Structures and Surfaces		General Information			Scan Survey Results					Removable Contamination Results	
Survey Unit Number	Area / Elevation	Survey Unit Name	Description, Current Conditions, and Special Considerations	Number of Existing Radioactive Material Areas	Number of Existing Posted Contamination Areas	Highest General Area Dose Rate (µR/hr)	Floor Surface Scan Area (Ft²)	Highest Floor Surface Scan Result (ncpm)	Wall / Ceiling Scan Area (Ft²)	Highest Wall / Ceiling Scan Result (dpm/100cm²)	1 min. Static Count Results (ndpm/100cm²)	Smears Collected	Highest Smear Result (dpm)
701-35	N/A	Lower Roof Section – Exterior	South roof over offices	None	None	9	4200	<MDCR ⁽¹⁾	N/A	N/A	None	10	51.26 beta 21.39 alpha
701-36	N/A	Reactor Building Roof - Interior	Elevated roof section over Pile including structural steel and catwalks	None	2 (on Catwalks)	9	750	40,000 ⁽¹⁾ (On Catwalk Surface)	1715	100,000 ⁽¹⁾ (On Catwalk Surface)	11,300 ⁽²⁾ (On Catwalk Surfaces)	27	1,198.89 beta 21.05 alpha (On Catwalk Surface)
701-37	N/A	Reactor Building Roof – Exterior	Elevated roof section over Pile	None	None	9	9300	<MDCR ⁽¹⁾	N/A	N/A	<MDA ⁽²⁾	10	57.71

Notes: 1 - Gas Flow Proportional Counter, Ludlum Floorwalker
2 - Hand Held Alpha/Beta Scintillation Detector, Eberline Model E-600
3 - Ludlum Model 3 GM Frisker

Table 9. Building 702 Pile Survey Units Radiological and Hazardous Material Results

702 Pile				General Information			Scan Survey Results					Removable Contamination Results	
Survey Unit Number	Area / Elevation	Survey Unit Name	Description, Current Conditions, and Special Considerations	Number of Existing Radioactive Material Areas	Number of Existing Posted Contamination Areas	Highest General Area Dose Rate (µR/hr)	Floor Surface Scan Area (Ft ²)	Highest Floor Surface Scan Result (ncpm)	Wall / Ceiling Scan Area ² (Ft ²)	Highest Wall / Ceiling Scan Result (dpm/100cm ²)	1 min. Static Count Results (ndpm/100cm ²)	Smears Collected	Highest Smear Result (dpm)
702-01	114'	East Face Balcony	East pile face balcony 114' elevation. Small RAM area.	1	None	60	175	<MDCR ⁽¹⁾	0	N/A	None	20	74.26
702-02	All	Balcony Stairway	Pile balcony access stairway next to freight elevator.	None	None	5	220	<MDCR ⁽¹⁾	0	N/A	None	20	30.12
702-03	133'	West CRDM Balconies	West CRDM access balconies. CA to control access to potential removable contamination.	None	1	4	200	<MDCR ⁽¹⁾	0	N/A	None	40	96.18
702-04	118'	North-West Face Balcony	North-West pile face balconies provided to access experimental ports.	None	None	18	970	<MDCR ⁽¹⁾	0	N/A	None	20	57.71
702-06	123'	East Face Balcony	East pile face balcony 123' elevation	None	None	9	1450	<MDCR ⁽¹⁾	0	N/A	None	22	63.23
702-07	133'	East CRDM Access Balconies	East CRDM access balconies. CA to control access to potential removable contamination.	None	1	6	340	<MDCR ⁽¹⁾	0	N/A	None	40	658.96
702-08	127'	West Face Balcony	West pile face balcony 127' balcony. 6-inch pile gutter removable contamination.	None	None	4	450	<MDCR ⁽¹⁾	0	N/A	<MDA ⁽²⁾	11	129.44
702-09	137'	North-West Face Balconies	Upper North-West pile face balcony 137' elevation. Access to pile top. CA's to control access to potential removable contamination.	None	2	5	125	12,500 ⁽¹⁾	0	N/A	32,000 ⁽²⁾	21	68.59
702-10	143'	Pile Top Access Stairways	Stairway providing access to the pile top. RAM area to control access to pile top where materials are stored.	1	None	30	160	<MDCR ⁽¹⁾	0	N/A	9000 ⁽²⁾	21	57.71
702-11	143'	Charging Elevator Catwalk	Charging elevator catwalk on south side of pile. CA to control access to potential contamination.	None	1	3	280	<MDCR ⁽¹⁾	0	N/A	<MDA ⁽²⁾	21	234.11
702-12	140'	Reactor Pile Top	Reactor pile top. RAM area to control removal of equipment.	1	None	440	1550	180,000 ⁽¹⁾	0	N/A	185,400 ⁽²⁾	21	88.06
702-13	All	East Reactor Pile Face	East reactor pile face. Survey unit is a RAM area.	1	None	4	0	N/A	204	<MDA ⁽²⁾	6,000 ⁽²⁾	11	52.19
702-14	All	South Reactor Pile Face	South reactor pile face. Survey unit is a CA.	None	1	4	0	N/A	208	<MDA ⁽²⁾	<MDA ⁽²⁾	11	46.68
702-15	All	West Reactor Pile Face	West reactor pile face. Gutter drain posted CA.	None	1	5	0	N/A	174	94,000 ⁽²⁾	386,000 ⁽²⁾	23	3191.47
702-16	All	North Reactor Pile Face	North reactor pile face. Gutter drain posted CA.	None	1	N/A	0	N/A	245	2,000 ⁽³⁾	23,000 ⁽²⁾	11	57.71

Notes: 1 - Gas Flow Proportional Counter, Ludlum Floorwalker
2 - Hand Held Alpha/Beta Scintillation Detector, Eberline Model E-600
3 - Ludlum Model 3 GM Frisker

Table 10. Building 701 – 702 Hazardous Materials Characterization of Wall / Floor Sealants, Coatings, and Paints

Parameter	Reporting Limit	Units	Min. Det. Level	System Sample Numbers*												
				701-23 ceiling plaster (SYS-16-01)	Eyerest Green Paint (SYS-16-02)	Seafoam Green Paint (SYS-16-03)	Seafoam Green Paint (SYS-16-04)	Rx. Bldg. Plaster (SYS-16-05)	Paint from CRDM Beams (SYS-16-06)	Blue Paint from Railings and Supports (SYS-16-07)	Red Paint from Railings and Supports (SYS-16-08)	Green Paint from Railings and Supports (SYS-16-09)	Paint from Rx. Bldg Beams (SYS-16-10)	Bioshield Paint (SYS-16-11)	133' / 143' Office Plaster (SYS-16-12)	Paint from minor supports (SYS-16-14)
Aroclor 1016	**	µg/Kg	**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1221	**	µg/Kg	**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232	**	µg/Kg	**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242	**	µg/Kg	**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	**	µg/Kg	**	ND	ND	ND	3,200,000	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254	**	µg/Kg	**	680	15,000	ND	ND	3,400,000	20,000	15,000	33,000	6,600	47,000	39,000	1,700	20,000
Aroclor 1260	**	µg/Kg	**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.033	mg/Kg	0.007	0.47	3.0	0.025	4.8	0.54	3.4	0.26	0.69	0.51	0.77	6.2	0.38	0.24
Aluminum	20	mg/Kg	2.48	4,520	6,980	8,130	9,300	3,420	2,120	9,220	983	11,800	1,430	1,690	1,550	1,340
Arsenic	1	mg/Kg	0.096	1.2	14.8	7.7	2.1	0.26	9.5	1.5	13.4	2.7	0.88	14.0	0.35	1.9
Lead	3	mg/Kg	0.067	16.1	76,200	498	507	1,890	114,000	3,320	6,110	850	26,400	3,130	647	114,000
Antimony	6	mg/Kg	4.56	0.28	8.8	ND	1.4	2.4	5.4	2.2	1.4	0.78	4.3	17.1	0.89	2.7
Barium	20	mg/Kg	0.42	80.1	128	727	892	200	169	89.5	158	76.0	337	1,060	233	161
Selenium	0.5	mg/Kg	0.20	ND	0.44	ND	ND	ND	5.4	0.27	5.3	ND	0.43	4.5	ND	2.3
Beryllium	0.5	mg/Kg	0.018	0.65	0.16	0.36	0.30	0.16	0.29	0.40	0.22	0.51	0.15	0.31	0.16	0.26
Thallium	1	mg/Kg	0.19	ND	ND	ND	ND	ND	6.6	ND	10.2	ND	ND	8.5	ND	2.5
Cadmium	0.5	mg/Kg	0.27	0.72	12.3	ND	0.73	14.1	ND	12.9	ND	0.91	4.7	ND	0.48	7.8
Calcium	1000	mg/Kg	21.6	192,000	86,800	160,000	138,000	148,000	41,200	134,000	17,500	160,000	127,000	29,900	218,000	36,000
Chromium	1	mg/Kg	0.11	20.6	179	9.2	18.9	242	680	21.8	170	43.6	443	794	55.1	254
Cobalt	5	mg/Kg	0.24	4.5	130	1.9	7.8	20.4	127	69.5	140	25.5	174	121	20.5	73.8
Copper	2.5	mg/Kg	0.42	4.2	12.4	6.3	9.4	19.5	153	72.6	223	38.7	62.7	1,180	1.8	83.5
Iron	20	mg/Kg	3.13	2,580	2,820	2,220	2,750	4,110	145,000	9,040	145,000	13,000	17,600	139,000	648	60,400
Magnesium	1000	mg/Kg	12.7	125,000	2,850	9,140	7,830	12,500	5,950	7,560	2,050	6,430	2,240	1,150	68,700	2,130
Manganese	15	mg/Kg	0.036	398	150	92.4	97.5	103	681	368	632	359	204	1,230	48.2	1,030
Nickle	4	mg/Kg	0.72	71.9	8.4	2.7	2.9	13.6	126	6.8	83.9	16.0	21.4	1,470	1.2	25.8
Potassium	1000	mg/Kg	73.7	635	345	42,700	22,800	8,000	ND	2,040	415	3,230	410	769	ND	ND
Silver	1	mg/Kg	0.62	ND	0.92	ND	ND	ND	ND	1.1	ND	ND	1.1	ND	ND	ND
Sodium	1000	mg/Kg	14.0	1,290	879	46,400	28,400	1,890	385	1,360	287	2,140	418	428	311	461
Vanadium	5	mg/Kg	0.31	2.8	3.4	67.0	73.3	2.0	9.7	10.1	9.0	13.7	5.9	17.9	1.2	7.5
Zinc	20	mg/Kg	0.30	110	8,040	20.4	190	1,860	7,180	250	1,220	303	1,570	1,080	282	805

