ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

April 7, 2009

Docket 030-03732
License 05-03166-05

Ms. Vivian Campbell, Chief
Nuclear Materials Safety Branch-A
U.S. Nuclear Regulatory Commission
Region IV
612 E. Lamar Boulevard, Suite 400
Arlington, TX 76011

SUBJECT: CONFIRMATORY SURVEY PLAN FOR ROOMS 2007, 2120, 2120A, 2124, AND 2124A IN BUILDING 1, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY CAMPUS, BOULDER, COLORADO (DOCKET NO. 030-03732; RFTA NO. 09-008) DCN 1788-PL-01-0

Dear Ms. Campbell:

Enclosed is the confirmatory survey plan for the subject areas at the National Institute of Standards and Technology (NIST) in Boulder, Colorado. Comments you may have will be incorporated into a final plan.

Please contact me at 865.576.0065 or Tim Vitkus at 865.576.5073 should you have any questions.

Sincerely,

Wade C. Adams
ORISE Health Physicist/Project Leader
HEAV/Survey Projects

WCA:bf

Enclosure

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CONFIRMATORY SURVEY PLAN
FOR ROOMS 2007, 2120, 2120A, 2124, AND 2124A IN BUILDING 1
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY CAMPUS
BOULDER, COLORADO

INTRODUCTION

The National Institute of Standards and Technology (NIST) is a federal agency that promotes innovation and industrial competiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improves our quality of life. NIST is a non-regulatory agency of the U.S. Department of Commerce. With a staff of 350 scientist, engineers, technicians, and support personnel, and an average of 300 visiting researchers, students and contractors annually, the NIST Boulder Laboratories conducts research in a wide range of chemical, physical, materials, and information sciences and engineering.

NIST Boulder Laboratories occupies an 84-hectare (ha) campus at the foot of the Colorado Front Range. The NIST campus (Figure 1) shares offices and laboratories with two other Department of Commerce agencies: the National Oceanic and Atmospheric Administration (NOAA) and the National Telecommunications and Information Administration (NTIA).

PLUTONIUM INCIDENT HISTORY

On June 9, 2008, a vial containing 0.25 grams (g) of mixed plutonium (Pu) isotopes ruptured resulting in the contamination of several laboratories, a bathroom, a hallway, an office, a sink and associated drain lines, the hood ventilation system leading to the roof, and various laboratory equipment/furniture in Building 1 (Figure 2). The spill impacted areas include: Rooms 2124, 2124A, 2120, 2120A (Figure 3), the hallway, a bathroom, the researcher office in Room 2007 (Figure 4), the roof (Figure 5), and the soil within the excavation of the drain line in Room 2124 (Figure 6).

NIST contracted with Energy*Solutions*, LLC (ESL) to perform the radiological cleanup activities within Building 1. ESL was tasked with stabilizing the contaminated areas, recovering and returning the source material to the U.S Department of Energy (DOE), decontaminating the affected areas, providing radiological data indicating that the impacted areas met release criteria, and the packaging

and shipping of contaminated materials for waste disposal. ESL was responsible for the cleanup of Rooms 2007, 2120, 2120A, 2124, 2124A and the roof (ESL 2009).

Radioactive waste was stored within a 20-foot (ft) long intermodal container which was located within a secured fenced area (Figure 2). ESL also had two additional intermodal containers that were used for temporary storage of items from the work areas that had been cleared for unrestricted release. These items were removed from the work areas to allow more room for decontamination activities and to prevent cross contamination.

The ESL staging area for the decontamination activities for entry into Room 2120 included Room 2109 (which served as the ESL personnel office) and the full width of the hallway between the doors to Rooms 2123 and 2121 (Figure 2). This portion of the hallway was temporarily demarcated and closed off to pedestrian traffic during the early stages of the decontamination activities. The hallway was reopened to pedestrian traffic after initial decontamination efforts in Room 2120 were completed.

The maximum contamination surface activity level was detected in Room 2124 during a survey that was performed by DOE personnel. The surface activity was greater than 500,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2). DOE treated the remaining laboratories and Room 2007 as potentially contaminated.

The U.S. Nuclear Regulatory Commission's (NRC's) Headquarters and Region IV Offices have requested that the Oak Ridge Institute for Science and Education (ORISE) perform confirmatory surveys of the contaminated areas within Building 1 at the NIST Campus in Boulder, Colorado. The surveys may be coincident with the licensee's surveys and soil sampling and may include the observation of the licensee's final status survey (FSS) protocols. The NRC has also tasked ORISE with performing limited radiological surveys of outdoor areas, including the roof of the facility and the temporary waste storage area where radiological waste from the impacted areas was stored.

CONTAMINANTS OF CONCERN

The radionuclides of concern (ROCs) for the NIST incident are well known since the contamination was from a standard radioactive source with an established radionuclide distribution and decay mode (Table 1). ESL has decided to use only those radionuclides that contribute greater than 1% or more

to the derived concentration guideline level (DCGL) in the FSS DCGL calculations. Therefore, all uranium (U) isotopes and neptunium-237 (Np-237) are excluded from the final FSS DCGL calculations. Since Pu-241 is a low energy beta emitter that is difficult to detect with direct beta surface activity measurements, ESL decided that they would only perform alpha direct surface activity measurements during the FSS activities.

