FINAL

RECOMMENDATIONS FOR PHASE II ENVIRONMENTAL CONDITION OF PROPERTY INVESTIGATION

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ACRONYMS AND ABBREVIATIONS

AFIP	Armed Forces Institute of Pathology
AR	Army Regulation
ARA	Army Radiation Authorization
BRAC	Base Realignment and Closure
C	Concentration of Radionuclides
CABRERA	Cabrera Services, Inc.
CENAB	U.S. Army Corps of Engineers, Baltimore District
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
cm^2	square centimeter
DCGL	derived concentration guideline level
DCI	Department of Clinical Investigation
DOA	Department of the Army
DOE	Department of Energy
DOIM	Directorate of Information Management
dpm	disintegrations per minute
DQOs	Data Quality Objectives
ECP	Environmental Condition of Property
FSS	Final Status Survey
g	gram
hr	hour
HPO	Health Physics Office
HSA	Historical Site Assessment
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mCi	milliCurie
µCi	microCurie
MeV	mega-electron volt
mph	miles per hour
mrem	millirem
NaI	sodium iodide
NRC	U.S. Nuclear Regulatory Commission
NUREG	U.S. Nuclear Regulatory Commission Regulation
pCi	picoCurie
RAM	radioactive material
ROPC	radionuclide of potential concern
SOR	sum of ratios
SU	survey unit
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USEPA	U.S. Environmental Protection Agency
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAIDR	U.S. Army Institute of Dental Research
WRAMC	Walter Reed Army Medical Center
yr	year

1.0 INTRODUCTION

1.1 Purpose and Objectives

The Main Post of the Walter Reed Army Medical Center (WRAMC) has been identified as one of the military installations identified as part of Base Realignment and Closure (BRAC) 2005 (Public Law 101-510 as amended). BRAC is the process by which the nation reshapes its military installations to become more efficient and effective in supporting its forces. An Environmental Condition of Property assessment (ECP) must be completed for all BRAC installations. The U.S. Army Environmental Center (USAEC), with support from the U.S. Army Corps of Engineers (USACE), is responsible for evaluating whether BRAC installations are suitable for release or reuse with respect to environmental conditions. Phase 1 of an Environmental Condition of Property (ECP) assessment was conducted concurrently for this installation by Shaw Environmental, Inc (Shaw, 2005). Cabrera Services, Inc. (CABRERA) prepared a radiological Historical Site Assessment (HSA) for the WRAMC Main Post as an addendum to the Phase 1 ECP. (CABRERA, 2006) This work was accomplished in accordance with the U.S. Army Corps of Engineers (USACE) Statement of Work entitled *Historical Site Assessment in Support of the Environmental Condition of Property Phase I for Selected Base Realignment and Closure Installations*, under the terms and conditions of Contract W912-DR-05-D-0024, Delivery Order 0003 between the USACE Baltimore District (CENAB) and CABRERA (USACE, 2006).

This document outlines the findings of the radiological HSA and provides recommendations for the next phase in the ECP process, hereafter referred to as 'Phase II.' Phase II of the ECP involves planning and investigation of those areas classified as 'Impacted' in the HSA in accordance with the guidance in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM; NUREG-1575 Rev. 1/EPA 402-R-97-016 Rev. 1/DOE/EH-0624, Rev. 1).

1.2 Summary of HSA Findings

An HSA was conducted to specifically address facilities and areas that had operations involving radioactive materials that were U.S. Nuclear Regulatory Commission (NRC) licensed, or that fall under a Department of the Army Radiation Authorization (ARA). As such, the purpose of the HSA was to: (1) identify potential, likely, or known sources of potential radioactive contamination resulting from radioactive material use or storage; (2) identify areas as Impacted or Non-Impacted in accordance with assessment protocol as outlined in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (USEPA, 2000); (3) identify specific data gaps for Impacted areas; and (4) provide information useful for designing subsequent radiological characterization surveys of Impacted areas that will support unrestricted release.