* See full analytical report in Volume II for details on sample locations and contents.

** Minimum detection levels and reporting limits vary based on sample. See full analytical report for specific sample reporting and minimum detection levels.

A.APPENDIX A

Building 701 –110' Elevation, Reactor Building

Survey Unit Number: 701-01

Description: Machine Shop

Location	Area (ft ²)	Materials
110' elev. Floor	1527	Asbestos containing material (ACM) tile & mastic
120' elev. Balcony	250	Painted (grey) Plywood
Ceiling	1572	Painted (white) Concrete / Steel
Walls below 5'	938	Sand – Lime Brick painted (original wall coating)
Walls above 5'	3340	Sand – Lime Brick painted (original wall coating)

Current Use: Staging area for daily work activities and sample preparation area

Previous Use: Machine shop for maintenance and repair of reactor related equipment

Current Materials Present: Furniture (Tables, chairs, bookcases, etc.)

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 8 μ R/hr.

Description of Remaining Radioactive Materials:

There are currently four Radioactive Material Area's (RMA's) occupying 450 ft² used for sample and equipment storage and one Contamination Area (CA) occupying 100ft² used as a sample drying and preparation station

Hazardous Materials:

Machine Shop floors covered in ACM tile and adhesive. All pipe insulation considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-1 Machine Shop

Survey Unit Number: 701-02

Description: Receiving Room

Location	Area (ft ²)	Materials
110' elev. Floor	136	ACM tile & mastic
110' elev Floor	305	Treated (original coating) concrete
Ceiling	441	Painted (original wall coating) concrete / steel
Walls	2367	Sand-Lime brick painted (original wall coating)
Wall Vault	368	Sand-Lime brick painted (original wall coating)

Current Use: Equipment storage and personnel monitoring station

Previous Use: Central receiving and distribution for Reactor Building deliveries

Current Materials Present: PCM on north wall for contamination monitoring

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Floor is partially covered with ACM floor tile. All piping insulation is considered ACM. Ceiling and wall coatings (i.e. paint) contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure A-2 Receiving Room

Survey Unit Number: 701-03

Description: Fuel Vault

Location	Area (ft ²)	Materials
110' elev. Floor	987	5/16" neoprene coated concrete
110' elev Balcony	305	Treated (original coating) flooring
Ceiling	987	Painted (original wall coating) concrete / steel
Walls	2367	Sand-Lime brick painted (original wall coating)
Internal Vault	420	Sand-Lime brick painted (original wall coating)

Current Use: Contaminated equipment storage and decon facility

Previous Use: Preparing new fuel and fuel related experiments

Current Materials Present: Fume hood on north wall, and a 10' X 10' Internal vault.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

Vacuums and bagged trash are currently stored in this area.

Hazardous Materials:

All piping insulation is considered ACM. Ceiling and wall coatings (i.e. paint) contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure A-3 Fuel Vault

Survey Unit Number: 701-04

Description: Reactor Building South General Area

Location	Area (ft ²)	Materials
110' elev. Floor	1160	ACM containing tile & adhesive

Current Use: General access to the machine shop & personnel elevator

Previous Use: General access to the machine shop, personnel elevator, charging elevator & CRDM's

Current Materials Present:

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr. This area is uncontrolled below the 5' elevation on the east and south wall.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire floor covered with ACM tile and adhesive

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-4 Reactor Building South General Area

Survey Unit Number: 701-05

Description: HP Office

Location	Area (ft ²)	Materials
110' elev. Floor	120	ACM Containing Tile & Adhesive
Walls	300	Drywall
Windows	36	Pane Glass

Current Use: This office is an “as built” addition installed after initial construction. It is used for storage and testing of radiological control instrumentation and consumable product storage.

Previous Use: Prior to the construction of the office this area was part of the general access corridor to the Machine shop, charging elevators, and CRDM’s

Current Materials Present: Radiological instrumentation and consumables

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 6 µR/hr. Dose rates increased to 10 µR/hr in the southeast corner near source locker.

Description of Remaining Radioactive Materials:

There is a source locker located in the southeast corner of the office posted as a controlled area and radioactive material area.

Hazardous Materials:

Entire floor covered in ACM tile and adhesive

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-5 HP Office

Survey Unit Number: 701-06

Description: Main 701 Entrance Area

Location	Area (ft ²)	Materials
110' elev. Floor	730	5/16" neoprene bonded aggregate
110' elev. Floor	730	ACM containing tile & adhesive

Current Use: Main access to Building 701 and general access to machine shop and personnel elevator

Previous Use: General access to building corridor leading to machine shop, personnel elevator, charging elevator, and CRDM's

Current Materials Present: There are no materials currently stored in this area

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr. This area is uncontrolled below the 5' elevation on the east and south wall.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire floor covered with ACM tile and adhesive

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-6 Main 701 Entrance Area



Figure A-7 Main 701 Entrance Area

Survey Unit Number: 701-07

Description: Reactor Building West, General Area

Location	Area (ft ²)	Materials
110' elev. Floor	3066	5/16" neoprene bonded aggregate
110' elev. Floor	3066	ACM containing tile and adhesive

Current Use: General access

Previous Use: General access to west side of Reactor Building. Machinery access via 12' X 14' rollup door

Current Materials Present: There are no materials currently stored in this area

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr. Area's near east wall as high as 15 µR/hr due to RMA stored nearby.

Description of Remaining Radioactive Materials:

There is currently one posted contaminated areas occupying 395 ft² within this survey unit used for storage of contaminated equipment.

Hazardous Materials:

The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-8 Reactor Building West, General Area

Survey Unit Number: 701-08

Description: West Air Intake Chamber (top surfaces)

Location	Area (ft ²)	Materials
116' elev. Platform	320	ACM containing tile and adhesive
	320	5/16" neoprene bonded aggregate

Current Use: None

Previous Use: General Access to west bay window and viewing area

Current Materials Present: There are no materials currently stored in this area

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

This area is currently posted as a controlled area. No radioactive material is currently stored in this area.

Hazardous Materials:

The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-9 West Air Intake Chamber (top surfaces)

Survey Unit Number: 701-09

Description: North Supply Room

Location	Area (ft ²)	Materials
110' elev. Floor	320	ACM containing tile and adhesive
	320	5/16" neoprene bonded aggregate

Current Use: General storage of consumable materials

Previous Use: General access corridor on the north side of reactor pile

Current Materials Present: General consumables.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr. The general area readings increase to 13 µR/hr in the northeast corner of the survey unit due to RMA's located under the north pile face balcony.

Description of Remaining Radioactive Materials:

There is one posted contamination area occupying 28 ft² on the east side of the survey unit. This area is used for storage of contaminated equipment

Hazardous Materials:

There is a 90-day hazardous material storage area occupying 25 ft² located in this survey unit. There are currently no materials present in the area. The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-10 North Supply Room

Survey Unit Number: 701-10

Description: Reactor Building North, General Area

Location	Area (ft ²)	Materials
110' elev. Floor	1760	ACM containing tile and adhesive
110' elev. Floor	1760	5/16" neoprene bonded aggregate

Current Use: General access to north side of reactor pile. 12' X 14' roll up doors present at west and east ends of survey unit.

Previous Use: General Reactor Building access from 110' elevation

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 10 µR/hr. Dose rates on the west end of the survey unit range from 50-1200 µR/hr resulting from RMA's located under the north pile face balcony.

Description of Remaining Radioactive Materials:

There is one posted RMA occupying 360 ft² on the southwest side of the survey unit. This area is used for equipment and sample storage.

