Achieving Termination of Radiological Controls Following a Cesium-137 Release at the Harborview Research and Training Building

John L. Bliss, MS, CHP

April 15, 2021

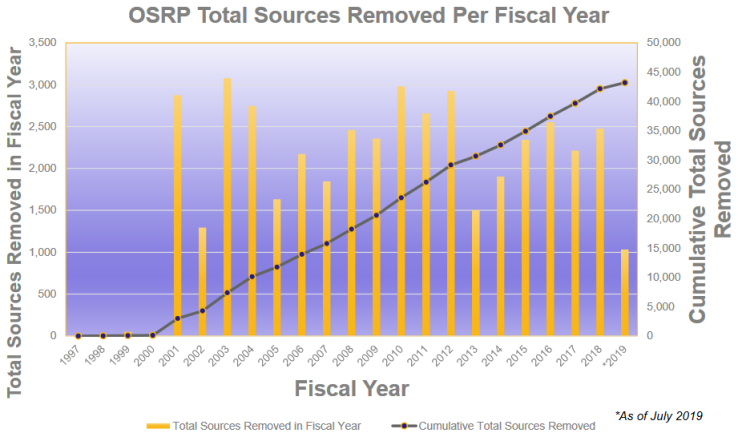
LA-UR-21-23383

Outline

1. Event and Early response
    1. OSRP
    2. Work in Seattle
2. Hazard Reduction
3. Characterization and Development of Methods
    1. Dose modeling
    2. Curtain wall
    3. Exhaust ventilation systems
4. Remediation
5. Final Status Survey

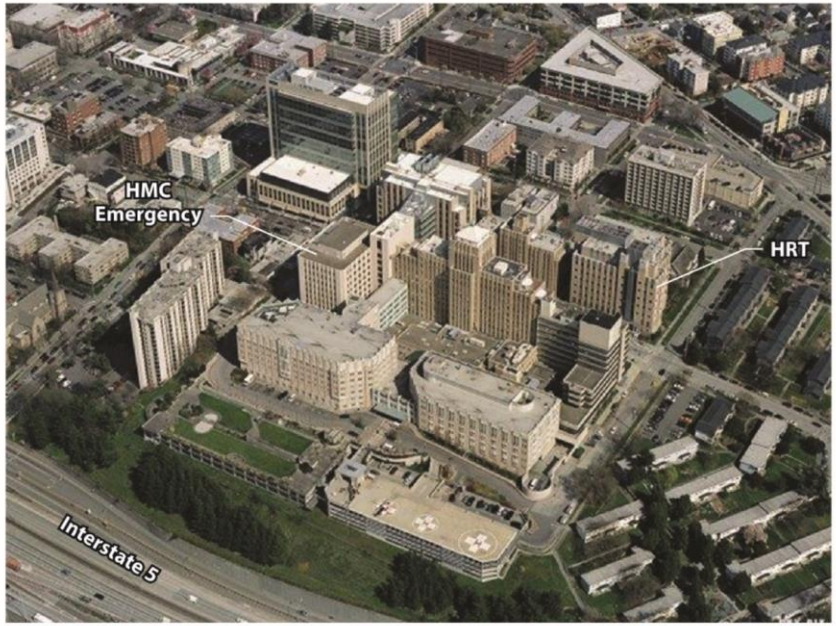
Off-Site Source Recovery Program

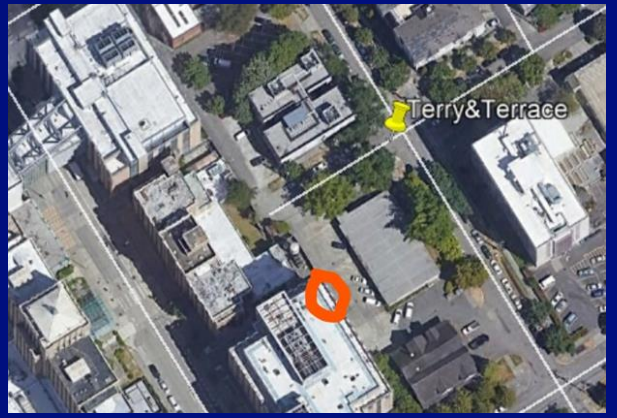
- Established 1998
- Sponsored by the NNSA Office of Radiological Security
- Collaborates with other National Laboratories and commercial vendors for recovery of high activity beta/gamma sources
- Only path for disposal of sealed TRU sources at WIPP



Graph and text from: Off-Site Source Recovery Program, R. Cole-Roback, LA-UR-19-29267, 2019

Harborview Hospital and HRT





Early Response

- 2 May: 2130 - contamination discovered
- 2200 - 2230 building ventilation turned off
- 2230 - SFD HAZMAT arrived on scene
- 2320 - REAC/TS contacted
- 2328 - cask unmated from MHC
- 3 May: 0051 - INIS workers all out of the loading dock
- 0400 transportation to HMC complete
- Morning – NA-21 notified
- 1907 – RAP 8 team arrived
- 4 May: Loading dock (Room 220) isolated
- RAP discovered independent HVAC systems
- RAP discovered contamination on freezer coils
- 5 May: RAP surveys continued
- Chase project manager arrived
- 1430 RAP 8 demobilized and departed
- 6-12 May: Limited Chase work, awaiting DOH approval and reciprocity
- 14 May: Triad and NNSA support arrived on site
- 17 May: Unified Command established

TOP; Seattle Fire Department response on May 2, 1019
Bottom: DOE RAP team on site May 3, 2019

Incident Command System (ICS)

- A standardized approach to the command, control, and coordination of emergency response.
  - A component of the Federal National Incident Management System (NIMS)
  - Used (mandated) for use in all problems with inter-agency responses
  - Originally developed to manage forest fire response
- Unified Command (UC)
  - (UC) used in lieu of an Incident Commander when multiple agencies need to cooperate
  - Acts as a single entity
  - For the HRT event, the UC consisted of:
    - University of Washington
    - Washington Department of Health
    - NNSA (DOE)