TABLE 1:
RUPTURED SOURCE ACTIVITY INFORMATION[a]

Radionuclide	Activity (μCi)	Activity (%)	Decay mode	Radionuclide of Concern (Y/N?)
Pu-238	3.64E+02	0.81%	Alpha	Yes
Pu-239	1.41E+04	31.32%	Alpha	Yes
Pu-240	4.48E+03	9.95%	Alpha	Yes
Pu-241	2.15E+04	47.76%	Beta	Yes
Pu-242	3.28E-01	0.00%	Alpha	Yes
U-234	5.15E-02	0.00%	Alpha	No
U-235	5.85E-04	0.00%	Alpha	No
U-236	5.40E-03	0.00%	Alpha	No
Am-241	4.57E+03	10.15%	Alpha	Yes
Np-237	3.16E-02	0.00%	Alpha	No
U-238	4.46E-06	0.00%	Alpha	No
Total	**4.50E+04**	**100.00%**		

[a]Data provided by ESL (ESL 2009).

PROJECT ORGANIZATION AND RESPONSIBILITIES

Work described in this survey plan will be performed under the direction of Eric Abelquist, Vice President and Program Director; Tim Vitkus, Survey Projects Manager; and Wade Adams, Project Leader, with ORISE. The cognizant site supervisor has the authority to make appropriate changes to the survey procedures as deemed necessary. After consultation with the NRC site representative, the scope of the survey may be altered based on findings as the survey progresses, and additional information provided by the NRC and/or licensee.

PROJECT HEALTH AND SAFETY

ORISE will adhere to all applicable regulatory requirements and participate in required site-specific training. Activities performed by ORISE will be conducted under the site's overall health and safety plan. Personnel working on the project will be informed of known or potential hazards to effectively apply required safety precautions. ORISE and designated site personnel will walk down the project areas prior to initiating surveys to evaluate any additional potential health and safety issues. The walk down will provide information to determine if the hazards present are currently addressed by ORISE's Job Hazard Analysis (JHA) contained in the Survey Procedures Manual (ORISE 2008a). Hazards identified that are not addressed by an existing JHA, will require the preparation of an applicable JHA in accordance with the ORISE integrated safety management system.

CONFIRMATORY SURVEY OBJECTIVES

The objective of the confirmatory survey is to generate independent radiological data for use by the NRC in evaluating the adequacy and accuracy of the licensee's FSS results. Data collected by ORISE and the licensee will be reviewed to assess whether the data quality is sufficient for comparison to the NRC approved site-specific DCGLs. The objective of the document review of the licensee's proposed final status survey plan (FSSP) is to evaluate the technical processes and radiological survey techniques that will be used to identify radiological contamination within the impacted areas.

DOCUMENT REVIEW

ORISE will review and evaluate the licensee's final radiological survey data and the FSSP for adequacy and appropriateness, considering the data quality objectives (DQOs) established in those documents.

FIELD SAMPLING AND MEASUREMENT PLAN

To expedite the survey process, ORISE will coordinate and work with the NRC site representative as the licensee plans and implements their survey activities. This will assure ORISE may complete

confirmatory surveys at such time as the licensee determines the probability of satisfying final status survey (FSS) DQOs is high.

SURVEY UNIT CLASSIFICATION

The MARSSIM FSS process relies upon the use of characterization surveys and site history to divide the site into properly classified survey units (SUs) of appropriate physical area. Modifications to the SU classification can be made based on new survey findings or information. SUs are limited in size based on their classification, exposure pathway modeling assumptions and site-specific conditions.

Under MARSSIM, the level of survey effort required for a given SU is determined by the potential for residual contamination as indicated by the classification. SUs with a higher classification will receive a higher degree of survey effort. The remediation contractor is using the following MARSSIM classifications:

- Non-impacted: Areas that have no reasonable potential for residual contamination from site operations.
- Impacted Areas: Areas that may contain residual contamination from licensed operations. Impacted areas include Class 1, 2, and 3 areas.
    - Class 1: Areas with the highest probability of contamination; with potential for containing concentrations of residual radioactivity that exceed the DCGLs.
    - Class 2: Areas with low potential for containing concentrations of residual radioactivity that exceed the DCGLs.
    - Class 3: Areas with little or no potential for containing concentrations of residual radioactivity that exceed the DCGLs.

ESL classified the impacted areas as either Class 1 or Class 2 SUs. The following table provides the ESL classifications for each area that received FSSs.

TABLE 2: SURVEY UNIT CLASSIFICATION[a]		
Survey Unit	**Size (m^2)**	**Survey Unit Classification**
Room 2124 Floor	89	1
Room 2124 Walls	197	1
Room 2124 Ceiling	89	1
Room 2124A Floor	37	1
Room 2124A Walls & Ceiling	115	2
Room 2120 Floor	58	1
Room 2120 Walls & Ceiling	222	1
Room 2120A Floor	28	1
Room 2120A Walls & Ceiling	93	2
Room 2007 Floor	18	1
Room 2007 Walls & Ceiling	60	2
Roof Area	392	2
Room 2124 Excavation	---[b]	2
Excavation Outside Room 2124	---	2

[a]Information provided by ESL.
[b]Excavation size not provided.