Hazardous Materials:

The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-11 Reactor Building North, General Area

Survey Unit Number: 701-11

Description: Reactor Building East, General Area

Location	Area (ft ²)	Materials
110' elev. Floor	1600	ACM containing tile and adhesive
110' elev. Floor	1600	5/16" neoprene bonded aggregate

Current Use: General access to east side of reactor pile.

Previous Use: General north - south access through the east side of the building. Access to CRDM's and east pile balcony.

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates range from 8 - 40 μ R/hr as a result of influence of radioactive materials within the canal access.

Description of Remaining Radioactive Materials:

There is one posted contamination area occupying 280 ft² on the east side of the survey unit. This area is used to control personnel and equipment access / egress to the canal.

Hazardous Materials:

The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-12 Reactor Building East, General Area

Survey Unit Number: 701-12

Description: East Air Intake Chamber (top surfaces)

Location	Area (ft ²)	Materials
116' elev. Platform	320	ACM containing tile and adhesive
	320	5/16" neoprene bonded aggregate

Current Use: None

Previous Use: General access to east bay window and viewing area.

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels from 9-12 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-13 East Air Intake Chamber (top surfaces)

Survey Unit Number: 701-13

Description: East CRDM Floor Surfaces

Location	Area (ft ²)	Materials
110' elev. Floor	177	ACM containing tile and adhesive
110' elev. Floor	177	5/16" neoprene bonded aggregate

Current Use: None

Previous Use: This area was exposed to personnel, equipment and potential debris fallout from operation of CRDM's

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Historically, removable contamination has been identified under the East CRDM. Although contamination is immediately removed when discovered, the potential remains for creating additional removable contamination.

Dose Rate

General area dose rates indicate background levels between 9-30 µR/hr.

Description of Remaining Radioactive Materials:

All 177 ft² of this area are currently a posted contamination area to control personnel / equipment access / egress.

Hazardous Materials:

The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-14 East CRDM Floor Surfaces from 701-04)



Figure A-15 East CRDM Floor Surfaces (from 701-11)

Survey Unit Number: 701-14

Description: West CRDM Floor Surfaces

Location	Area (ft ²)	Materials
110' elev. Floor	320	ACM containing tile and adhesive
110' elev. Floor	320	5/16" neoprene bonded aggregate

Current Use: None

Previous Use: This area was exposed to personnel, equipment and potential debris fallout from operation of CRDM's

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Historically, removable contamination has been identified under the West CRDM. Although contamination is immediately removed when discovered, the potential remains for creating additional removable contamination.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

220 ft² of this area are currently a posted contamination area to control personnel / equipment access / egress.

Hazardous Materials:

PCB contamination is present on floors near access points. Area is posted for PCB exposure control.

The entire floor of the survey unit is covered in ACM tile and adhesive. The concrete floor base is coated with a 5/16" neoprene bonded aggregate sealing surface designed to prevent contamination of the concrete.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure A-16 West CRDM Floor Surfaces (from 701-04)



Figure A-17 West CRDM Floor Surfaces (from 701-07)

Survey Unit Number: 701-15

Description: East 701 Entryway and Main Stairwell

Location	Area (ft ²)	Materials
All elevations	2484	Interior brick (original wall coating)
	120	Corrugated rubber stair treads
	120	ACM floor tile & adhesive

Current Use: Stairwell leading to office spaces on 133' and 143' elevations.

Previous Use: Stairwell leading to office spaces on 133' and 143' elevations.

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination was identified on the bull-nose of the third rising step between the 138' and 143' platforms. The bull-nose was replaced and subsequent readings were <MDA

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Stair treads covered in ACM tile & adhesive. All piping insulation is considered ACM. Ceiling and wall coatings (i.e. paint) contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure A-18 East 701 Entryway and Main Stairwell

Survey Unit Number: 701-16

Description: Control Room Stairwell & Walkway

Location	Area (ft ²)	Materials
Elevation 110' to 156'	228	Corrugated rubber tread w/bull-nose
Elevation 156' to 169'	40	Diamond plate steel treads
Elevation 152'	60	5/16" neoprene bonded aggregate
All elevations	371	ACM floor tile & adhesive

Current Use: Stairwell utilized within the Reactor Building with fire exits from 133' and 143' office elevations.

Previous Use: Egress between the control room and Reactor Building.

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination was identified on areas of the 133', 138', 143' and 148' platforms. Areas were posted as fixed contamination areas.

Dose Rate

General area dose rates indicate background levels of 6 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Stair treads covered in ACM tile & adhesive. All piping insulation is considered ACM. Ceiling and wall coatings (i.e. paint) contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure A-19 Control Room Stairwell & Walkway

Survey Unit Number: 702-01

Description: East Pile Face 114' Balcony

Location	Area (ft ²)	Materials
114' Elevation	350	4 ½ " concrete slab
	350	ACM floor tile & adhesive
	300	Nylon carpet tiles & adhesive

Current Use: Source storage

Previous Use: Access to pile experimental ports

Current Materials Present: There is currently no material present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 6-10 µR/hr. Northwest corner indicates background of 60 µR/hr due to presence of a hot soil locker just west of the survey unit.

Description of Remaining Radioactive Materials:

There is currently one RMA occupying 16 ft² used for source storage in the northeast corner of the survey unit.

Hazardous Materials:

Entire balcony covered in ACM tile and adhesive. Most tiles covered with nylon carpet tiles and adhesive. All pipe insulation considered ACM. Surface coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure A-20 East Pile Face 114' Balcony

Survey Unit Number: 702-02

Description: Pile Balcony Stairwell

Location	Area (ft ²)	Materials
Elevation 110'-140'	220	Plate steel constructed stair / landing
	189	Nylon carpet tiles & adhesive
	30	Rubber stair tread & bull-nose

Current Use: Access to pile balconies and top of pile.

Previous Use: Access to pile balconies and top of pile.

Current Materials Present: There are no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Steps covered with nylon carpet tiles and adhesive and rubber tread w/bull-nose. Surface coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.



Figure A-21 Pile Balcony Stairwell

B. APPENDIX B

Building 701 –133' Elevation, Office Spaces

Survey Unit Number: 701-17

Description: Offices 101, 102, & 103

Location	Area (ft ²)	Materials
133' elev. Floor	1420	ACM containing tile & adhesive
Walls	1012	Painted interior brick
Walls	692	Painted cement block
Walls	728	Painted sheet rock
Walls	204	Glass windows
Walls	480	¾" troweled concrete over brick

Current Use: Offices space (except for small smear counting lab and annex)

Previous Use: Health physics office and instrument shop.

Current Materials Present: Office furniture and fixtures.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels. Some scan areas indicated higher background due to presence of naturally occurring radioactive impurities in external wall face brick.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

There is currently a posted RMA occupying 320 ft² located within this survey unit. The area contains a smear counting lab and associated annex.

Hazardous Materials:

Entire floor covered in ACM tile & adhesive. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure B-1 Office 103

Survey Unit Number: 701-18

Description: Men's & Ladies's Rooms

Location	Area (ft ²)	Materials
133' elev. Floor	198	Terrazzo flooring material
Ceiling	198	Plaster
Walls	360	¾" troweled concrete over brick

Current Use: Primary restroom facility for 701 building.

Previous Use: Primary restroom facility for 701 building.

Current Materials Present: Standard restroom fixtures.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure B-2 Men's Lavatory



Figure B-3 Women's Lavatory

Survey Unit Number: 701-19

Description: Foyer, Offices 104, 105, 106, & Associated Corridor

Location	Area (ft ²)	Materials
133' elev. Floor	1038	ACM tile & adhesive
133' elev. Floor	290	18" X 18" Nylon carpet tile & adhesive
Walls	662	¾" troweled concrete over brick
Walls	504	Interior red clay brick
Walls	189	Concrete block
Walls	800	Drywall
Walls	196	Window glass
Ceiling	256	Acoustic tile
Ceiling	408	Plaster

Current Use: Office space (No access to Reactor Building)

Previous Use: Instrument shop with direct access to Reactor Building

Current Materials Present: Office furniture and fixtures.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 4 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire surface covered with ACM tile & adhesive. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure B-4 Office 104



Figure B-5 Office 105



Figure B-6 Office 106



Figure B-7 701-19 Hallway

Survey Unit Number: 701-20

Description: Offices 107, 108, 109, 110, & Associated Corridor

Location	Area (ft ²)	Materials
133' elev. Floor	975	ACM tile & adhesive
133' elev. Floor	975	18" X 18" Nylon carpet tile & adhesive
Walls	303	Interior red clay brick
Walls	1681	Drywall
Walls	238	Window glass
Walls	217	Metal door
Ceiling	975	Acoustic tile
Ceiling	975	Plaster

Current Use: Office space

Previous Use: Electrical conduit and piping room

Current Materials Present: Office furniture and fixtures.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 4 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire surface covered with ACM tile & adhesive. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure B-8 Office 107