MARSSIM

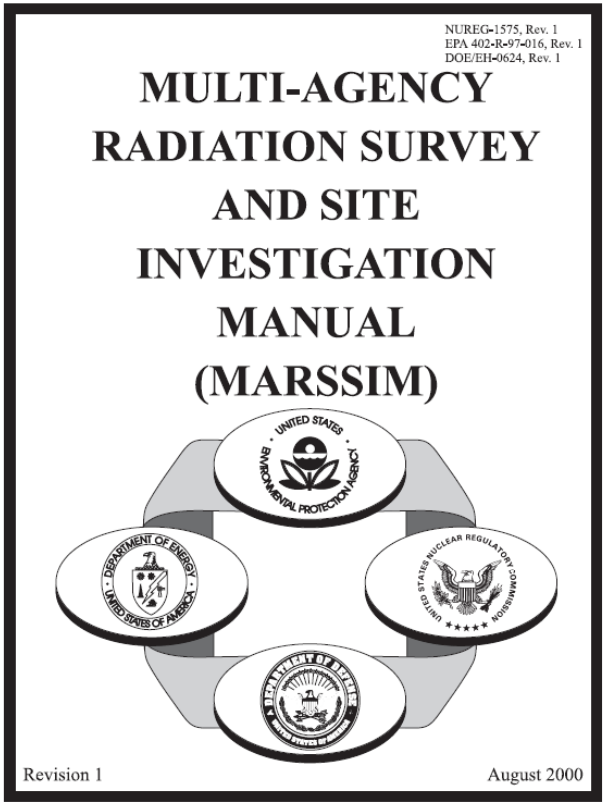


Table 2.1 The Data Life Cycle used to Support the Radiation Survey and Site Investigation Process

RSSI Process	Data Life Cycle		MARSSIM Guidance
Site Identification			Provides information on identifying potential radiation sites (Section 3.3)
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Area Classifications

Non-Impacted - Areas without residual radioactivity from licensed activities and are not surveyed during final status surveys.

Impacted - Areas that have potential residual radioactivity from licensed activities.

Class 1 – Impacted areas with the highest potential for contamination has the potential for delivering a dose above the release criterion, has the potential for small areas of elevated activity, and having insufficient evidence to support classification as Class 2 or Class 3. (No Class 1 areas in Phase 1)

Class 2 – Impacted areas that have a low potential for delivering a dose above the release criterion and little or no potential for small areas of elevated activity.

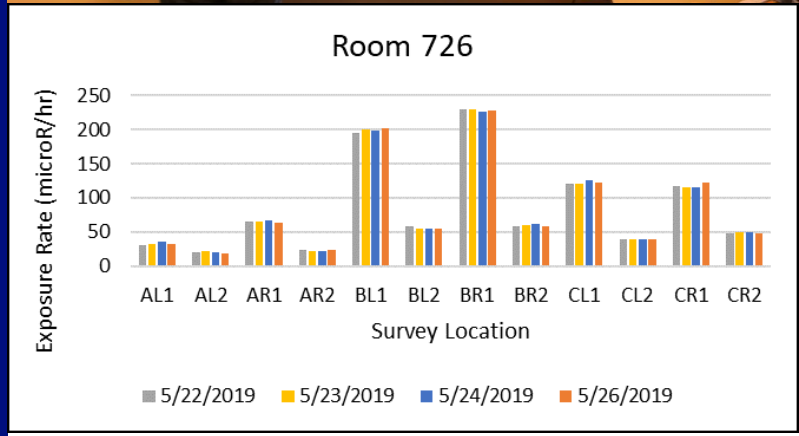
Class 3 – Impacted areas that have little or no potential for delivering a dose above the release criterion and little or no potential for small areas of elevated activity.

NOT included in Phase 1 FSS

- The following areas did not meet the criteria for Phase 1 work because of their survey levels:
  - Majority of the 2nd Floor
  - Service Elevator
  - Areas where general area dose rates were elevated as a result of the source term located in Room 220.
  - Labs on the north-east corner of the building floors 3 through 7 due to elevated general area dose rates from the curtain-wall
  - Ventilation Systems EF-2, EF-3 and EF-8
  - Outdoor areas, i.e. shipping/receiving area, sidewalk between Harborview R&T and Harborview Hall.
- Phase 1 FSS, 3 Part, report completed July 27, 2019 (Part 1 on May 27th)

The “curtain wall”

- Contamination detected within the wall in Room 726 during Phase I FSS
- A concern that the contamination may still be moving within the walls

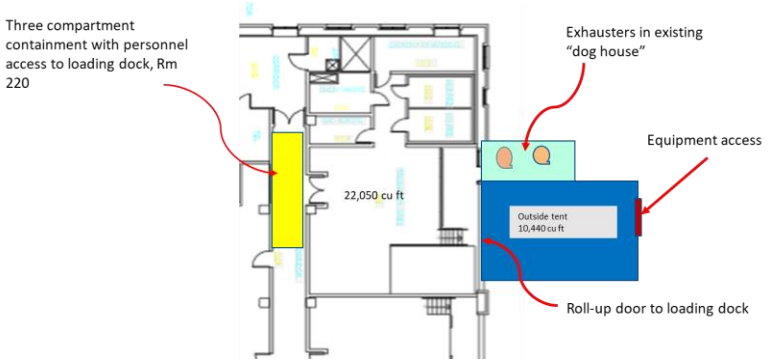


Phased recovery

- Phase 1 – International Isotopes, Inc. (INIS) with Chase Environmental
  - Phase 1 FSS
  - No invasive, destructive work
- Phase 2 – International Isotopes, Inc.
  - Phase 2ai: Enter Room 220, recover source
  - Phase 2b: Ship source
  - Phase 2aii: Remove mobile hot cell and related gear
- Phase 3 – PermaFix
  - Characterize remainder of building including systems
  - Decontaminate/remediate
  - Perform Phase Final Status Survey (FSS)
  - Obtain “free release” of building from Washington Department of Health
- Phase 4 – University of Washington
  - Repair and recondition building for full beneficial use