PROCEDURES

ORISE personnel will visit the NIST site to perform visual inspections and independent measurements and sampling. ORISE survey activities will be conducted in accordance with the ORISE Survey Procedures and the ORAU Quality Program Manuals (ORISE 2008 and ORAU 2007). Deviations to this survey plan or procedures will be documented in the site logbook.

REFERENCE SYSTEM

Measurements and sampling locations will be referenced to the existing NIST/ESL grid system or room/area landmarks.

STRUCTURAL SURFACE SCANS

Surface scans for alpha and gamma radiation will be conducted on up to 50% of accessible floor, lower wall (up to 2 meters) and counter/hood surfaces within the impacted areas. Professional

judgment will be used to select upper surfaces for scanning. Particular attention will be given to cracks and fissures in the surfaces being scanned and other places where material may have accumulated during the incident (e.g., walkways, drain lines, wall/floor interfaces, roof, remaining equipment surfaces, etc.) as well as other judgmentally selected locations based on site observations. Surface scans will be performed using gas proportional, zinc sulfide (ZnS) scintillation, sodium iodide (NaI) scintillation and/or a Field Instrument for the Detection of Low-Energy Radiation (FIDLER) detectors coupled to a ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation, suggesting the presence of residual contamination, will be marked and identified for judgmental measurements. At the discretion of the NRC site representative, inaccessible surfaces, drains and ductwork may also be included within the scope of the confirmatory surveys.

ROOF SCANS

Surface scans for gamma (and/or alpha if applicable) radiation will be conducted on up to 50% of accessible roof surfaces within the impacted areas; concentrating on the hood exhausts from the impacted rooms. Surface scans will be performed using FIDLER (and/or gas proportional) detectors coupled to a ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation, suggesting the presence of residual contamination, will be marked and identified for judgmental measurements.

SOIL SCANS

Surface scans for gamma (and/or alpha if applicable) radiation will be conducted on up to 50% of accessible soil surfaces within the impacted areas. Surface scans will be performed using FIDLER (and/or gas proportional) detectors coupled to a ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation, suggesting the presence of residual contamination, will be marked and identified for judgmental measurements.

SURFACE ACTIVITY MEASUREMENTS

Static direct measurements will be made to quantify total alpha activity levels. Construction material-specific or radon build-up background measurements will be determined, if necessary,

within designated background reference area rooms. Direct measurements will be performed at approximately ten random locations per survey unit using gas proportional and/or ZnS scintillation detectors coupled to ratemeter-scalers. These measurements, after correcting for material/radon backgrounds, will be used to estimate the mean residual activity levels in each laboratory. Judgmental measurements will also be collected at any locations of elevated direct radiation detected during scanning. Additional measurements will be collected around judgmental locations in order to provide a means for estimating the average activity level in the contiguous area.

Smears may be collected and used as an investigative tool to determine if further investigations are required and not for determining compliance with release criteria. The data will be collected to determine if contamination is removable and/or to evaluate radon concentrations on the measured surfaces.

SOIL SAMPLING

ORISE plans to collect a minimum of five random surface (0 to 15 cm) soil samples from the exposed soil surfaces if excavated soil surfaces are accessible during confirmatory surveys. Samples may also be collected below the initial 15 cm depth should field investigations indicate the potential for subsurface contamination. It is possible that some excavations may be covered with clean fill prior to ORISE gaining access, thus precluding direct confirmatory surveys. In these cases, ORISE may review licensee scan and analytical data for volumetric sampling. ORISE may also request ESL-collected split soil samples, if available. The final number of soil samples collected will depend upon survey findings and will be based on the results of surface scans.

MISCELLANEOUS MATERIAL SAMPLING

At the discretion of the NRC site representative, samples of miscellaneous material such as concrete, sediment, and other residues may be collected from judgmental locations that are not accessible for direct survey or from locations of elevated direct alpha or gamma radiation detected by surface scans.

LIMITED RADIOLOGICAL SURVEYS

At the discretion of the NRC site representative, ORISE will perform limited radiological surveys of areas that are not part of the ESL FSSP. These areas may include a bathroom, the hallway, Room 2109 and areas in the vicinity of the intermodals.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data will be returned to the ORISE/IEAV laboratory in Oak Ridge, Tennessee for analysis and interpretation. Sample analyses will be performed in accordance with the IEAV Laboratory Procedures Manual (ORISE 2009). Soil samples will be analyzed by gamma spectroscopy and for isotopic plutonium by alpha spectroscopy and results reported in units of picocuries per gram (pCi/g). The primary radionuclides of concern are provided in Table 1; however, spectra also will be reviewed for other gamma-emitting radionuclides. If applicable based on confirmatory survey results, dry smears may be analyzed using a low-background proportional counter. Smear data and direct measurement data will be converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2).

The data generated will be compared with the licensee's radiological sampling results and the applicable NRC approved site-specific DCGLs for the site-specific contaminants of concern. Results will be presented in a draft report and provided to the NRC for review and comment. Data and samples collected as part of this survey will be archived by ORISE until the completion of the project at which time they will be returned to the site for disposal.