Figure B-9 Office 108

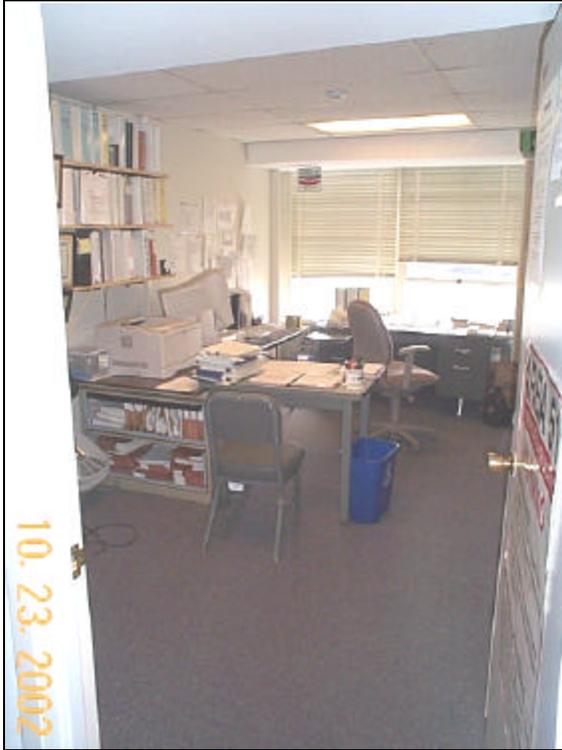


Figure B-10 Office 109



Figure B-11 Office 110

Survey Unit Number: 701-21

Description: Offices 111, 112, 113, 114, 115, & Associated Corridor

Location	Area (ft ²)	Materials
133' elev. Floor	835	ACM tile & adhesive
133' elev. Floor	643	18" X 18" Nylon carpet tile & adhesive
Walls	286	Interior red clay brick
Walls	2258	Drywall
Walls	180	Metal door
Walls	88	Brick covered with 1/2" concrete
Ceiling	747	Acoustic tile

Current Use: Office space.

Previous Use: Electrical conduit and piping room

Current Materials Present: Office furniture and fixtures. Southwest hallway contains miscellaneous trunks.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire surface covered with ACM tile & adhesive. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure B-12 Office 111



Figure B-13 Office 112



Figure B-14 Office 114



Figure B-15 Office 115



Figure B-16 701-21 Hallway (facing SE)



Figure B-17 701-21 Hallway (facing SW)

C.APPENDIX C

Building 701 –133' Elevation, Reactor Building

Survey Unit Number: 702-03

Description: West CRDM Access Balconies

Location	Area (ft ²)	Materials
118' Elevation	92	4 1/2" concrete slab walkway
	124	Open grate steel walkway
126'-128' elevation	100	Open grate steel walkway

Current Use: Access to 118', 126' and 128' elevations of West CRDM system.

Previous Use: Access to 118', 126' and 128' elevations of West CRDM system.

Current Materials Present: There are no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 4 µR/hr.

Description of Remaining Radioactive Materials:

There is currently one contaminated area occupying 20 ft² in this survey unit. This area is posted to control access to potential loose contamination.

Hazardous Materials:

Hand-rails and miscellaneous surface coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.



Figure C-1 West CRDM Access Balconies (from crane stairwell)

Survey Unit Number: 702-04

Description: Northwest 118' Pile Face Balconies

Location	Area (ft ²)	Materials
118' Elevation	1340	ACM tile & adhesive
	1340	4 ½" concrete slab walkway
	370	Nylon carpet tiles & adhesive

Current Use: Post construction modifications added an additional ten feet to west and north balconies to incorporate the two and provide access to adjoining Building 703.

Previous Use: Access to pile experimental ports

Current Materials Present: There are no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 5 µR/hr. Elevated background of 18 µR/hr in some locations due to presence of radioactive material stored in adjacent survey units.

Description of Remaining Radioactive Materials:

There are currently no radioactive materials in this area.

Hazardous Materials:

Entire balcony area covered in ACM tile and adhesive. Majority of west balcony covered with nylon carpet tiles and adhesive. Surface coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure C-2 Northwest 118' Pile Face Balconies



Figure C-3 Northwest 118' Pile Face Balconies

Survey Unit Number: 702-06

Description: East Pile Face 123' Balcony

Location	Area (ft ²)	Materials
123' Elevation	1517	ACM tile & mastic
	1517	4 ½" concrete slab
	1200	Nylon carpet tile & adhesive

Current Use: Access to pile experimental ports.

Previous Use: Access to pile experimental ports.

Current Materials Present: There are no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 5-9 µR/hr.

Description of Remaining Radioactive Materials:

There are currently no radioactive materials in this area.

Hazardous Materials:

Entire balcony area covered in ACM tile and adhesive. Majority of balcony covered with nylon carpet tiles and adhesive. Pipe insulation considered ACM. Surface coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure C-4 East Pile Face 123' Balcony

Survey Unit Number: 702-07

Description: East CRDM Access Balconies

Location	Area (ft ²)	Materials
118' Elevation	90	4 ½" concrete slab walkway
	200	Open grate steel walkway
126' – 128' Elevation	100	Open grate steel walkway

Current Use: Access to 118', 126' and 128' elevations of East CRDM system.

Previous Use: Access to 118', 126' and 128' elevations of East CRDM system.

Current Materials Present: There are no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 6 µR/hr.

Description of Remaining Radioactive Materials:

With the exception of the step off-pads positioned at the walkway access points the entire survey unit is posted as a contamination area.

Hazardous Materials:

Surface coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.



Figure C-5 East CRDM Access Balconies

D.APPENDIX D

Building 701 –143' Elevation, Office Spaces

Survey Unit Number: 701-23

Description: Offices 1, 2, 2A, 3 & Associated Corridor

Location	Area (ft ²)	Materials
143' elev. Floor	1011	ACM tile & adhesive
143' elev. Floor	1011	18" X 18" Nylon carpet tile & adhesive
Walls	717	Interior plaster coated red clay brick
Walls	1508	Drywall
Walls	221	Window glass
Walls	45	Cement block
Walls	200	Metal door
Ceiling	582	Acoustic tile
Ceiling	1011	Plaster

Current Use: Office space

Previous Use: Office space for reactor staff

Current Materials Present: Office furniture and fixtures.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 4 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire surface covered with ACM tile & adhesive. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure D-1 Office 1



Figure D-2 Office 2



Figure D-3 Office 2A



Figure D-4 Office 3

Survey Unit Number: 701-24

Description: Offices 4, 5, 6, Lobby, Storeroom & Associated Corridor

Location	Area (ft ²)	Materials
143' elev. Floor	1261	ACM tile & adhesive
143' elev. Floor	1090	18" X 18" Nylon carpet tile & adhesive
Walls	875	Interior plaster coated red clay brick
Walls	1849	Drywall
Walls	170	Window glass
Walls	216	Metal door
Ceiling	760	Acoustic tile
Ceiling	1261	Plaster

Current Use: Office space.

Previous Use: Reception lobby, observation room, and office space for reactor staff.

Current Materials Present: Office furniture and fixtures.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire surface covered with ACM tile & adhesive. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure D-5 701-24 elevator annex



Figure D-6 Office 4



Figure D-7 Office 5



Figure D-8 Office 6

Survey Unit Number: 701-25

Description: Offices 7, 8, 9, 10, 11, 12, Kitchen, Conference Room, & Associated Corridor

Location	Area (ft ²)	Materials
143' elev. Floor	1811	ACM tile & adhesive
143' elev. Floor	1509	18" X 18" Nylon carpet tile & adhesive
Walls	846	Interior plaster coated red clay brick
Walls	2747	Drywall
Walls	238	Window glass
Walls	340	Metal door
Walls	423	Painted metal/hardboard raised panel
Ceiling	1274	Acoustic tile
Ceiling	1781	Plaster

Current Use: Office space

Previous Use: Used by operations to control reactor pile. Also contained kitchen / lunch area for reactor staff.

Current Materials Present: Office furniture and fixtures.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Entire surface covered with ACM tile & adhesive. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.