A Certified Health Physicist (CHP) reviewed historical information to determine if there is sufficient data to declare buildings as "Impacted" or "Not Impacted" in accordance with MARSSIM methodology (USEPA, 2000). Documents gathered from various sources were reviewed and evaluated to extract information on the possession and use of radioactive materials (RAM). These documents included licenses, permits, authorizations, inventory records, surveys,

historical drawings, and floor plans. In addition, the HSA included a visual inspection of buildings and areas where RAM was either used or stored, and interviews with individuals knowledgeable of RAM handling, storage, and disposal.

The use of RAM at WRAMC has historically, and is currently conducted in accordance with a number of U.S. Nuclear Regulatory Commission (NRC) licenses and Army Radiation Authorizations (ARAs). Specific uses of RAM can be summarized as follows:

- Medical treatment using sealed sources in milliCurie (mCi) quantities (e.g., brachytherapy and oncology seeds).

- Health physics support using sealed sources in milliCurie (μCi) quantities (e.g., calibration sources).

- Clinical and biomedical research using unsealed μCi and mCi quantities. Of the various unsealed isotopes used in research, only long-lived radioisotopes, i.e. half-lives greater than 1 year to present any potential for residual contamination.

Seven buildings on the WRAMC Main Post were found to be impacted from historical use of RAM (See Figure 1-1). This information is summarized in Table 1-1. Within the seven buildings identified, 102 rooms or laboratories have been classified as "Impacted." These specific rooms are identified in Appendix B of the HSA (CABRERA, 2006) and are summarized in Section 4.2 of this report. No radiologically impacted outdoor areas or release points were identified for the Main Post.

Nuclides considered of potential concern for future surveys include Carbon-14, Calcium-45, Hydrogen-3, Iodine-129, Radium-226, and Uranium-238, based on reported use and evaluation of radioactive half-life (decay).