SITE RELEASE CRITERIA

The primary contaminants of concern for the NIST impacted areas are alpha emitters and a low-energy gamma emitter resulting from the rupture of the Pu source (Refer to Table 1). ESL has developed site-specific DCGLs based on dose modeling not to exceed 25 mrem/year total effective dose equivalent (TEDE) as presented in 10 CFR 20 (ESL 2009). ESL used the "Building Occupancy Scenario" and the "Residential Occupancy Scenario" in version 2.1.0 of the NRC DandD code in deriving the DCGLs for structural and soil surfaces, respectively (ESL 2009). With the exception of changing the resuspension factor (RF) for the "Building Occupancy Scenario" for structural surfaces, ESL used the default values. The ESL site-specific DCGLs for structural

surfaces and surface soils are provided in Table 3. ESL also determined gross activity DCGLs for structural and soil surfaces based on activity and/or surrogate ratios.

TABLE 3:
ESL DERIVED CONCENTRATION GUIDELINE LEVELS[a]

Radionuclide	Structural Surfaces	Soil Surfaces
	$DCGL_w$ (dpm/100 cm^2)	$DCGL_i$ (pCi/g)
Pu-238	407	2.5
Pu-239	370	2.2
Pu-240	370	2.3
Pu-241	18,939	73
Pu-242	387	2.4
U-234	1,256	9.0
U-235	1,336	7.8
U-236	1,329	13.6
Am-241	358	2.1
Np-237	293	0.10
U-238	1,404	10.0
Gross Activity[b]	**692**	**0.42**

[a]Data in table provided by ESL (ESL 2009).
[b]Gross activity for structural and soil surfaces calculated by ESL.

SCHEDULE

The following activities are planned to be conducted in accordance with the following schedule:

- Field Measurements — April 14 through 16, 2009
- Sample Analysis — April 2009
- Draft Report — Within three weeks of sample analysis

The final report will be issued within 15 days of the receipt of the NRC comments on the draft report.

REFERENCES

Energy*Solutions*, LLC. (ESL). *Final Status Survey Plan for NIST Boulder Campus Building 1 Affected Rooms.* CS-HP-PN-008, Revision 1. Oak Ridge, TN, March 26, 2009.

Oak Ridge Associated Universities (ORAU). *Quality Program for the Independent Environmental Assessment and Verification Program.* Oak Ridge, Tennessee; November 1, 2007.

Oak Ridge Institute for Science and Education (ORISE). *Survey Procedures Manual for the Independent Environmental Assessment and Verification Program.* Oak Ridge, Tennessee; May 1, 2008.

Oak Ridge Institute for Science and Education. *Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program.* Oak Ridge, Tennessee; March 3, 2009.

U.S. Nuclear Regulatory Commission (NRC). *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), NUREG-1575; Revision 1. Washington, DC; August 2000.

U.S. Nuclear Regulatory Commission. *Request for Technical Assistance – Description of Work for the National Institute of Standards and Technology*, NRC Form 305 (8-1997) completed by Robert Evans; March 16, 2009.

U.S. Nuclear Regulatory Commission. NRC screening computer code DandD Version 2.1.0.