Figure D-9 701-25 Conference Room



Figure D-10 701-25 Hallway



Figure D-11 701-25 Hallway (facing NW)



Figure D-12 Kitchen



Figure D-13 Office 7



Figure D-14 Office 8



Figure D-15 Office 9

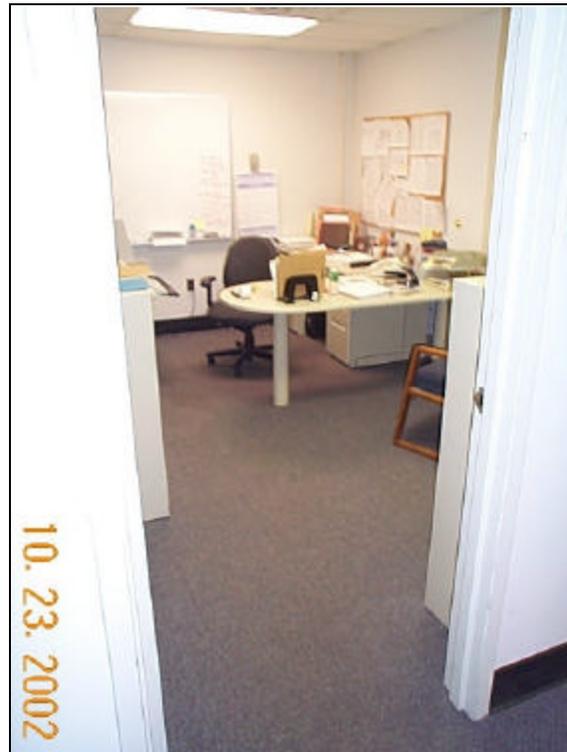


Figure D-16 Office 10



Figure D-17 Office 11



Figure D-18 Office 12

E. APPENDIX E

Building 701 –143' Elevation, Reactor Building

Survey Unit Number: 701-22

Description: Mechanical Equipment Room

Location	Area (ft ²)	Materials
110' elev. Floor	987	5/16" neoprene coated concrete
110' elev Balcony	305	Treated (red coating) flooring
Ceiling	987	Painted (original wall coating) concrete / steel
Walls	2367	Sand-Lime brick painted (original wall coating)
Internal Vault	420	Sand-Lime brick painted (original wall coating)

Current Use: Contaminated equipment storage and decon facility

Previous Use: Preparing new fuel and fuel related experiments

Current Materials Present: Fume hood on north wall, and a 10' X 10' Internal vault.

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

All piping insulation is considered ACM. Ceiling and wall coatings (i.e. paint) contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure E-1 Mechanical Equipment Room

Survey Unit Number: 702-08

Description: West 127' Pile Face Balcony

Location	Area (ft ²)	Materials
127' Elevation	500	ACM tile & adhesive
	500	4 ½" concrete slab walkway
	500	Nylon carpet tiles & adhesive

Current Use: Access to pile experimental ports. Post construction modification added an additional six feet to the balcony.

Previous Use: Access to pile experimental ports.

Current Materials Present: There are no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels. Historically, contamination has been identified in the 6" pile gutter adjoining the balcony to the pile face.(this gutter is system survey unit SYS-07)

Dose Rate

General area dose rates indicate background levels of 4 µR/hr.

Description of Remaining Radioactive Materials:

There are currently four RMA's occupying 450 ft² used for sample and equipment storage and one CA occupying 100ft² used as a sample drying and preparation station

Hazardous Materials:

Balconies are covered with ACM tile and adhesive. The majority of this tile is covered with nylon carpet tiles and adhesive. Coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure E-2 West 127' Pile Face Balcony

Survey Unit Number: 702-09

Description: Upper Northwest 137' Pile Face Balconies

Location	Area (ft ²)	Materials
137' Elevation	150	ACM tile & adhesive
	150	4 ½" concrete slab walkway

Current Use: Staging area for daily work activities and sample preparation area

Previous Use: Servicing pile operations

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity outside posted contamination areas less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 8 µR/hr.

Description of Remaining Radioactive Materials:

There are currently two posted contamination areas occupying 95 ft² used for access control to potentially contaminated areas.

Hazardous Materials:

Balconies are covered with ACM tile and adhesive. Coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure E-3 Upper Northwest 137' Pile Face Balconies



Figure E-4 Upper Northwest 137' Pile Face Balconies

Survey Unit Number: 702-10

Description: 702 10 Pile Top Access Stairways

Location	Area (ft ²)	Materials
Horizontal platforms	120	ACM tiles & adhesive
Horizontal platforms	15	Nylon carpet & adhesive
Treads & Risers	110	Rubber treads & risers w / bull-nose

Current Use: Currently, all access between Reactor Building and offices spaces is isolated.

Previous Use: Reactor Building access from instrumentation machine shop, air handling room, and the charging elevator.

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 8 - 30 μ R/hr.

Description of Remaining Radioactive Materials:

There is currently one RMA occupying 15 ft² used for access control to potentially contaminated areas.

Hazardous Materials:

Horizontal platform surfaces are covered with ACM tile and adhesive. Uppermost platform is covered with nylon carpet and adhesive. Coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.



Figure E-5 702 10 Pile Top Access Stairways

Survey Unit Number: 702-11

Description: Charging Elevator Catwalk

Location	Area (ft ²)	Materials
143' Elevation	450	Steel diamond plate decking

Current Use: Access to charging elevator machinery for service and inspection.

Previous Use: Access to charging elevator machinery for service and inspection.

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 3 μ R/hr.

Description of Remaining Radioactive Materials:

This entire survey unit is currently posted as a contamination area for controlling access to potentially contaminated areas.

Hazardous Materials:

Hand-rails and miscellaneous surface coatings contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.



Figure E-6 Charging Elevator Catwalk

APPENDIX F

Building 701 – Walls and Interior Structures

Survey Unit Number: 701-26

Description: 701 South Wall Interior Structures

Location	Area (ft ²)	Materials
All Elevations	9000	Interior clay brick- triple coated paint
143' Elevation	300	Glass pane for viewing area
All Elevations	1200 lft	Structural steel (various dimensions)

Radiological Data:

Contamination

Beta contamination above the levels reported in Table 1 was detected on the catwalk and ventilation ducts in this survey unit. Alpha contamination above the levels reported in Table 1 was detected in one location on the east end of the catwalk. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

Currently 200 ft² of this survey unit is posted as a contamination area in order to control access to potential fixed or loose contamination.

Hazardous Materials:

Entire surface area, including structural components, triple coated with lead based sealants and paint. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.

Survey Unit Number: 701-27

Description: 701 West Wall Interior Structures

Location	Area (ft ²)	Materials
All Elevations	3480	Interior clay brick – triple coated paint
	2241	Pebble glass pane / Aluminum

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination was identified in one location in the survey unit.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Excepting glass surfaces, entire survey surface area, including structural components, is triple coated with lead based sealants and paint. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.

Survey Unit Number: 701-28

Description: 701 North Wall Interior Structures

Location	Area (ft ²)	Materials
All elevations	8000	Interior clay brick – triple coated paint
143' Elevation	675	Glass pane for viewing area

Radiological Data:

Contamination

Removable activity is less than the levels reported in Table 1. Fixed contamination is present in various locations in this survey unit.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

200 ft² of the upper catwalk is a posted contamination area to control access in the fixed or potential loose contamination environment.

Hazardous Materials:

Excepting glass surfaces, entire survey surface area, including structural components, is triple coated with lead based sealants and paint. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.

Survey Unit Number: 701-29

Description: 701 East Wall Interior Structures

Location	Area (ft ²)	Materials
All elevations	5040	Interior clay brick – triple coated paint
All elevations	2241	Pebble glass pane / Aluminum
All elevations	N/A	Structural steel beams

Radiological Data:

Contamination

Removable Alpha activity above the levels of Table 1 has been identified on wall as accessed from CRDM balcony.

Removable Beta contamination is less than the levels reported in Table 1. Fixed contamination has also been identified in the survey unit

Dose Rate

General area dose rates indicate background levels of 8 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Excepting glass surfaces, entire survey surface area, including structural components, is triple coated with lead based sealants and paint. All piping insulation is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.

Survey Unit Number: 701-30

Description: 701 South Face Exterior Surfaces & Structures

Location	Area (ft ²)	Materials
Reactor Building	3000	Darlington royal grey face brick
Support building	4800	Darlington royal grey face brick
	960	4 panel glass windows

Radiological Data:

Contamination

Elevated scan backgrounds due to presence of naturally occurring radioactive materials in decorative brick facing. Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 µR/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

No hazardous materials have been identified in this survey unit.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.

Survey Unit Number: 701-31

Description: 701 West Face Exterior Surfaces & Structures

Location	Area (ft ²)	Materials
Reactor Building	4050	Darlington royal grey face brick
	2100	Hammered heat resistant glass
Support building	1900	Darlington royal grey face brick
	256	4 panel glass windows

Radiological Data:

Contamination

Elevated scan backgrounds due to presence of naturally occurring radioactive materials in decorative brick facing. Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr forty feet from building, and 10 μ R/hr on contact with face of building.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

No hazardous materials have been identified in this survey unit.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Survey Unit Number: 701-32

Description: 701 North Face Exterior Surfaces & Structures

Location	Area (ft ²)	Materials
All Elevations	5075	Darlington royal grey face brick
	5075	Double layer structural brick
	704	Panel glass windows

Radiological Data:

Contamination

Elevated scan backgrounds due to presence of naturally occurring radioactive materials in decorative brick facing. Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

No hazardous materials have been identified in this survey unit.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Survey Unit Number: 701-33

Description: 701 East Face Exterior Surfaces & Structures

Location	Area (ft ²)	Materials
Reactor Building	4050	Darlington royal grey face brick
	2100	Hammered heat resistant glass
Support building	1900	Darlington royal grey face brick
	256	4 panel glass windows

Radiological Data:

Contamination

Elevated scan backgrounds due to presence of naturally occurring radioactive materials in decorative brick facing. Removable activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

No hazardous materials have been identified in this survey unit.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Survey Unit Number: 701-34

Description: Lower Roof Section - Interior

Location	Area (ft ²)	Materials
164' Elevation	5800	Primed and Sealed corrugated sheet metal
	3800	Suspended plaster ceiling

Radiological Data:

Radiological data obtained from exposed plaster ceiling surfaces is reported within specific office survey units 701-23 through 701-25.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

Ceiling plaster is considered ACM. Surface coatings (i.e. paint) contain lead. Materials of construction obtained from original plant drawings.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 2 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.