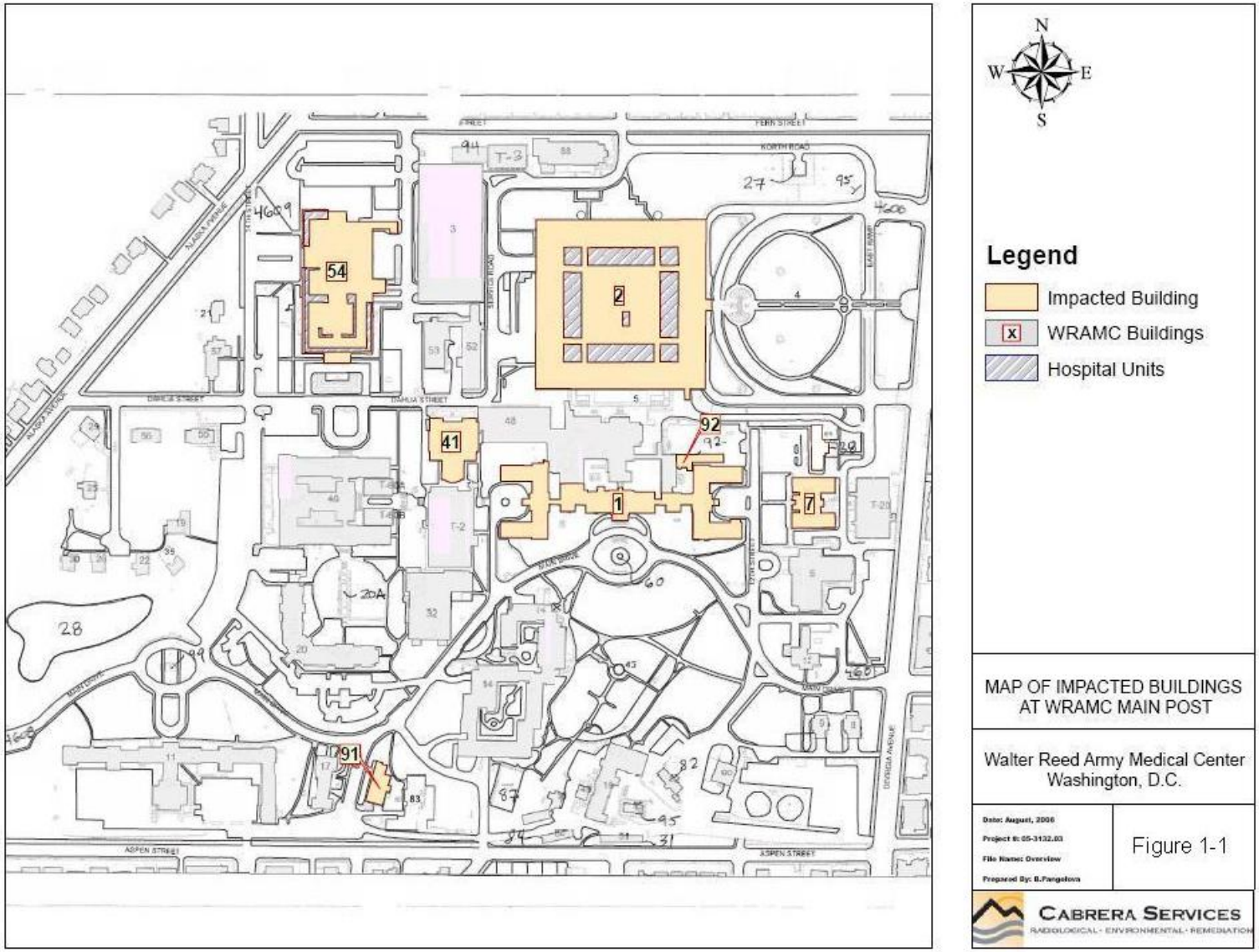

FIGURE 1-1: LOCATION OF IMPACTED BUILDINGS AT WRAMC

TABLE 1-1: WRAMC MAIN POST BUILDINGS CONSIDERED IMPACTED

Building No.	Original / Former Use	Current Tenant / Use	Radiological Data Summary	MARSSIM Classification
1	Primary patient care facility and Post Library at WRAMC from 1909 until construction of new hospital, Building 2 in 1977	Installation Commander and Administration Building	Location of former Nuclear Medicine Clinic and Radiation oncology departments presumed to be in SE wing of Bldg (Ref. 037). Appendix A of the BRAC 2005 ECP Report (Ref. 037) lists radioisotopes room B-19 in Building 1B (East Pavilion). No authorization or permit found for Bldg 1. RAM use in Bldg 1predates all active staff at WRAMC. • RCOPCs: Ra-226, Cs-137, H-3, C-14, others • Potentially Impacted Rooms: B-19	Impacted, MARSSIM Class 3
2	Primary patient care facility at WRAMC from 1977 to present	Primary patient care facility at WRAMC from 1977 to present	Building 2 has an active Nuclear Medicine clinic, Radiation Oncology and Radiology units, and several research laboratories that use radioactive materials. Rooms 7544 and 7545 are used by the HPO for temporary radioactive waste storage. • RCOPCs: C-14, Ca-45, Cr-51, Eu-152, H-3, I-125, I-131, In-111, P-32, P-33, Ra-226, Rb-86, S-32, S-35 • Potentially Impacted Rooms: 1H24A, 1J33, 1J39, 1J39A, 1J43, 2B51, 2B53, 2B54, 2B56, 2B59, 2B62, 2B81D, 4750C, 5Z60, 5Z68, 5Z70, 6Z60, 6Z70, 7A03, 7A07, 7A09, 7A14, 7A16, 7A18, 7B02, 7B03, 7C01, 7C05, 7C06, 7C07A, 7C07B, 7E10A, 7F15, 7F59, 7Z60, 7Z68, 7Z70, 1847, 1848, 1849, 4742, 4743, 4744, 4746, 4747, 4748, 4750, 4751, 4752, 4754, 4760, 4942, 7544, 7545 *(Room 1H24A no longer appears on building 2 floor plans. Rooms 1H23 and 1H25 are now shown as potentially impacted rooms.)*	Impacted, MARSSIM Class 3