Planning for Phase 2

- Re-entry to Room 220 required controls to ensure no further spread of contamination
  - Amendment to INIS NRC license and required WDOH reciprocity
  - Three compartment tent in hallway
  - HEPA equipped air movers to maintain negative pressure in Room 220 and WDOH Radioactive Air Emission License (RAEL)
  - Return of RAP team
  - Senior Supervisory Watch present during all activities



Loading source into RH-72B, Type B Container

Source Leaving HRT in RH-72B, July 17, 2019

Additional controlled workspace for Phase 2aii

- Completed new containment permitting the opening of Room 220 rollup door

Phase 2aii – Recovering MHC

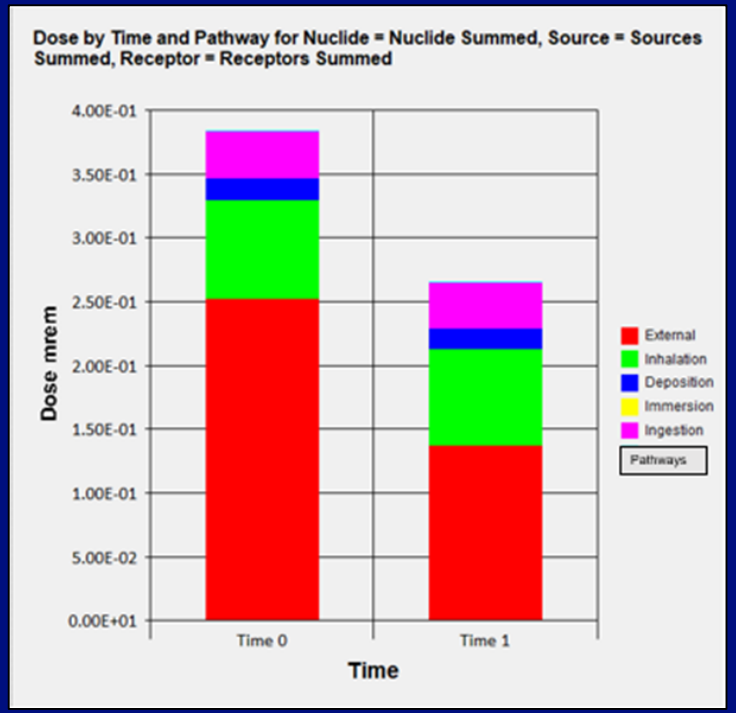
Screening Values for Termination of Controls

Radionuclide	Half-life	Total Contamination (dpm/100 cm^2)	Removable Contamination (dpm/100 cm^2)
Cs-137	30.08 y	28,000 (4.67 Bq/cm^2)	2,000 (0.33 Bq/cm^2)

AND As Low As Reasonably Achievable (ALARA)

NUREG 1757 Vol. 1 Table B.1 *Acceptable License Termination Screening Values of Common Radionuclides for Building-Surface Contamination*

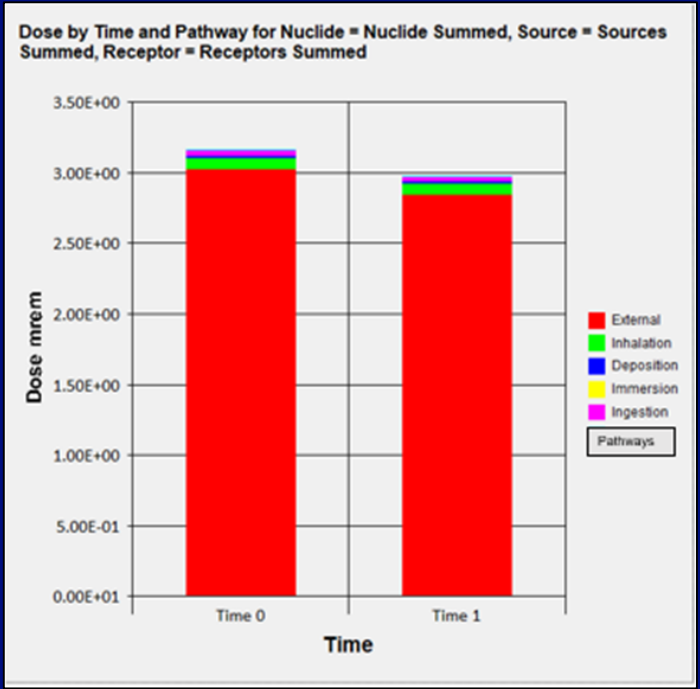
A Researcher in Room 726 – Removable Condition



The Cs-137 concentration is 2,800 dpm/100cm2 on a wall extending from Room 726 to Room 626 (modeled as two area sources, see Table 1 below).

The researcher is assumed to stay in Room 726, 1 m from the contaminated wall, for 2,000 hours in one year (indoor time fraction = 0.2283).

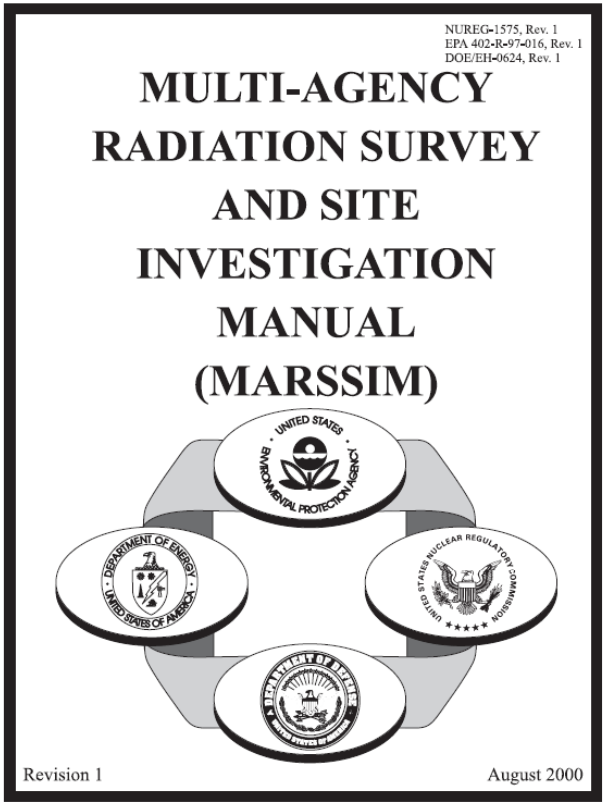
A Researcher in Room 726 – Fixed Condition



The Cs-137 concentration is 28,000 dpm/100cm2 on a wall extending from Room 726 to Room 626.