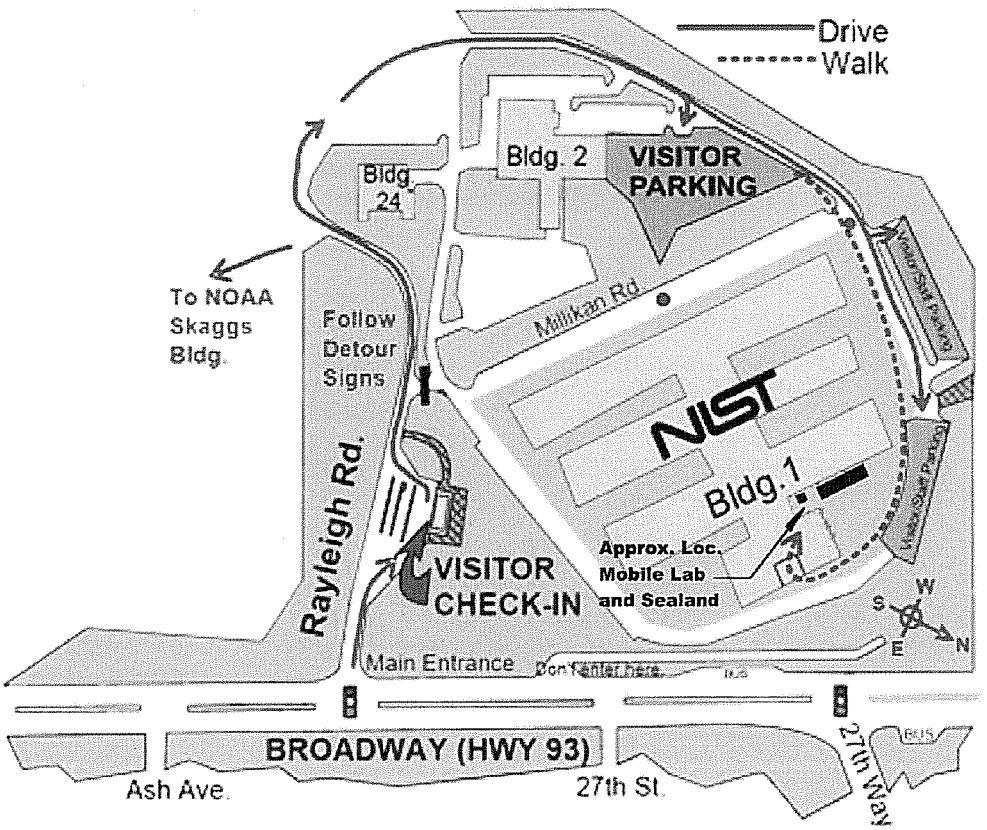

Figure provided by ESL.

Figure 1: NIST Boulder Colorado Campus Building 1 Area

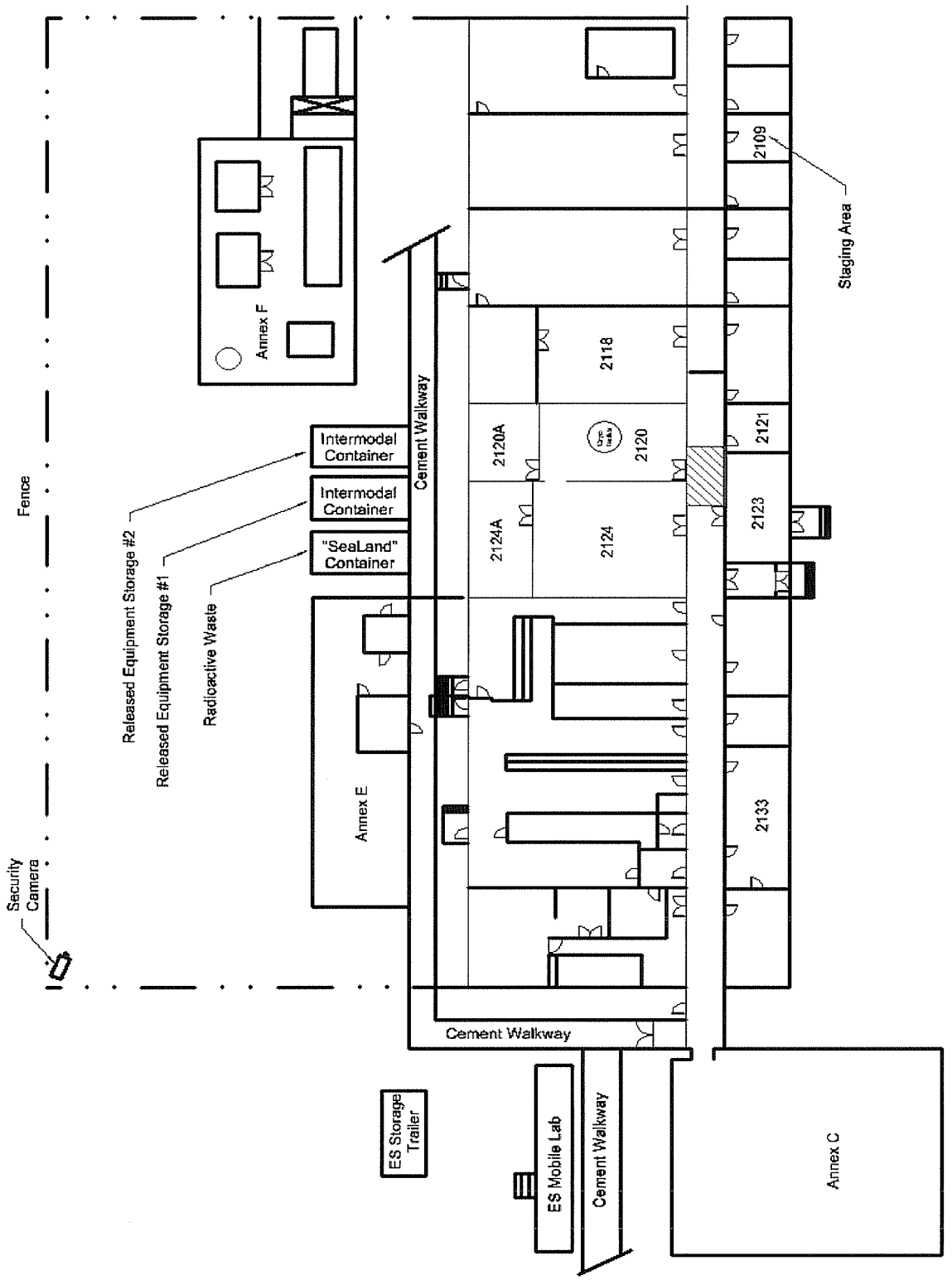

Figure provide by ESL.