Building No.	Original / Former Use	Current Tenant / Use	Radiological Data Summary	MARSSIM Classification
7	Main Barracks	Pathology Laboratories, Department of Clinical Investigation (DCI)	Room G26 is the only remaining laboratory with RAM usage [DCI under Authorization 676 (Ref 25]. All other former research labs with RAM were closed out by HPO (Ref. 025) prior to extensive building renovation. However, records of the HPO surveys are not available. • RCOPCs: C-14, Cr-51, Eu-152, H-3, I-125, I-131, In-111, P-32, P-33, Ra-226, Rb-86, S-32, S-35 • Potentially Impacted Rooms: G-01, G-09, G-11, G-18, G-19, G-22, G25, G-25A, G-25H, G-26, G-26A, G-31, G-34, G-35, G-40, G-42, G-46, G-53, 209, 216, 218, 221, 222	Impacted, MARSSIM Class 3
41	Red Cross Building	Instructional, Outpatient Clinic, Health Physics Offices (HPO)	Room 39 is the HPO counting lab. Room 42 is used for source storage, temporary rad waste storage, and instrumentation. All rooms are routinely surveyed by HPO staff. • RCOPCs: All isotopes listed on NRC License 08-01738-02 • Potentially Impacted Rooms: 39, 42 (Ref. 035, 040).	Impacted, MARSSIM Class 2

Building No.	Original / Former Use	Current Tenant / Use	Radiological Data Summary	MARSSIM Classification
54	Armed Forces Institute of Pathology (AFIP)	AFIP, WRAMC Museum is located on the eastern side of the Ground level.	Closeout survey records are available for the following rooms: 1028 (Ref. 014, pp 3-7); 1030 (Ref. 020, pp. 1-2); 2008 (Ref. 030, p. 11); 3012 (Ref. 030, p. 13); 5007 (Ref. 030, pp. 59-62); 5044 (Ref. 030, pp. 63-66); and 5050 (Ref. 030, p. 12). A reference to an abandoned firing range in the basement of Bldg 54 was made during the initial building tour. The tour guide mentioned potential for depleted uranium from firing of 50-caliber rounds. Exact location of the range is unknown at this time. There are records of electron microscope usage in Building 54 (Ref. 035). Therefore, uranium was added to the RCOPC list since uranyl acetate is typically used as a staining agent for these purposes. Uranyl acetate contamination was also observed during decommissioning of Building T-2 in an electron microscopy laboratory. • RCOPCs: Ba-133 , C-14 , Ce-141 , Cr-51 , H-3 , I-125 , I-129 , Ni-63 , P-32 , P-33 , Ra-226 , S-35 , Sc-46 , Sr-85, uranium • Potentially Impacted Rooms: B042A, B045, B063, B088, B092, G014, G075, M093A, 1040, 2012, 2014, 2046, 3002, 3004, 3014, 3032, 3034, 3060, 3099, 4008, 4016, 4031, 4032, 4053, 4064, 4086, 4100, 5047 (Note: many of the aforementioned rooms reflect pre-renovation conditions in Bldg. 54)	Impacted, MARSSIM Class 3

Building No.	Original / Former Use	Current Tenant / Use	Radiological Data Summary	MARSSIM Classification
91	United States Army Institute of Dental Research (USAIDR)	Directorate of Information Management (DOIM) / Industrial Hygiene	RAM use documented in Room 2 (Ref. 013), but terminated in Oct 1991. Authorization 572 activities transferred to Building 40. HPO closeout surveys requested by PI (pp. 8-9 of Ref . 013). Record of HPO survey not available. Building completely renovated after closeout. Now houses administrative departments. Room 2 has been completely renovated, but has been screened as Class 3 due to lack of closeout survey documentation. No other documentation found. • RCOPCs: C-14, Cr-51, H-3, I-125, Ra-226 • Potentially Impacted Rooms: Room 2	Impacted, MARSSIM Class 3
92	Nuclear Medicine Clinic	Administration (Audio/Visual Photolab)	• RCOPCs: The HPO has no records of RAM use in Bldg 92. RAM use likely ceased in or before 1977 (year Bldg 2 opened). Therefore, nuclides typically used in nuclear medicine and imaging, with half-lives greater than 5 years, should be considered as potentially present. • Potentially Impacted Room(s): All	Impacted, MARSSIM Class 3

Many of the buildings identified during records searches have had extensive renovations performed since the use or possession of RAM was terminated. The WRAMC Health Physics Office (HPO) is required to perform closeout surveys of all authorized rooms that are terminated; however, document retention procedures at WRAMC only require storage of survey documentation for 3-5 years. As a result, many of the buildings and/or rooms at the Main Post were determined to be impacted due to the lack of appropriate closure documentation.