To set up the “fixed” condition in RESRAD-BUILD, the removable fraction is set to 0.1, and the air release fraction is conservatively set to 1 for the area source in Room 726 (i.e., 10% of the Cs-137 will gradually become loose, and all the loose Cs-137 will release into the air in Room 726).

MARSSIM



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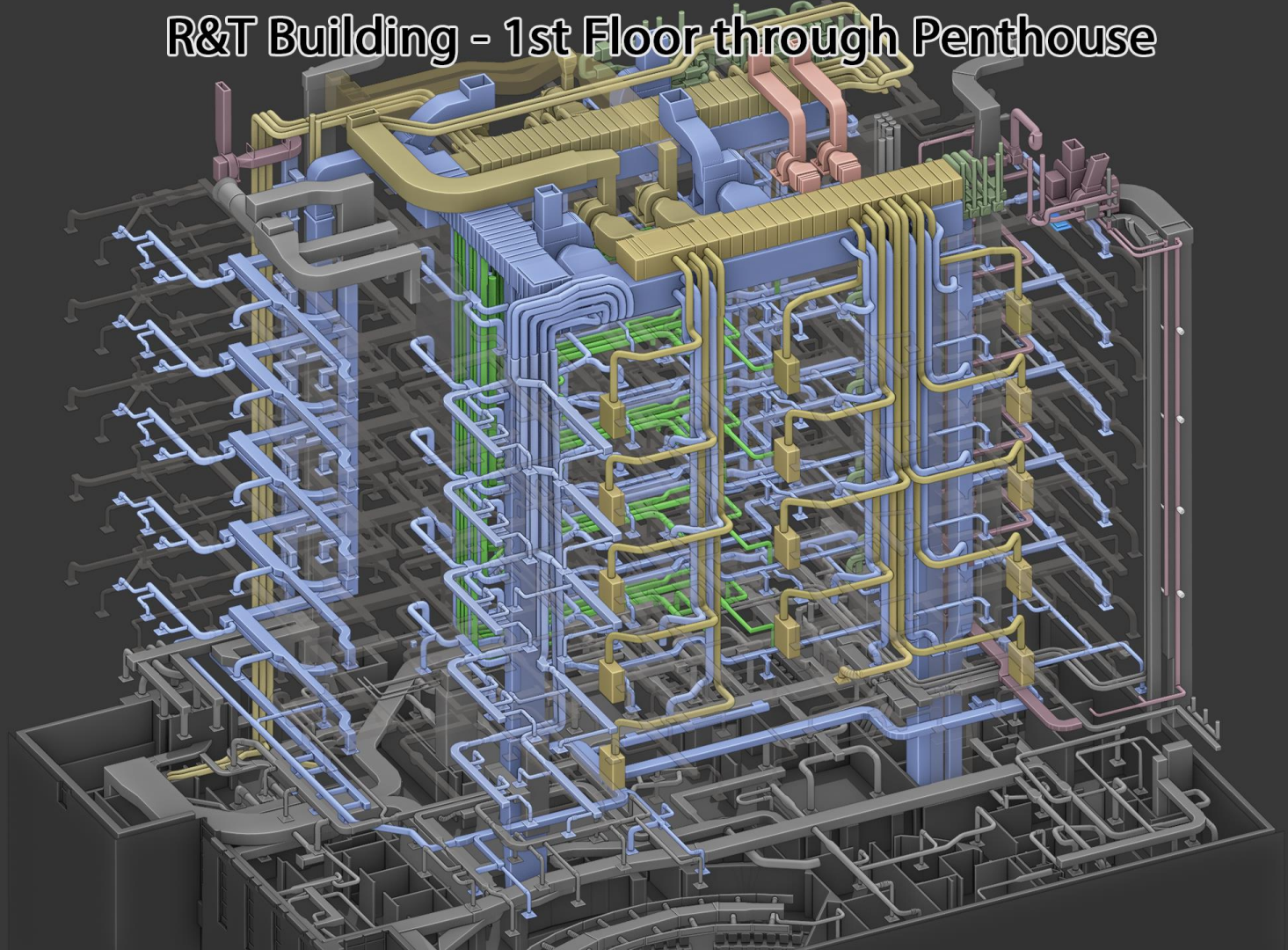
R&T Building - 1st Floor through Penthouse

Survey View

Systems

- FE
- GE
- BSC Takeoffs
- VE
- EF



N

R&T Building

Development of an NDA method as an Approved Alternative Technology

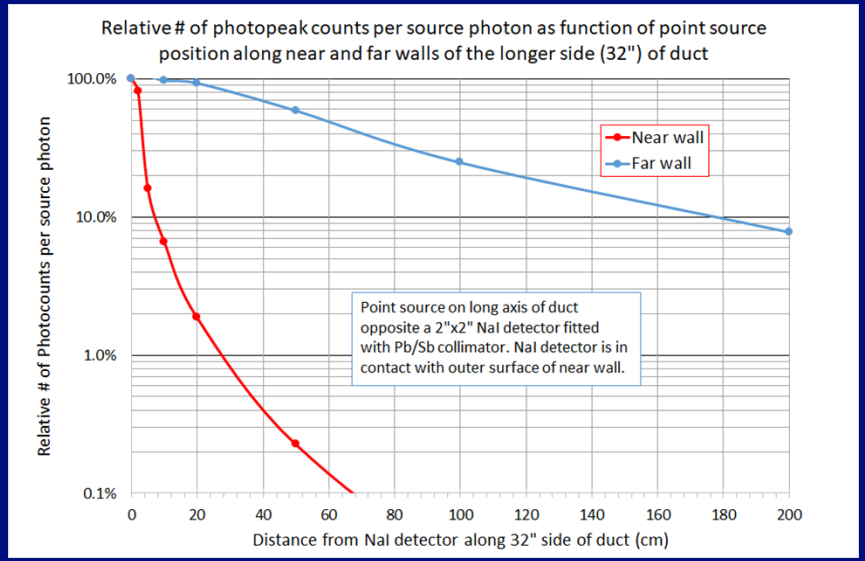
Los Alamos NATIONAL LABORATORY EST.1943

LA-UR-20-27729

Approved for public release; distribution is unlimited.