Survey Unit Number: 701-35

Description: Lower Roof Section - Exterior

Location	Area (ft ²)	Materials
164' Elevation	5800	4 ply built up roofing with 1" insulation
	220	Lead coated copper flashing

Radiological Data:

Contamination

Removable Alpha contamination above the levels identified in Table 1 was identified on the south vent. Alpha scans of roof surfaces surrounding both vents indicated background. Beta activity is less than the levels reported in Table 1. Fixed contamination indicates background levels.

Dose Rate

General area dose rates indicate background levels of 9 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

All roofing material is considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.

Survey Unit Number: 701-36

Description: Reactor Building Roof - Interior

Location	Area (ft ²)	Materials
180' Elevation	10980	Primed and Sealed corrugated sheet metal
	600	Assorted structural steel (catwalks)

Radiological Data:

Contamination

Removable Alpha contamination above the levels identified in Table 1 was identified in the survey unit. Beta activity is less than the levels reported in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

334 ft² of the North and South Catwalks are posted as contamination areas.

Hazardous Materials:

All piping insulation is considered ACM. Surface coatings (i.e. paint) contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos and lead during remediation activities.

Survey Unit Number: 701-37

Description: Reactor Building Roof - Exterior

Location	Area (ft ²)	Materials
164' Elevation	10980	4 ply built up roofing with 1" insulation
	10800	Lead coated copper flashing

Radiological Data:

Contamination

Removable Alpha contamination above the levels identified in Table 1 was identified on the south access hatch. Beta activity is less than the levels reported in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

No radioactive material is currently stored in this area.

Hazardous Materials:

All roofing materials considered ACM.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for asbestos during remediation activities.

APPENDIX G

Building 702 –Reactor Pile

Survey Unit Number: 702-12

Description: Reactor Pile Top

Location	Area (ft ²)	Materials
143' Elevation	1612	Assorted steel / aluminum on top of pile

Current Use: Access for controlled removal of equipment

Previous Use: Pile experiment access and service

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination was identified in several locations and posted accordingly.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

This entire survey unit is currently posted as a RMA to facilitate the controlled removal of equipment.

Hazardous Materials:

Coated surfaces contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.

Survey Unit Number: 702-13

Description: East Reactor Pile Face

Location	Area (ft ²)	Materials
All Elevations	1620	Steel / Aluminum sheet sealing ports

Current Use: Access for controlled removal of equipment

Previous Use: Pile experiment access and service

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination was identified and posted in one location in the survey unit.

Dose Rate

General area dose rates indicate background levels of 4 μ R/hr.

Description of Remaining Radioactive Materials:

This entire survey unit is currently posted as a RMA to facilitate the controlled removal of equipment.

Hazardous Materials:

Coated surfaces contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.

Survey Unit Number: 702-14

Description: South Reactor Pile Face

Location	Area (ft ²)	Materials
All Elevations	600	Aluminum sheet sealing charging ports

Current Use: Access for controlled removal of equipment.

Previous Use: Fuel charging and movement area and pile service.

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 4 μ R/hr.

Description of Remaining Radioactive Materials:

This entire survey unit is located within a posted contamination area.

Hazardous Materials:

Coated surfaces contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.

Survey Unit Number: 702-15

Description: West Reactor Pile Face

Location	Area (ft ²)	Materials
All elevations	1620	Steel / Aluminum sheet sealing ports

Current Use: Access for controlled removal of equipment.

Previous Use: Pile experiment access and service

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity above the levels indicated in Table 1 has been identified in this survey unit. Fixed contamination indicates background levels

Dose Rate

General area dose rates indicate background levels of 3 - 5 μ R/hr.

Description of Remaining Radioactive Materials:

There is currently one contaminated area occupying 35 ft² used for controlling access to gutter drain.

Hazardous Materials:

Coated surfaces contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.

Survey Unit Number: 702-16

Description: North Reactor Pile Face

Location	Area (ft ²)	Materials
All elevations	1620	Cement compound sealing ports

Current Use: Access for controlled removal of equipment.

Previous Use: Pile experiment access, fuel movement, and service

Current Materials Present: There are currently no materials present in this area.

Radiological Data:

Contamination

Removable activity less than levels indicated in Table 1. Fixed contamination was identified in one location and posted appropriately.

Dose Rate

General area dose rates indicate background levels of 5 μ R/hr.

Description of Remaining Radioactive Materials:

There is currently one contaminated area occupying 35 ft² used for controlling access to gutter drain.

Hazardous Materials:

Coated surfaces contain lead.

Recommendations for future work or samples:

Based on historical and current data and information, this area is Class 1 for radiological surveys.

Recommend additional sampling for lead during remediation activities.

APPENDIX H

Systems

Survey Unit Number: SYS-01

System Name: Control Rod Drive Mechanisms

System Description:

The Control Rod Drive Mechanisms (CRDM) consist of sixteen control rod assemblies, eight on the west side of the reactor and eight on the east side of the reactor. Drive motors and associated gear boxes are position on a four level steel platform constructed of steel I-beams and support iron.

14 of the 16 CRDMs have a 1/3 HP electric motor for constant speed insertion and extraction. As a second power source, each of these rod have an electrohydraulic use for rapid rod insertion under Emergency Shutdown (ESD) conditions. The hydrolic pump is powered by a 3-HP elctric motor.

2 of the sixteen CRDMs utilize a 1 HP electric motor. These rods are commonly refered to as the regulating rods and were used to control nuetron flux within the pile during routine operations.

System Location(s):

CRDMs are located on the east and west side of the reactor pile.

One bank of eight CRDMs are positioned outward from the reactor pile in the southeast direction and the other eight CRDMs are positioned outward from the reactor pile in the southwest direction.

Current Status:

Control Rod Blades and Drive Mechanisms are isolated and secured. The last recorded use of the CRDMs was in 1972.

The hydrolic lift mechanism is removed and stored within a fenced area on the east 11' elevation pile balcony.

System Environment:

Control Rod Drive Mechanisms are isolated with access controlled by chain-link fence and applicable safety postings.

System Classification:

Radiological Data

The East and West CRDM System are currently situated within posted Contamination Areas. All components of the system and associated support/structural materials are suspected of being radiologically contaminated.

20 random smears were taken at various elevations on the East CRDM. Smears indicated elevated

Hazardous Material Data

Hydrolic lift and CRDM oil was tested and indicated no PCBs. However, smears taken on residual oils on floor tiles beneath the CRDMs tested positive for PCBs at levels between 10 mg/wipe - 140 mg/wipe. In addition, paint scrapings obtained from the structural steel indicated elevated levels of PCBs, Mercury,

removable radioactivity levels but none exceeding BNL release limits.

19 random smears were taken at various elevations on the West CRDM. Of the 19 smears a single smear (Number 01) obtained on the 126' elevation indicated removable beta radioactivity above the BNL release limits of Table 1. None of the remaining 18 smears indicated levels exceeding BNL release limits.

Aluminium, Lead, Barium, Selenium, Thallium, Calcium, Chromium, Cobalt, Copper, Iron, Magnesium, Manganese, Nickel and Zinc. See Letter submitted to Mr. David Greenlaw USEPA dated Mar 6 1998.

Survey Unit Number: SYS-02

System Name: Sanitary Sewer

System Description:

The sanitary system within Building #701 collects liquid waste generated within the restrooms, kitchens and deepsinks located throughout the building and directs the waste to the BNL Sewage System.

System Location(s):

The BGRR Sanitary System received waste water from various locations outside of the Reactor Building proper. They included janitorial deep sinks, lavatories and kitchenettes.

Current Status:

Currently the only remaining sources contributing to the Sanitary System within Building #701 are the mens and ladies restroom, janitorial deepsink and a kitchen on elevation 133', and a kitchen on 143' elevation. All other sources have been isolated.

System Environment:

The BGRR Sanitary System remains operational.

System Classification:

Radiological Data

Radiological assessment was performed using a portable Na-I scintillation detector. Scans and static counts were performed on the drain traps of all the remaining sinks within the system. All scans and static counts indicated <MDA of the portable NA-I detector.

Hazardous Material Data

Because the system remains operational and utilizes the BNL sanitary system it was determined that there is no obvious reason to suspect hazardous materials exist within this system.

Survey Unit Number: SYS-03

System Name: Instrument Air

System Description:

The air supply for all pneumatically operated instrument and equipment within Building #701 originates from two main air compressors located in the machinery room of Building #703. An auxiliary source of air can be supplied from a small compressor located in the Fan House Building #704. Currently the air supply system remains in use with air supply to Building #701 isolated.

System Location(s):

Compressed air supply lines are routed throughout the Reactor Building with pre-filters and moisture separators installed on specific components utilizing compressed air.

Current Status:

Instrument and compressed air supply is isolated. Minor leak-by provided air line pressure indication but no continued flow.