Figure 2: Plot Plan of Building 1 Indicating Impacted Rooms and the Storage and Waste Areas

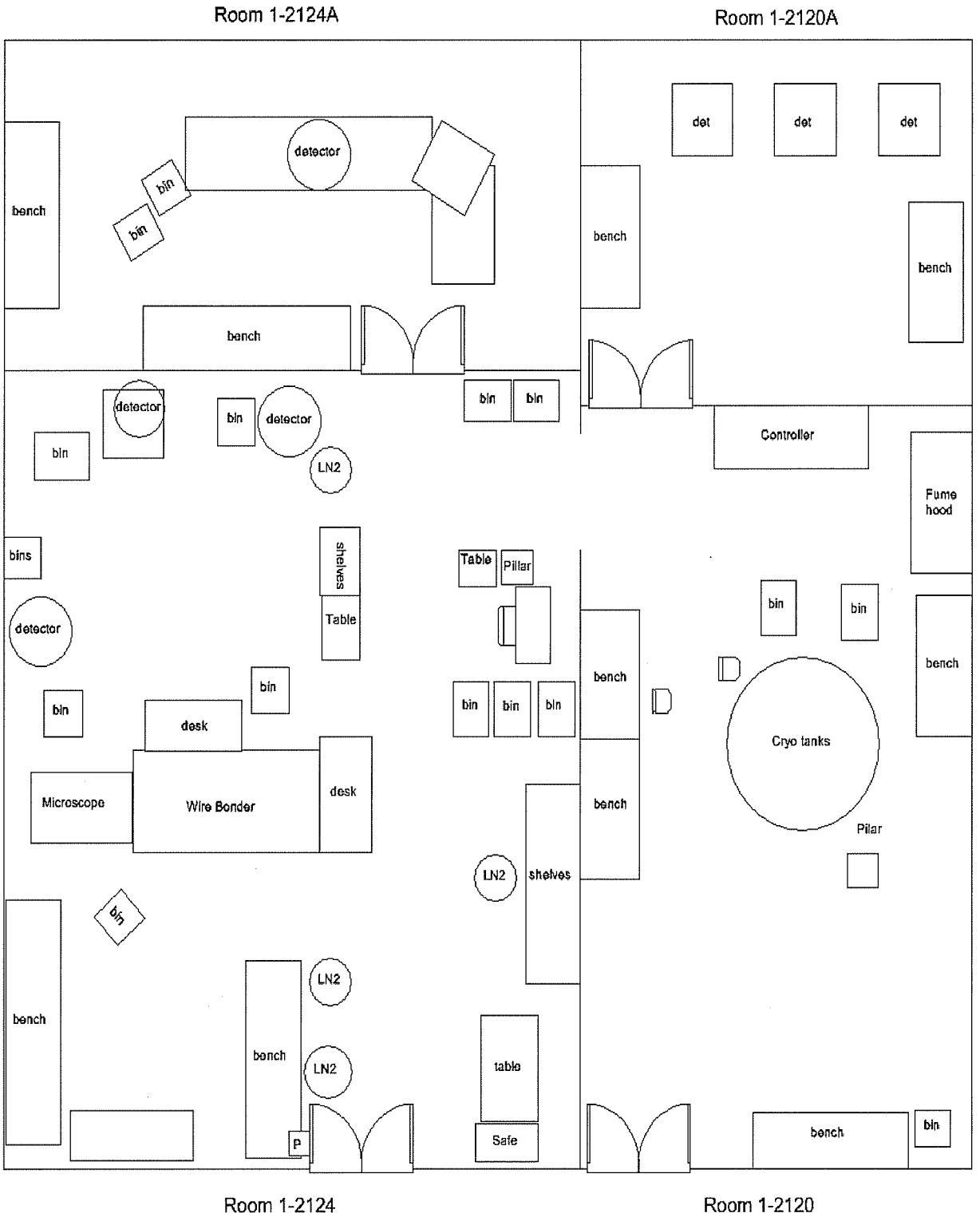

Figure provided by ESL.