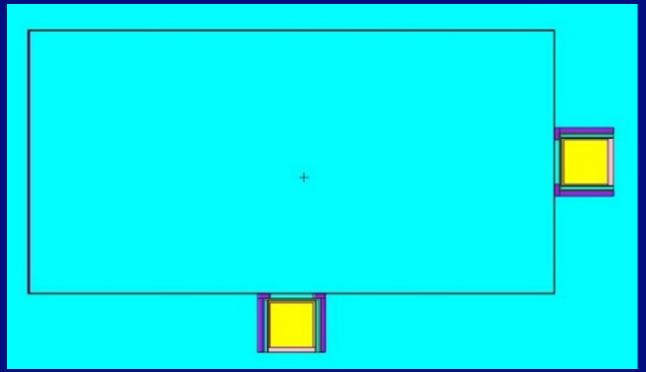
Title:	A comprehensive final summary of the MCNP calculations performed concerning the UW 137Cs release event
Author(s):	Mclean, Thomas Donaldson
Intended for:	Report
Issued:	2020-09-30

LA-UR-27729

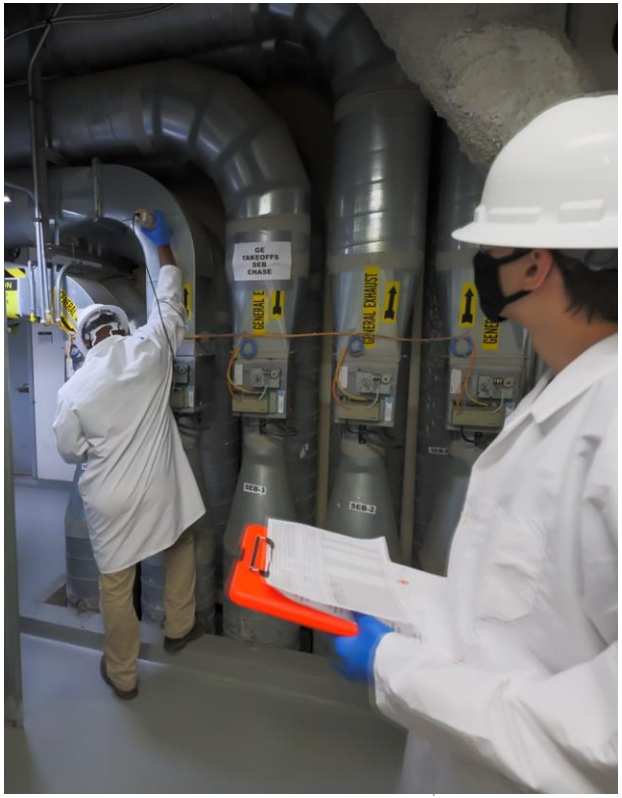


2"x2"NaI + Ludlum collimator

Rectangular 8"x12" duct. Uniformly contaminated	length (m)	area (cm^2)	NaI #1 cpm per	NaI #2 pCi/cm^2	ratio #2/#1
	0.1	1.01E+03	4.47	4.53	1.01
	0.25	2.53E+03	7.11	7.17	1.01
	0.5	5.05E+03	8.98	9.02	1.00
	1	1.01E+04	10.28	10.29	1.00
	2	2.02E+04	10.89	11.08	1.02
	5	5.05E+04	11.19	11.46	1.02
	10	1.01E+05	11.29	11.52	1.02