1.3 General Approach to Proposed Radiological Phase II ECP Investigations

The information contained herein is intended to form the framework for future MARSSIM investigations at WRAMC. The findings outlined in the HSA will be used to develop scoping survey strategies for each impacted area with the intent of filling data gaps for future characterization or verifying that the area is non-impacted and may be released. With the latter point in mind, it is advantageous to design the scoping surveys with the rigor of a MARSSIM Final Status Survey (FSS) so that areas confirmed to be free of residual contamination may be released after this next step. Conversely, rooms or areas found to have residual radioactive contamination will be evaluated against the initial MARSSIM survey unit (SU) classifications assigned in the HSA to assess whether any impacted areas may require upgrade.

Data Quality Objectives (DQOs) for specific radiological scoping activities in Impacted areas are provided in Section 2.0. Specific recommendations for each building and future scoping survey efforts are provided in Section 4.0.

1.4 Radionuclides of Potential Concern

Radionuclides of Potential Concern (ROPC) were developed from research of WRAMC's U.S. Nuclear Regulatory Commission (NRC) radioactive material (RAM) licenses and amendments and discussions with key personnel. Based on this research, the ROPC list is shown in Table 1-2. It should be noted that this list represents radionuclides that were most prevalently used WRAMC, but may not be all-inclusive since WRAMC's licenses permitted possession of any radionuclide with atomic number between 1 and 83. The goal of developing a ROPC list is to determine the instrumentation needs for the scoping surveys in order to ensure that residual contamination will be detected and properly characterized.

The list of ROPCs indicates that instrumentation must be able to detect alpha, low energy to high energy beta, and gamma radiation.

TABLE 1-2: RADIONUCLIDES OF POTENTIAL CONCERN - WRAMC

Nuclide	Name	Half-Life	Principal Emissions
H-3	Hydrogen-3 (tritium)	12.3 yr	0.019 MeV (beta)
C-14	Carbon-14	5730 yr	0.156 MeV (beta)
Ca-45	Calcium-45	162.2 d	0.257 MeV (beta)
I-129	Iodine-129	1.57E+7 yr	0.154 MeV (beta)

			0.040 MeV (gamma)
Ra-226	Radium-226	1600 yr	4.601 MeV (alpha) 4.784 MeV (alpha) 0.186 MeV (gamma)
U-238	Uranium-238	4.47E+09 yr	4.1512 MeV (alpha) 4.198 MeV (alpha) 2.268 MeV (beta)(2)

Notes: (1) Nuclides used in the nuclear medicine clinic at WRAMC were deliberately excluded from the ROPC list as their short half-lives will make them unimportant for decontamination and decommissioning purposes.
(2) The 2.268 MeV beta shown for U-238 is actually from Protactinium-234(m), a decay daughter expected to be in equilibrium with the uranium parent.

2.0 DATA QUALITY OBJECTIVES

The following outlines the DQOs for this phase of radiological investigation.

2.1 Step 1: State the Problem

2.1.1 Problem Description

RAM has been used in existing and former hospital facilities and research laboratories at WRAMC over the course of its operating history. A scoping survey must be conducted in impacted areas as defined in the HSA to provide a more comprehensive picture of what Site areas have been truly impacted by this RAM usage.

2.2 Step 2: Identify the Decision

2.2.1 Principal Study Question

Do ROPC concentrations within impacted WRAMC areas exceed background levels by more than the chosen applicable levels for unrestricted release; and if so, what is the nature and extent of the contamination?

2.2.2 Decision Statements

The following statements assume that ROPC concentrations inside buildings exceed release levels. If ROPC concentrations inside impacted areas do not exceed the Derived Concentration Guideline Levels (DCGLs), the condition of the area will satisfy the release criterion.