System Environment:

Building #701 compressors remain fully operational with supply to Building #701 isolated. Major components of the auxiliary supply have been removed.

System Classification:

Radiological Data

Several moisture traps were opened in an attempt to obtain samples from within the system. No liquid or sludge was present. A total of nine (9) smears were obtained from within the trap housings. All smears indicated <MDA for beta and alpha radioactivity.

Hazardous Material Data

There was no evidence of residual liquid or sludge within the system therefore no sample could be obtained. There is no obvious reason to suspect hazardous materials exist within this system.

Survey Unit Number: SYS-04

System Name: 701 Building HVAC

System Description:

Building #701 HVAC System is divided into three distinct zones.

Zone I - Provides ventilation over the reactor area.

Zone II - Provides ventilation to the south side of the Reactor Building below the balcony at 123' elevation and to the office spaces.

Zone III - Provides ventilation to Building #703 research laboratories.

System Location(s):

Zone I - Fans/filters/conditioners are located within the Machine Room of Building #703 and discharge above the reactor.

Zone II - Fans/filters/conditioners are located within the Machine Room of Building #701, 140' elevation and discharge throughout the office spaces and within the south side of the Reactor Building.

Zone III - Fans/filters/conditioners are located within the attic area of Building #703 and supply air to the research laboratories.

Current Status:

Zone I HVAC supply to Building #701 is isolated.

Zone II and Zone III HVAC to Building #701 and #703 are fully operational.

System Environment:

Fans/filters/conditioners for Zone I supply to above the reactor is no longer in operation and is flanged off at the north wall of Building #701.

All other HVAC Systems are operational and routinely maintained.

System Classification:

Radiological Data

A total of thirty-eight (38) smears were obtained within the filter/fan housings and associated inlet duct work during the characterization survey. An additional fifty-eight (58) smears taken previously were also considered. Of all the smears one (1) indicated alpha levels above MDA but below Table 1 release limits. Fifty smears obtained within the system indicated beta levels above MDA but below Table 1 release limits.

Hazardous Material Data

Insufficient residue was available within the ventilation systems to obtain a sample for hazardous materials. The Zone I HVAC filter banks had been either refurbished or removed and vacuumed clean. External surfaces of the ventilation duct work were evaluated within the Building Survey Units they were associated with.

Survey Unit Number: SYS-05

System Name: Building Steam

System Description:

The Building Steam System receives its steam from the BNL central steam plant. Its primary use is to supply heating to the building heating and cooling system.

System Location(s):

Building steam lines are routed throughout the Reactor Building and support structures. Moisture traps are installed on specific components and at system low points within the building.

Current Status:

Building Steam has been isolated to the Reactor Pile. Steam supply remains operational to all Reactor Building space heaters and office radiant heaters.

System Environment:

Building Steam is supplied from the BNL central steam plant.

System Classification:

Radiological Data

A composite sample was obtained from several Steam System condensate traps and analyzed for radioactive materials. Alpha and Beta-Gamma analysis indicates no measurable radioactivity is present within the system.

Hazardous Material Data

Steam is supplied from the BNL central steam plant and is not suspected of containing hazardous materials.

Survey Unit Number: SYS-06

System Name: Building Natural Gas

System Description:

Building #701 is equipped with numerous outlets supplied with natural gas. These outlets supplied researches with gas for use throughout their experiments within Building #701 and laboratories within Building #703. Natural gas supplied has been isolated throughout Building #701 but remains in use within selected labs of Building #703.

System Location(s):

Natural gas supply ports are located throughout the Reactor Building primarily in balcony areas where research occurred.

Current Status:

Supply to the natural gas outlet ports have been isolated throughout Building #701.

System Environment:

All supply lines are free of residual gas and either open ended or vented.

System Classification:

Radiological Data

A total of ten (10) smears/swabs were taken at various natural gas supply ports throughout the Reactor Building. All smears/swabs indicated <MDA for alpha and beta radioactivity.

Hazardous Material Data

There was no evidence of residual liquid or sludge within the system therefore no sample could be obtained. There is no obvious reason to suspect hazardous materials exist within this system.

Survey Unit Number: SYS-07

System Name: Building Drains

System Description:

Building 701/702 Drain System collects and distributes waste liquids from various locations within the building and directs it to the appropriate waste treatment system, storage facility, or sump/drywell.

System Location(s):

There are numerous drains throughout Building 701/702 terminating in a variety of locations including the Waste Water Treatment Area (801), BNL Storm Drain System, Sanitary System and independent sumps and drywells.

Current Status:

The Building Drain system is currently operational in a limited capacity.

System Environment:

Several drains and associated sumps/drywells that have been identified as containing hazardous materials or have a high potential for containing hazardous materials have been isolated to prevent additional intrusion of liquid wastes.

System Classification:

Radiological Data

In lieu of performing radiological analysis on a "sampling" of the various building drains a detailed assessment was performed as part of Subpart B of "Sampling and Analysis Plan for the 701 Building, 701 Below Ground Structures, 702 Pile, and Remaining Soils, BGRR-052, Rev. 0" (BNL 2002a.)

Refer to Subpart B Sample Location ID Numbers 35 through 47 for Building Drain Characterization results.

Hazardous Material Data

In lieu of performing hazardous material assessment on a "sampling" of the various building drains a detailed assessment was performed as part of Subpart B of "Sampling and Analysis Plan for the 701 Building, 701 Below Ground Structures, 702 Pile, and Remaining Soils, BGRR-052, Rev. 0" (BNL 2002a.).

Refer to Subpart B Sample Location ID Numbers 35 through 47 for Building Drain Characterization results.

Survey Unit Number: SYS-08

System Name: Pneumatic Sample Transfer System

System Description:

The Pneumatic Sample Transfer System provides a means for rapidly inserting samples into the reactor and removing them. In addition the system allows for transferring irradiated samples quickly to their point of use within Building #701 or the Hot Lab within Building #801.

System Location(s):

The pneumatic tubes penetrate the reactor bioshield from the north face. The transfer tube exits the north face of the reactor and is housed within the trench on the north side of the reactor.

Current Status:

The pneumatic transfer tube has been capped off at the east side of Building #701. Associated piping outside of Building #701 has been removed and disposed of.

System Environment:

The system is non-operational with major portions of transfer piping removed.

System Classification:

Radiological Data

A total of twelve (12) smears were obtained within the pneumatic transfer system piping during the removal process performed november of 2001. Five (5) where obtained at the inlet to Building #801 and five (5) at the outlet of Building #701. Nine of the 12 smear indicated elevated beta radioactivity above MDA but less than Table 1 release levels. None of the 12 smears indicated alpha radioactivity above MDA. An additional forty-nine (49) smears where obtained on the exterior of the piping and within the trench housing the pneumatic transfer tube. Several smears indicated removable radioactivity above Table 1 release limits existed within the Pile Gutter, Concrete Walls of the Trench and Pipe Tray. The Pile Gutter and entire Trench were posted as Contamination Areas.

Hazardous Material Data

There was no evidence of residual liquid or sludge within the system therefore no sample could be obtained.

Survey Unit Number: SYS-09

System Name: Chemo-Nuclear Loop

System Description:

The Brookhaven Graphite Research Reactor Chemo-Nuclear Loop was designed to provide researchers with the means to perform experiments involving nuclear induced chemical reactions at temperatures, pressures and neutron flux evident within an operating nuclear reactor.

The system consists of filters, coolers, heaters and compressors designed to handle gas streams that have been exposed to fissioning fuel within the reactor.

The entire loop is doubly contained to minimize the possibility of fission product release. Since it is designed to process fresh fission products the entire system is housed within shielding specifically designed to absorb neutrons (delayed-neutrons) in addition to reducing massive gamma radiation dose.

System Location(s):

The Chemo-Nuclear Loop penetrates the reactor from the southwest corner. The filters, coolers, heaters and associated equipment are housed within a shielded vault located in the southwest corner of the Reactor Building.

Current Status:

The Chemo-nuclear system is shut down.

System Environment:

The Chemo-nuclear system is non-operational with some neutron/gamma shielding removed for access.

System Classification:

Radiological Data

A total of thirty-four (34) smears were obtained on components and surrounding floor area within the confines of the system. Six of the 34 smears indicated elevated beta radioactivity above MDA but less than Table 1 release levels. None of the 34 smears indicated alpha radioactivity above MDA. A small portion of the return filter was analyzed and indicated elevated levels of Co-60 at 651pCi/gm.

Hazardous Material Data

There was no evidence of residual liquid or sludge within the system.

The system contains approximately 250 cubic feet of lead. The lead is in various forms including 1280 lead bricks, 2120 square feet of 1" lead sheet and 1040 square feet of 1/4" lead sheet.

Survey Unit Number: SYS-10

System Name: Building Crane

System Description:

The reactor area crane is a 10-ton, 4 motor, double box girder, travelling bridge crane. The crane consists of a bridge spanning north-south, travelling east-west. The four electric motors are used to power the two hoists, the hoist trolley and the bridge.

System Location(s):

The bridge of the reactor crane is spans the entire Reactor Building from north to south. The bridge travels the length of the building from east to west travel to within approximately twelve feet of the outer walls.