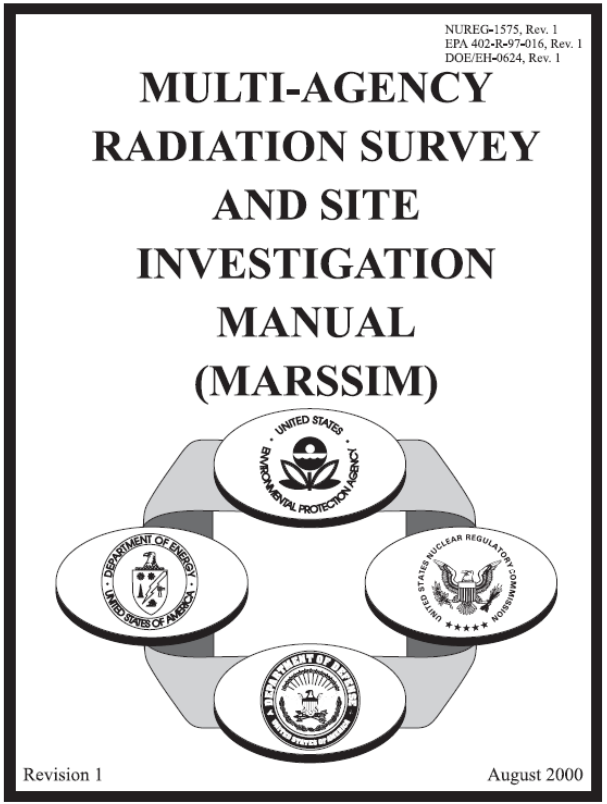


NDA Characterization FE System



Characterization survey of GE plenum

MARSSIM



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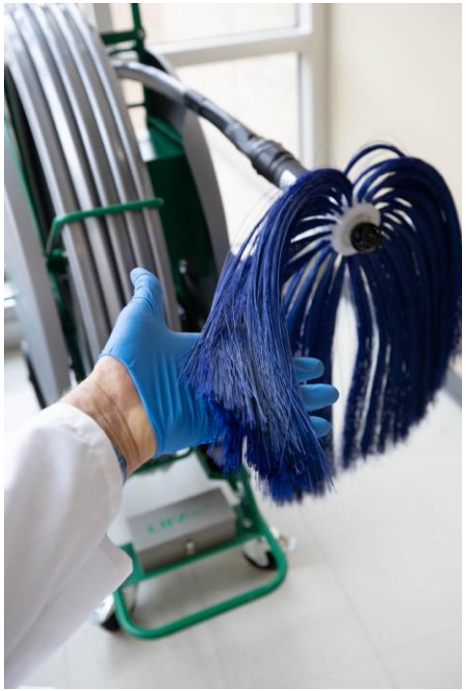
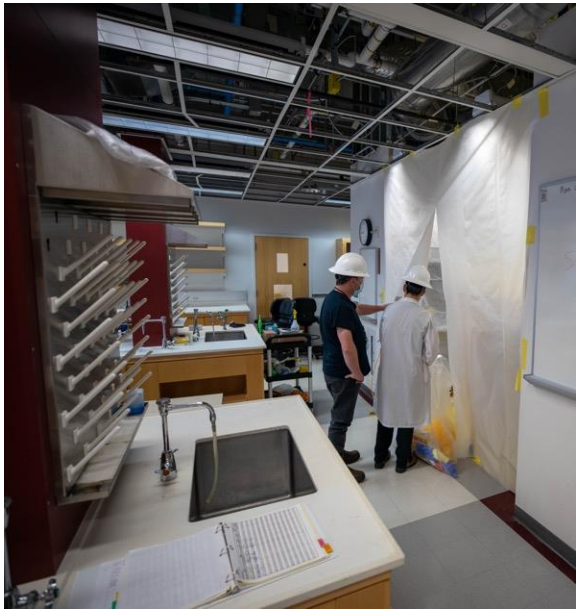
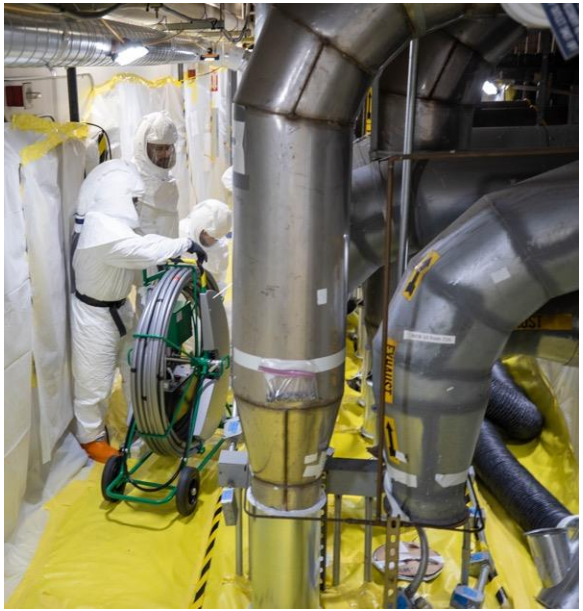
Cleaning GE-3 and GE-4

