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A-1.0 SURVEY RESULTS

A-1.1 SCOPE OF RADIOLOGICALLY IMPACTED AREAS

This report presents the results of the FSSs performed on radiologically impacted portions of Magill, Rhodes, and Johnson Halls, and the Biology Greenhouse at Southeast. All portions of Magill Hall were classified as radiologically impacted. Impacted areas within Rhodes Hall include Chemistry and Physics Department facilities as well as a few rooms occupied by the Geosciences Department. Biology spaces other than the Radiation Laboratory were determined to not be radiologically impacted. The only area of Johnson Hall determined to be radiologically impacted was Room 222, a room used to house Chemistry Department materials and in which a contaminated desk was located. It is notable that all impacted areas of Magill, Rhodes, and Johnson Halls were resurveyed as part of the recent decontamination and survey effort (except Rooms 214, 216, 218, and 218A, which were remodeled after 2005 and prior to the current FSS effort). In addition, soil areas adjacent to Magill Hall were surveyed and relevant information provided to the NRC to demonstrate compliance with applicable criteria. As such, NRC issued Amendment 14 to NRC License 24-09296-02 in June 2010 authorizing unrestricted release of such areas.

The radiological COPC at Southeast is Am-241. This radionuclide decays by alpha emission with a half-life of about 432 years to neptunium-237. Neptunium-237, in turn, also decays by alpha emission with a half-life of about 2.14×10^6 years. In addition to the emission of alpha particles with energies of 5.4 to 5.5 MeV, Am-241 also emits gamma photons with an energy of 59.5 KeV and an abundance of about 35.9 percent. As such, radiological surveys can use both alpha and gamma emissions in the quantification of Am-241 activity.

Attachments A-1 through A-15 contain detailed survey information for radiologically impacted soil and structures at Southeast, to include applicable sample locations and results for each SU.

A-1.2 SUMMARY OF SURVEY APPROACH

SUs were surveyed in accordance with guidance provided in MARSSIM. Surveys consisted of:

- GWSs were performed on structure surfaces and on soil surfaces to identify areas for further investigation. These surveys used 1" by 1" gamma scintillation detectors, 2" x 2" gamma scintillation detectors;
- Gross alpha/gross beta scan surveys and fixed-point measurements using dual phosphor alpha/beta scintillation detectors;
- Collection of fixed-point measurements and removable contamination surveys to confirm the validity of modeling assumptions used in the development of DCGLs. Systematic fixed-point measurements were obtained using a triangular grid for Class 1 and 2 areas and at random locations for Class 3 surveys. The preliminary MARSSIM survey plan indicated that 8 samples were required per area; and
- Collection and analysis of surface soil samples to characterize areas where the potential for Am-241 soil contamination existed (i.e., below the pedestal in the basement of Magill Hall).
- Structure surfaces and materials and equipment which exhibited residual activity exceeding DCGLs and "acceptable surface contamination levels," respectively, were subjected to additional decontamination and subsequent resurvey to confirm achievement of applicable criteria or were disposed of as radioactive waste.

Special emphasis was placed on assuring that:

- Surveys were performed only by fully qualified health physics personnel;
- All measurements were obtained using survey instruments compliant with applicable QA requirements with respect to instrument functionality and source and background efficiency;
- Scan surveys involved appropriate percentages of each SU;
- A sufficient number of measurements were collected with which to correctly evaluate the area;
- Instrumentation was selected such that applicable MDCs were achieved;
- Each SU passes the Sign Test. (It may be noted that, consistent with MARSSIM [Table 4, Roadmap-13], statistical testing is not required if the difference between the maximum SU measurement and the minimum reference area measurement is less than the DCGL; such SUs will achieve the release criterion, and thus a formal Sign Test is not required.)
- All structure surfaces were accurately classified as MARSSIM Class 1, Class 2, or Class 3 SUs, as reflected in Attachments A-1 through A-15 of this appendix.