Figure 3: NIST Building 1 Impacted Rooms

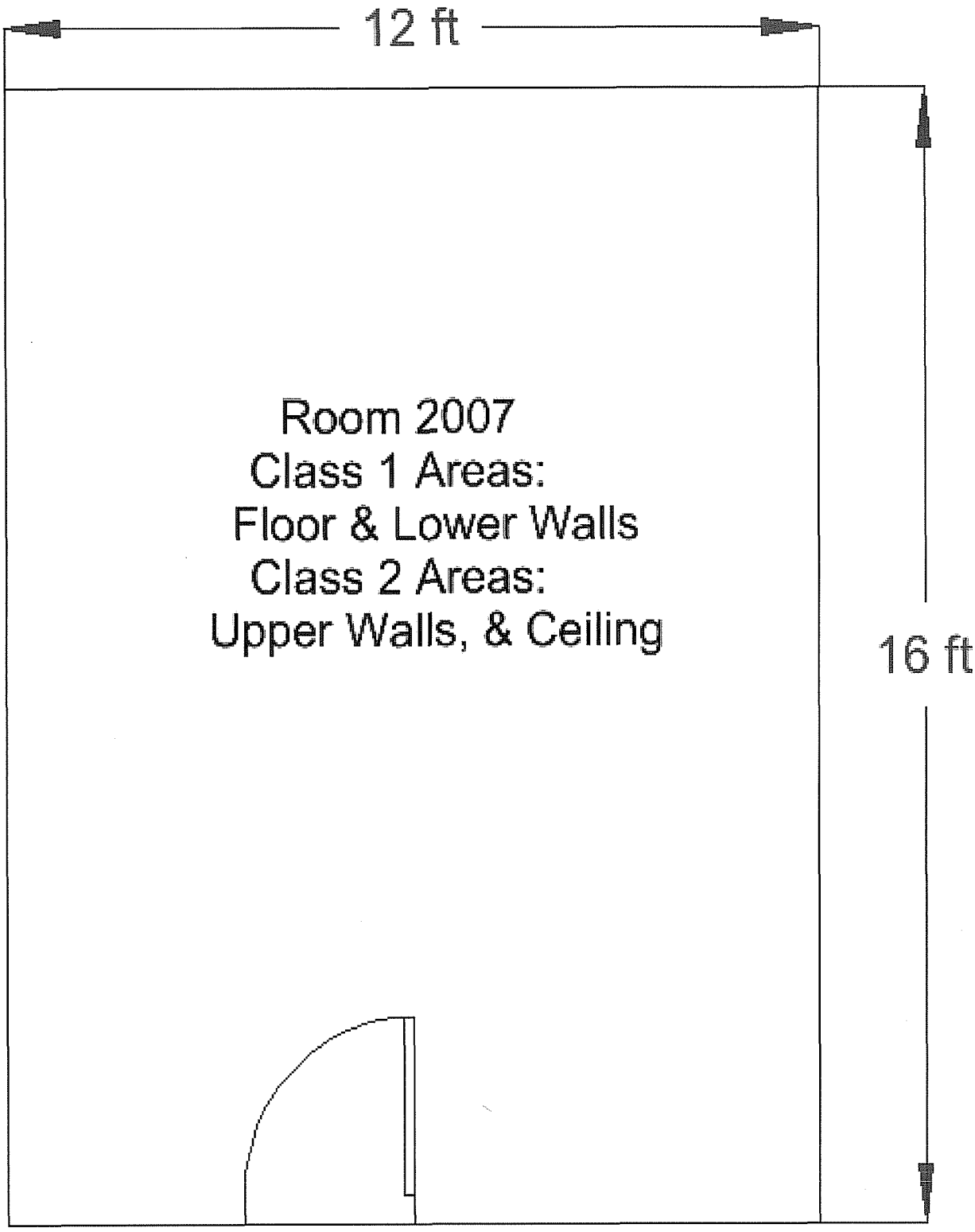

Figure provided by ESL.