LIFAair Duct Cleaning System

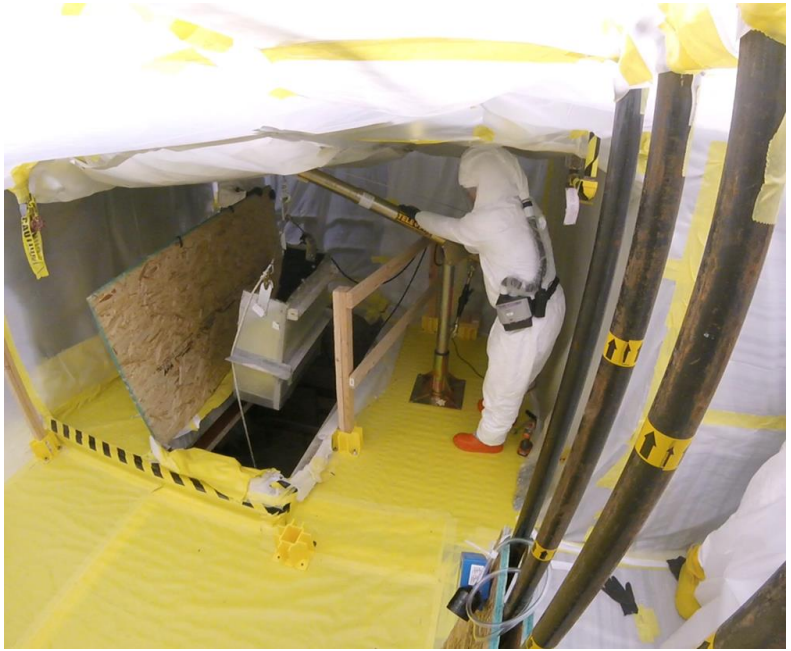




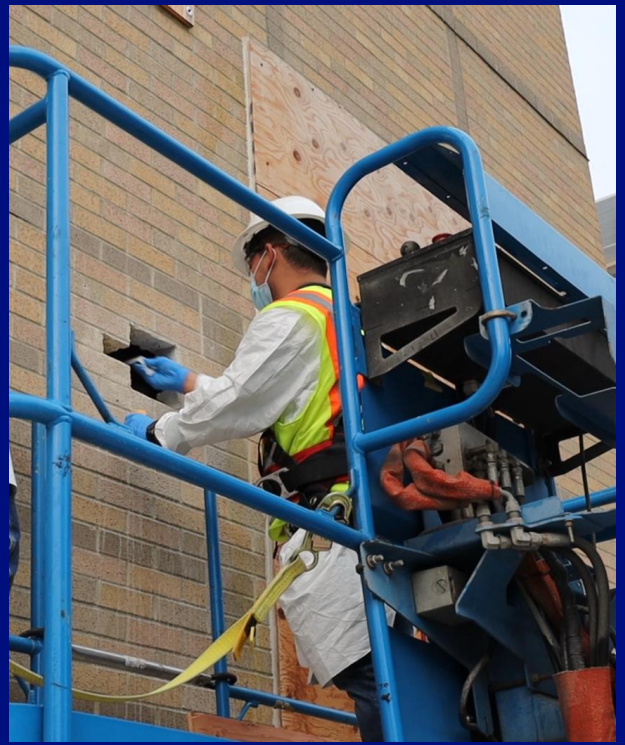


Cleaning GE East Side Lab Takeoffs

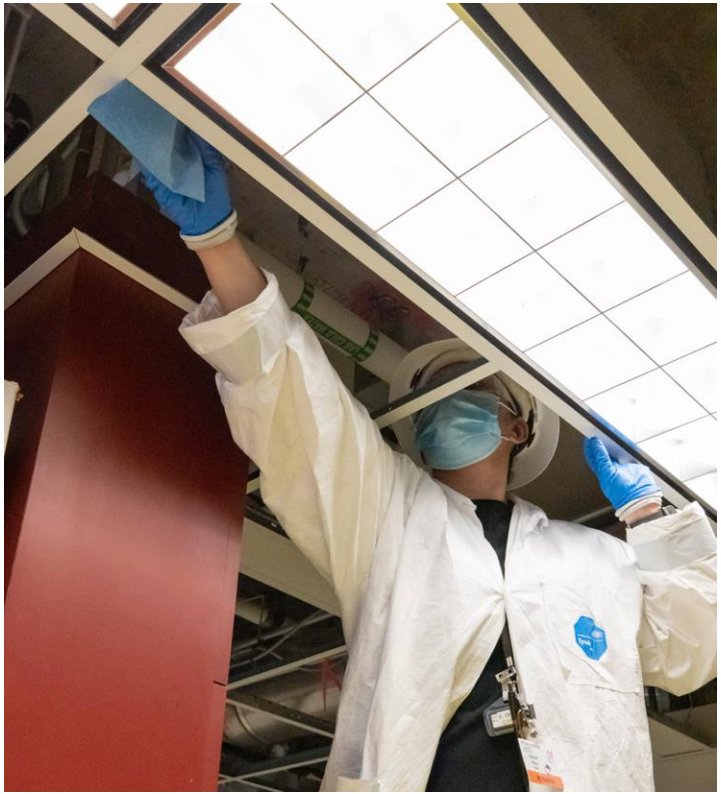
SW Riser and Removal



Characterization of External Curtain Wall Interstitial space

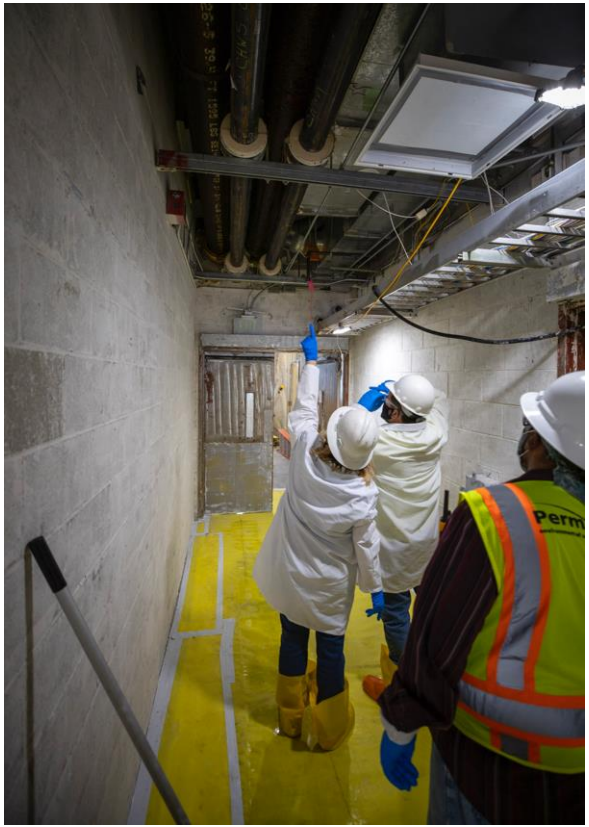


Cleaning Overhead Areas



Room 220 Duct Removal

2nd floor Hallway GE Duct Removal



2nd Floor Corridor

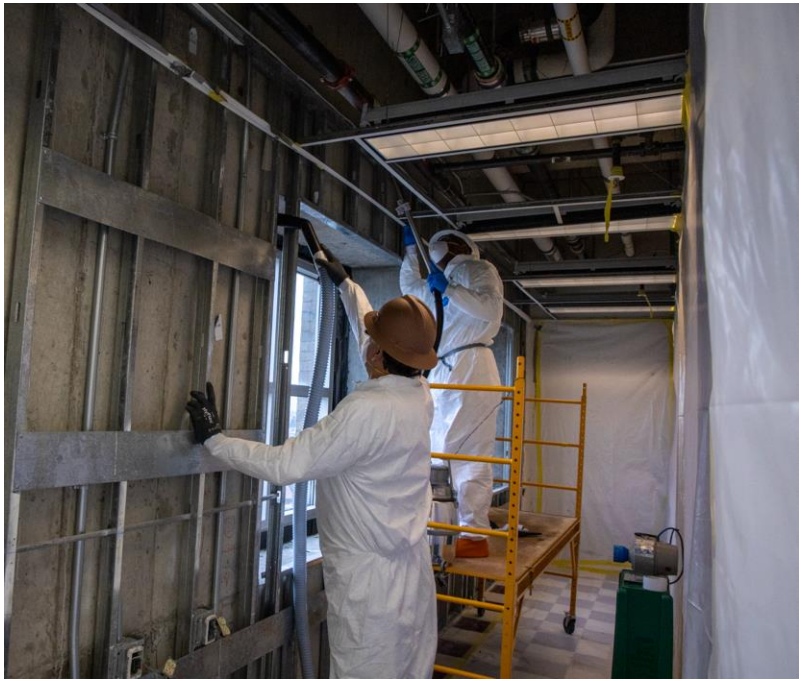
2nd Floor Comm Room

Movement of Contamination from Room 220 to Laboratories

- Contamination was found to be concentrated in fiberglass insulation near windows in laboratories
- Opening in wall permits airflow to space between concrete structural wall and brick curtain wall.