A-1.3 SURVEY RESULTS

Radiological surveys are performed for a variety of reasons, including to obtain information; to evaluate whether existing concentrations of site contaminants exceed DCGLs (including as part of the FSS process); to identify the lateral and vertical extent of identified COPCs exceeding DCGLs and thus to enable the scope of remedial actions to be defined; and to evaluate the effectiveness of decontamination. The surveys performed within impacted areas of Southeast address each of these objectives.

As noted above, the scope of this survey effort included all impacted rooms within Magill, Rhodes and Johnson Halls at Southeast. Information provided in Attachments A-1 through A-15 of this appendix includes alpha, beta, and gamma scan and fixed-point measurement data, as well as detailed survey information relative to MARSSIM classification and maps reflecting measurement locations. Statistical Sign Test results were not required.

See Tables A-1 through A-3 for a list of the rooms addressed in detail within this report and the corresponding attachments in which they are addressed.

Table A-1. Magill Hall Impacted Rooms and Attachment Number

Room Number	Attachment
Corridor 100B, Foyer 100C, Office 142, Corridor 100C, Corridor 100E, Office 130, Corridor 100G/Room 134A	A-1
Lobby 100F, Classroom 116, Storage 116A, Lab 120, Storage 120A, Classroom 128, Classroom 134, Classroom 138, Storage 138A	A-2
Lab 101, Corridor 107, Office 107A, Office 107B, Office 107C, Office 107D, Office 109, Office 109A, Office 109B, Office 109C, Office 109D, Electric 111, Closet 113, Restroom 123, Classroom 124, Storage 124A, Storage 128A, Classroom 131, Office 135, Storage 135A, Storage 135B, Lab 135C, Storage 139, Janitor 141, Classroom 144, Restroom 149	A-3
Classroom 100, Storage 100A, Lobby 100H, Lab 104, Storage 104A, Classroom 108, Closet 108B, Storage 108A, Classroom 112, Closets 112B and 112C, Storage 112A, Storage 144A, Classroom 148, Storage 148A	A-4

Table A-1. Magill Hall Impacted Rooms and Attachment Number (Continued)

Room Number	Attachment
Corridor 209, Corridor 225, Lab 218A, Vestibule 232, Office 232B, Corridor 237, Corridor 250, Office 244A, Vestibule 244C	A-5
Lab 200, Lab 200A, Classroom 228, Lab 230, Classroom 232A, Lab 234, Storage 242A, Lab 235, Classroom 236, Lab 238, Storage 227, Lab 239, Lab 239A, Lab 239B, Lab 239C, Lab 239D, Storage 239E, Lab 239F, Lab 240, Lab 241, Lab 242, Lab 242A, Lab 242B, Lab 243, Classroom 244, Janitor 245, Classroom 248, Storage 248A, Storage 249	A-6
Lab 202, Lab 204, Lab 206, Lab 208, Lab 208A, Lab 208B, Lab 210, Lab 211, Lab 212, Lab 212A, Storage 213, Lab 214, Office 215, Lab 216, Lab 217, Lab 218, Janitor 219, Lab 220, Lab 220A, Lab 222, Restroom 223, Lab 224, Office 226, Office 226A	A-7
Vestibule 001, Corridor 002, Vestibule 003, Lab 016, Storage 011, Storage 015, Lab 017, Storage 019, Storage 021, Storage 021A, Storage 023, Storage 023A, Storage 026, Storage 029, Storage 19A, Electric 018, Mechanical 013, Corridor 013B	A-8
NW Penthouse, SE Penthouse	A-9
Ventillation	A-10
Biology Greenhouse	A-11