Figure 4: NIST Building 1, Room 2007

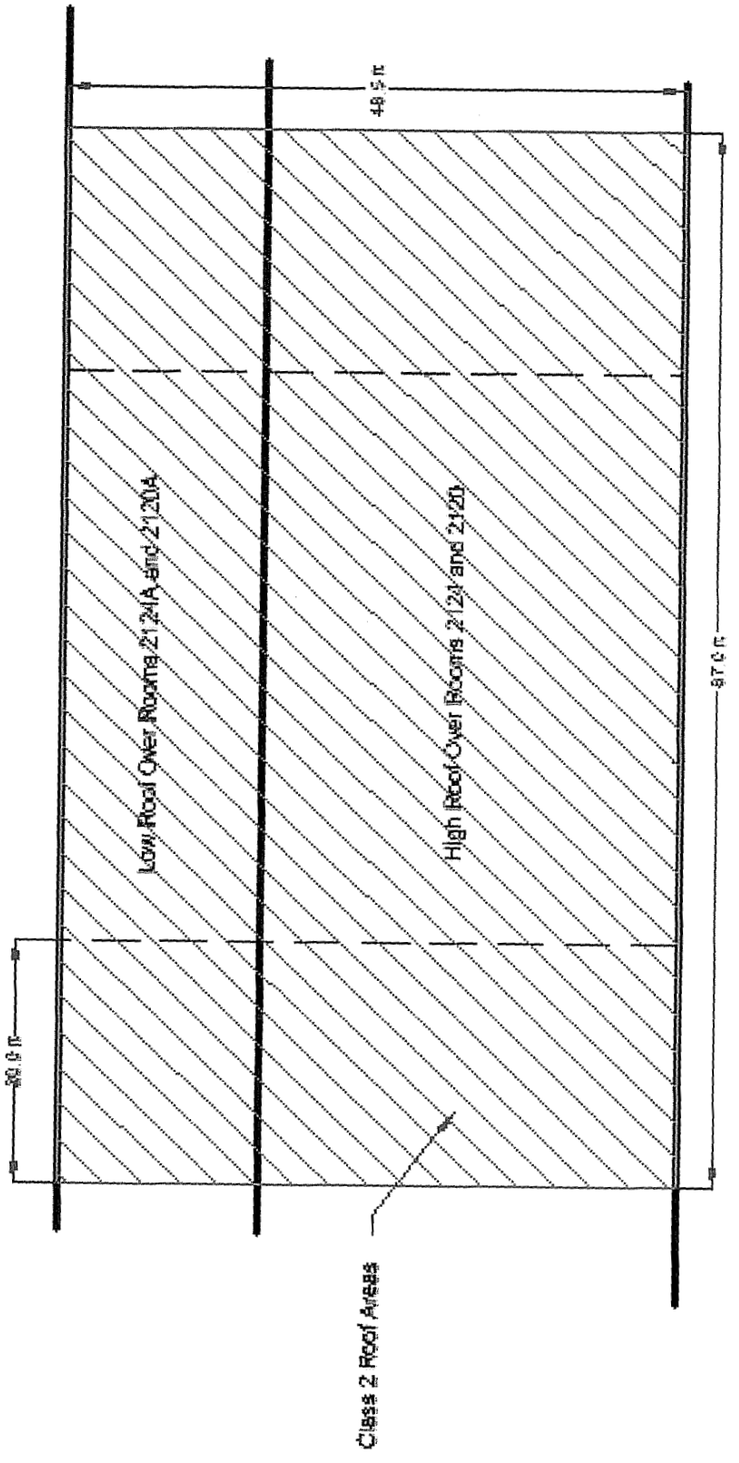

Figure provided by ESL.

Figure 5: NIST Building 1, Impacted Roof Area

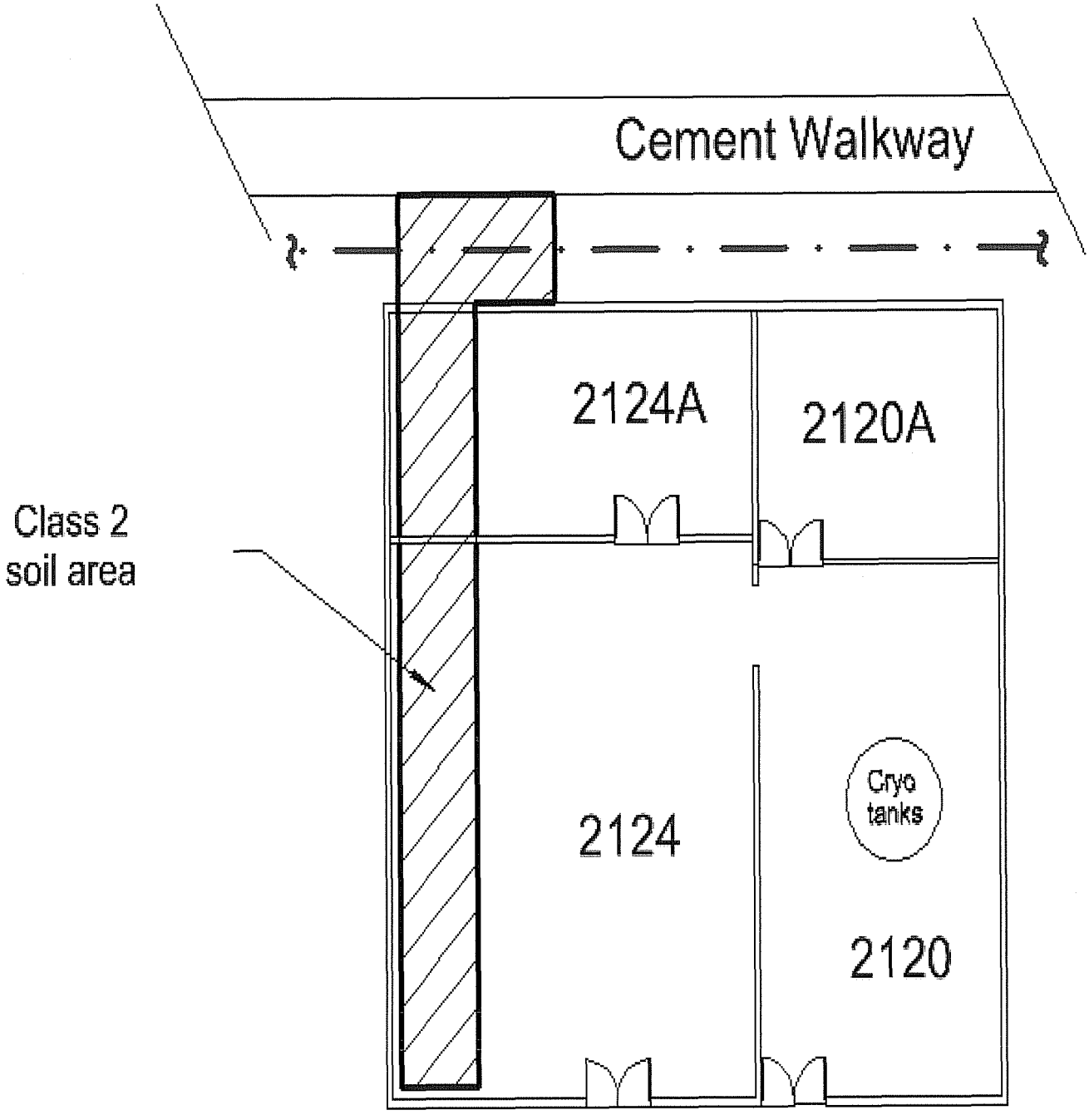

Figure provided by ESL.

Figure 6: Impacted Area Soil Excavation