Top: Fiberglass insulation acted as filter trapping contamination
Bottom: Wall opening in Room 220

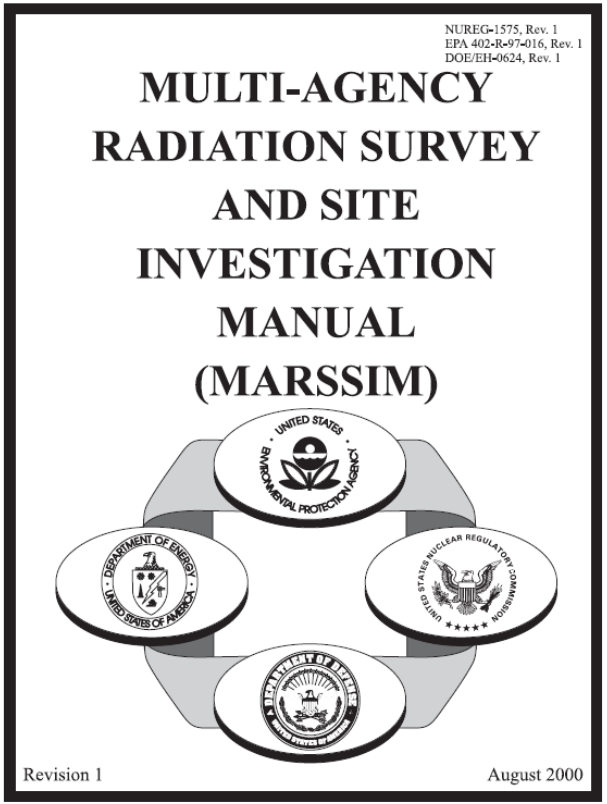
Interior Curtain Wall Cleaning



Service Elevator Shaft Decontamination

Surface Grinding of Concrete Parking Area

MARSSIM



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FSS Survey Instruction Packages (SIP)

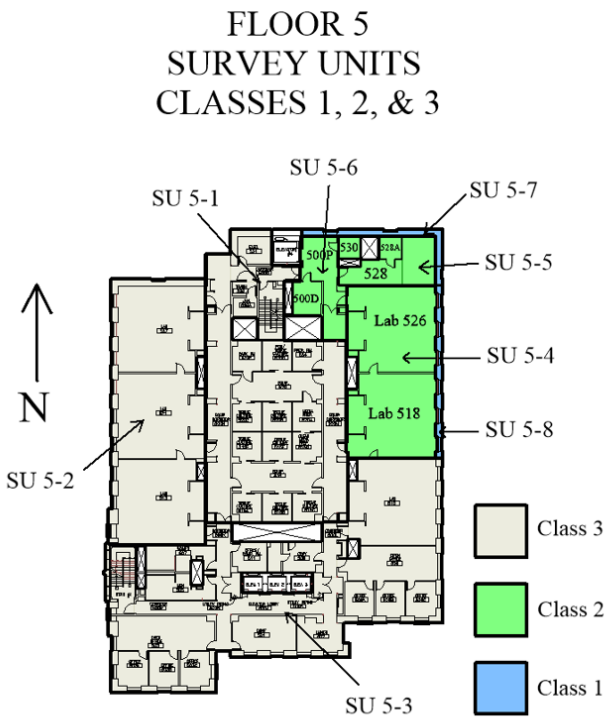


Figure 1 - Map of 5th Floor Survey Units

Table 4 - 5th Floor Survey Units

Survey Instruction Package	Survey Unit	Description	MARSSIM Class	SU Size (m^2)
SIP 05-01	HRT-5-1	Central Rooms	Class 3	404
	HRT-5-2	West Labs	Class 3	318
	HRT-5-3	South and East Rooms	Class 3	560
SIP 05-02	HRT-5-4	Labs 518 and 526	Class 2	658
	HRT-5-5	NE Corner Rooms	Class 2	272
	HRT-5-6	Comm. Room and NE Hall	Class 2	277
SIP 05-03	HRT-5-7	NE Corner Walls	Class 1	86
	HRT-5-8	Lab 518 and 526 Walls	Class 1	86

FSS 200 Hallway

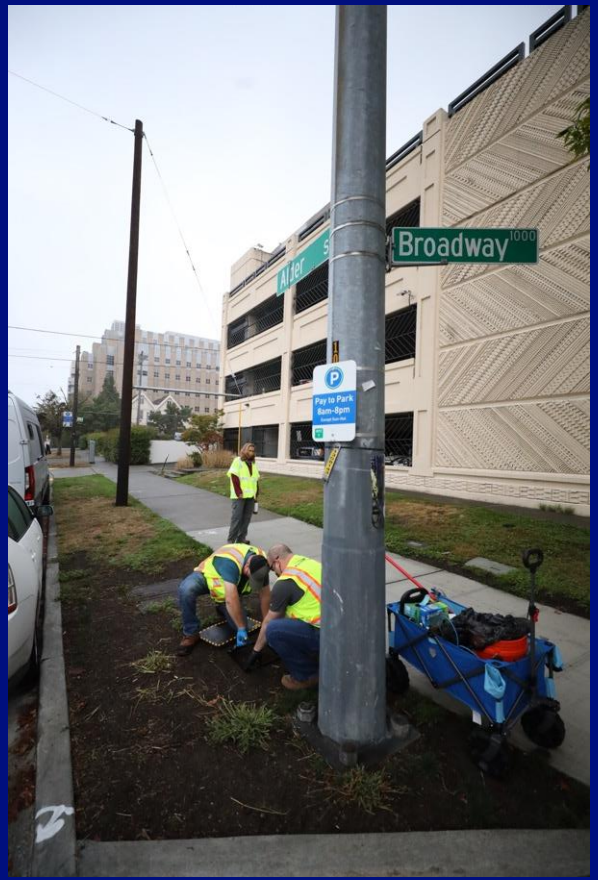
Final Status Surveys

FSS and DOH Confirmatory Sampling GE Plenum

Environmental sampling

Soil under cracks in pavement

Environmental sampling



Final Status Survey Submitted on March 15, 2021

- Termination of radiological controls anticipated by mid-April
- Phase 4 underway and has made encouraging progress

Chapter	Survey Instruction Packages (SIPs)	Survey Units
1	3	13
2	3	40
3	3	10
4	3	8
5	3	8
6	3	8
7	3	8
8	2	13
9	2	9
10	7	19
11	14	29
Totals	**46**	**165**