Table A-2. Rhodes Hall Impacted Rooms and Attachment Number

Room Number	Attachment
Storage 121B, Depository 123, Lab 125, Corridor 100, Corridor 100B, Vestibule 100C, Corridor 100G, Office 102A, Storage 102B, Mail Room 102E, Lab 104, Office 107, Office 107E, Lab 109, Advising Center 117, Lecture Hall 121, Lab 122, Lab 124, Lab 126, Women 130	A-12
Corridor 200B, Office 201, Office 201A, Office 201B, Office 201C, Office 201D, Office 201E, Office 201F, Office 201G, Office 201H, Lab 216, Office 224E, Lab 226, Office 230A, Office 230B, Office 230C, Office 230D, Corridor 200A, Corridor 200H, Corridor 200J, Office 202, Lab 203, Lab 204, Office 206, Lab 207, Lab 211, Lab 215, Classroom 220, Classroom 223, Office 224B, Lab 227, Men 231	A-13
Classroom 301, Lab 303, Lab 304, Office 306C, Office 312, Lab 319, Office 319A, Classroom 323, Corridor 300, Office 302, Office 305, Office 306, Office 306E, Lab 307, Lab 309, Office 311, Lab 314, Classroom 315, Classroom 316, Lab 317, Lab 318B, 318C, Lab 321, Office 321A, Men 324	A-14

Table A-3. Johnson Hall Impacted Rooms and Attachment Number

Room Number	Attachment
Room 222	A-15

A-1.3.1 General Structure Survey Information

Static measurements were collected using the Ludlum Model 43-89 ZnS detector coupled with a Ludlum Model 2360 scaler (measurements using this instrument are given in cpm). In order to compare this measurement with the DCGLs, it must be converted to dpm/100 cm². This is accomplished using the following equation:

$$\frac{dpm}{100 \text{ cm}^2} = \frac{\text{measurement}(cpm) - \text{background}(cpm)}{(\varepsilon_i)(\varepsilon_s)\left(\frac{\text{probe area}}{100 \text{ cm}^2}\right)}$$

Where:

measurement (cpm) = reading from the instrument

background (cpm) = appropriate background/reference area measurement

ε_i = instrument efficiency

ε_s = surface efficiency

probe area = area of the detector face

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A-2.0 RESULTS AND CONCLUSIONS

Residual levels of radioactivity in Magill, Rhodes, and Johnson Halls clearly demonstrate that residual concentrations of radionuclide COPCs achieve the site-specific Am-241 (alpha) DCGL of 1,160 dpm/100 cm² and the most restrictive beta DCGL of 5,000 dpm/100 cm² for Cs-137. In addition, removable activity measurements were within the range of background variability and, as such, demonstrated that the associated RESRAD inputs were sufficiently conservative.

Given these results, it is clearly demonstrated that the null hypothesis (i.e., that the SUs exceed DCGLs) is rejected. Review of survey data supports the conclusion that each SU in Magill, Rhodes, and Johnson Halls contain an adequate number of samples; a sufficient percentage has been scanned; and they have been appropriately classified consistent with MARSSIM requirements using the process noted in Section 4.0 of the main text of this document. All scan and fixed measurement results were below the DCGL. As such, formal assessment using the Sign Test is not required in any SU.

Levels of radioactivity in Magill, Rhodes, and Johnson Halls, achieve criteria for unrestricted release consistent with the provisions of 10 *CFR* 20, Subpart E.

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ATTACHMENT A-1
MAGILL HALL
FIRST FLOOR CORRIDORS

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ATTACHMENT A-2
MAGILL HALL
FIRST FLOOR SOUTHEAST

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ATTACHMENT A-3
MAGILL HALL
FIRST FLOOR CENTRAL

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ATTACHMENT A-4
MAGILL HALL
FIRST FLOOR NORTHWEST

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ATTACHMENT A-5
MAGILL HALL
SECOND FLOOR CORRIDORS

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ATTACHMENT A-6
MAGILL HALL
SECOND FLOOR SOUTHEAST

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ATTACHMENT A-7
MAGILL HALL
SECOND FLOOR WEST

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ATTACHMENT A-8
MAGILL HALL
BASEMENT

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ATTACHMENT A-9
MAGILL HALL
PENTHOUSE FOUNDATIONS

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ATTACHMENT A-10
MAGILL HALL
VENTILATION SYSTEM

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ATTACHMENT A-11

BIOLOGY

GREENHOUSE

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ATTACHMENT A-12

RHODES HALL

FIRST FLOOR

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ATTACHMENT A-13

RHODES HALL

SECOND FLOOR

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ATTACHMENT A-14

RHODES HALL

THIRD FLOOR

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ATTACHMENT A-15

JOHNSON HALL

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