Current Status:

The Reactor Building Bridge Crane is fully functional.

System Environment:

The Reactor Building Bridge Crane is operational and routinely maintained and inspected.

System Classification:

Radiological Data

A total of eleven (11) smears were obtained at various locations on the bridge crane. Eight of the 11 smears indicated elevated beta radioactivity above MDA but less than Table 1 release levels. None of the 11 smears indicated alpha radioactivity above MDA.

Hazardous Material Data

PCB Samples were obtained on the oil within the crane motor and lubricating grease on the crane cable. Both samples indicated PCBs were below regulatory levels.
Cable lubricating grease - 8.5 mg/100 sq. cm.
Motor oil - 2.4 ppm

Survey Unit Number: SYS-11

System Name: Electrical

System Description:

Electrical power for reactor controls, rod drive mechanisms, instrumentation, emergency shutdown circuits, experimental facilities is supplied from a substation at the southwest corner of Building #701. The substation consists of a 1000kva transformer, three 250 kva transformers and a section of a 15 kvs switchgear panel. Electrical power for the reactor and its auxiliaries is supplied from two 7500 kva transformers located directly south of the Fan House Building #704.

System Location(s):

Reactor Building substation is located at the southwest corner of Building #701. Reactor and auxiliary sub-station is located directly south of the Fan House Building #704.

Current Status:

The Building #701 electrical distribution sub-station has been isolated since January 2000.

System Environment:

Electrical supply lines are severed and transformers drained and vented. Oils from transformers has been removed and disposed of.

System Classification:

Radiological Data

A total of twenty (20) smears were obtained at various locations within the 701 sub-station. Three of the 20 smears indicated elevated beta radioactivity above MDA but less than Table 1 release levels. None of the 25 smears indicated alpha radioactivity above MDA.

Hazardous Material Data

PCB Samples were obtained on the oil within the 701 sub-station prior to draining. Transformer oil was disposed of in accordance with regulatory requirements.

Survey Unit Number: SYS-12

System Name: Helium System

System Description:

The fuel channel probe system (Helium System) is a portable system consisting of a vacuum pump, purge (helium) gas and an ionization chamber. Routinely or upon identifying increased radioactivity release from the pile the fuel channel probe system would be used to sample for increased fission product gases within specific fuel channels. The portable system probe was inserted into a specific fuel channel thermocouple conduit. A vacuum pump extracted gas through the probe and passed it through an ion chamber. Increased radioactivity detected within the ion chamber would provide qualitative indication of a potential fuel defect.

System Location(s):

All components of the fuel channel probe system are installed on a portable cart for mobility. The system utilized existing reactor pile systems and required no specific installed components.

Current Status:

The fuel channel probe system is non-operational. Probe lines to the fuel channels have been severed and sealed at the bioshield wall.

System Environment:

The cart containing the monitoring system vacuum pump and ion chamber is currently being stored under the North 118' Pile Balcony in a posted Radioactive Material Area.

System Classification:

Radiological Data

The cart containing the monitoring system vacuum pump and ion chamber is posted as Radioactive Material. No additional radiological characterization is considered necessary.

Hazardous Material Data

There was no evidence of residual liquid or sludge within the system therefore no sample could be obtained. With the exception of radioactivity, there is no obvious reason to suspect hazardous materials exist within this system.

Survey Unit Number: SYS-13

System Name: Personnel Elevator

System Description:

The passenger elevator is an electric traction elevator obtained from Oak Ridge National Laboratory, rebuilt by John W. Keisling & Son for use at the BGRR. The elevator travels from elevation 110' to 143' servicing elevation 110', 133' and 143'. The elevator engine is located in the elevator machine room directly east of the elevator shaft and is powered by a 5-horsepower electric motor.

System Location(s):

The passenger elevator is located in the southeast corner of the Reactor Building, due south of the reactor pile charge elevator.

Current Status:

The Passenger Elevator is fully functional.

System Environment:

The Passenger Elevator is operational and routinely maintained and inspected.

System Classification:

Radiological Data

Historic survey records indicate that a detailed radiological survey of the Passenger Elevator revealed no radiological hazard within the system. A total of one hundred and fifty four (154) smears were obtained during the survey of June 2000. One (1) of the 154 smears (elevator pit) indicated elevated beta radioactivity above MDA but less than Table 2 release levels. None of the 154 smears indicated alpha radioactivity above MDA. An additional twenty-five (25) smears were obtained as part of the current characterization survey. None of the 25 smears indicated beta or alpha radioactivity above MDA. A full scan of the interior shaft was performed using a hand-held, 100 cm², beta scintillation detector. A total of six (6) localized areas indicated fixed radioactivity levels ranging from 2K - 5K dpm/100cm².

Hazardous Material Data

PCB samples were obtained on the oil within the passenger elevator motor and a small spill on the floor of the motor house. No indication of PCBs within the oil but the smear obtained on the floor tiles indicated PCBs at 24.6 mg/100cm². A composite sample of paint scrapings from similar coatings on walls and structural steel indicate elevated levels of PCBs, Mercury, Aluminium, Lead, Barium, Calcium, Chromium, Cobalt, Copper, Iron, Magnesium, Manganese, Nickel, Vanadium and Zinc. All floor tiles and adhesive within the elevator lift are classified as ACM.

Survey Unit Number: SYS-14

System Name: Charging Elevator

System Description:

The fuel charging elevator is a 25 foot (east-west) by 12 foot (north-south) open platform constructed within a framework of I-beams and channel iron. The platform is driven by a 20-horsepower electric a-c induction motor through a Keisling double-reducer unit all located on the elevator walkway at the 140' elevation. The platform has a 30,000 pound capacity and a travel length of 21 feet which is adequate to service all of the reactor fuel channels.

System Location(s):

The fuel charging elevator is platform is located on the south face of the reactor. The elevator walkway and service platform is located directly above the elevator platform on the 140' elevation.

Current Status:

The Charging Elevator currently has all necessary components to operate. The elevator is operational but requires inspection and testing prior to authorizing any future use.

System Environment:

Electrical power to the Charging Elevator is isolated to prevent operation.

System Classification:

Radiological Data

The entire Charging Elevator man-lift and walkway are currently posted as a Contamination Area to control potential release of removable contamination.

A total of twenty-one (25) smears were obtained in the Charging Elevator sump area as part of the current characterization survey. Of the smears all 25 indicated elevated beta radioactivity levels with three (3) above the Table 1 release limits. Two (2) of the 25 smears indicated alpha radioactivity above Table 1 release limits with the remaining smears less than MDA for alpha.

Direct scan of the structural steel frame indicated several isolated areas above Table 1 release limits for Total radioactivity. Additional information can

Hazardous Material Data

PCB samples were obtained on the oil within the charging elevator motor and several locations on the man-lift platform and walkway. There was no indication of PCBs within the oil but smear obtained on the floor tiles of the man-lift indicated PCBs at 16.8 mg/100cm² and 78 mg/100cm².

In addition, a composite paint scraping sample was obtained from similar coatings on structural steel that indicated potential elevated levels of PCBs, Mercury, Aluminum, Lead, Barium, Selenium, Thallium, Calcium, Chromium, Cobalt, Copper, Iron, Magnesium, Manganese, Nickel and Zinc.

All floor tiles and adhesive on the elevator

be obtained from Building 701 Characterization Survey Unit Numbers SU-702-11 (Charging Elevator Walkway) and SU-702-14 (Bioshield South Face).

manlift are classified as ACM.

Survey Unit Number: SYS-15

System Name: Freight Elevator

System Description:

The freight elevator is an electric traction elevator with a capacity of 8,000 pounds. The elevator travels from elevation 110' to 144' servicing platforms at elevation 114', 118', 123' and 140'. The elevator engine is located in the elevator machine room at elevation 140' directly west of the elevator shaft and is powered by a 25-horsepower electric motor.

System Location(s):

The freight elevator is located in the northeast corner of the Reactor Building, at the northeast corner of the reactor pile.

Current Status:

The Freight Elevator currently has all necessary components to operate. The elevator is operational but requires inspection and testing prior to authorizing any future use.

System Environment:

Electrical power to the Freight Elevator is isolated to prevent operation.

System Classification:

Radiological Data

A total of twenty-four (24) smears were obtained in the Freight Elevator shaft and lift as part of the current characterization survey. Twelve (12) of the 24 smears indicated elevated beta radioactivity above MDA but less than Table 1 release levels. None of the 24 smears indicated alpha radioactivity above MDA. Direct scan of the structural I-beam frame indicated several isolated areas above Table 1 release limits for Total radioactivity.

Hazardous Material Data

PCB samples were obtained on the oil within the freight elevator motor and a small spill on the floor of the motor house. No indication of PCBs within the oil but the smear obtained on the floor tiles indicated PCBs at 146 mg/100cm². A composite sample of paint scrapings from similar coatings on walls and structural steel indicate elevated levels of PCBs, Mercury, Aluminum, Lead, Barium, Calcium, Chromium, Cobalt, Copper, Iron, Magnesium, Manganese, Nickel, Vanadium and Zinc. All floor tiles and adhesive within the elevator lift are classified as ACM.