- Determine whether ROPC concentrations on interior building surfaces exceed background concentrations by more than the applicable DCGLs.
- If survey unit ROPC concentrations inside buildings exceed background by more than the applicable release criteria, then affected areas must undergo further investigation and or remediation to levels satisfying the release criteria.
- Surveys of mechanical systems with impacted areas found to be in excess of chosen DCGLs will be flagged for further characterization and possible remediation. Examples of mechanical systems that should be investigated include sinks and drains in known RAM labs; floor drains suspected for use of disposal of RAM into the sanitary sewer; and ventilation systems in RAM use areas.

2.3 Step 3: Identify Inputs to the Decision

2.3.1 Information Inputs

Data collection and evaluation should be performed using guidance found in the MARSSIM, and include:

- Interior scan surveys for alpha, beta, and gamma ROPCs;
- Fixed-point measurements at designated systematic, random, and judgmental locations;

- Smear surveys for removable contamination at designated systematic, random , and judgmental locations;
- Dose rate surveys within the confines of each survey area; and
- Analysis of debris and material samples from within mechanical system components.

2.4 Step 4: Define the Study Boundaries

2.4.1 Data Population

The population of interest should be the concentrations of ROPCs on interior building surfaces and in building systems in the impacted buildings. This population will be further subdivided by floors into survey areas during future scoping surveys.

2.4.2 Spatial and Temporal Boundaries

Spatial boundaries for this investigation are horizontally and vertically limited to interior building surfaces of impacted rooms and mechanical system components suspected to be impacted. Appendix B of the HSA (CABRERA, 2006) contains maps of each building with areas designated for evaluation that are suspected to be impacted.

Data collection and analyses should be performed in a time frame to support the future decommissioning and BRAC milestones at WRAMC.

2.4.3 Constraints on Data Collection

Constraints on data collection include the continued occupancy and use of various hospital and laboratory spaces during execution of future scoping surveys. In those cases where existing operations restrict collection of additional radiological information, disposition will likely have to be delayed until these areas are abandoned.

Constraints on data collection may also exist in inaccessible areas, such as pipe runs between drains and cleanout traps. In these instances, decisions may be made based on data collected from the areas where radioactive material may have entered the system, such as drains and hood exhaust vents.

2.5 Step 5: State the Decision Rules

2.5.1 Surface Scan Surveys

If areas of elevated radioactivity are identified during alpha and beta surface scan surveys above chosen DCGL levels or assigned Action Levels, identified areas should be marked for additional follow-up characterization activities or decontamination, as appropriate. Additional surveys should include static and smear samples for removable activity. The source and radionuclide mix at that location should also be determined, if feasible.

Scan surveys for gamma ROPCs with a sodium iodide (NaI) detector, or equivalent, should also be considered for supplemental characterization information.

2.5.2 Exposure Rate Measurements

Exposure rate surveys will be evaluated directly against nominal background levels in non-impacted areas of WRAMC.

2.5.3 Systems Surveys

Surveys of building systems should also be evaluated to determine if they have been impacted by historical use of RAM at the Site. Evaluation of volumetric samples should initially be compared directly to instrument background levels to determine if any residual contamination requires characterization. Positively identified system samples may be evaluated against soil screening levels in NUREG-1757 Appendix B (NRC, 2003) as a means for determining whether a more rigorous dose assessment may be required.

2.6 Step 6: Define Acceptable Decision Errors

Constraints on decision error are not needed, because a statistical sampling plan is not required at the scoping survey phase of the project. The numbers of samples selected would likely be acceptable for a final status survey; however, no statistical evaluation is performed at this phase. Areas surveyed will be deemed impacted or non-impacted based on historical information, scoping survey results, and professional judgment.

2.7 Step 7: Optimize the Design

The variability of data will have an effect on the sampling design. If necessary, the sample frequency and the analytical procedures will undergo changes to optimize the design. Changes will occur concurrently for several steps with the DQO process. The design options, such as sample collection design, sample size, and analytical procedures will be evaluated based on cost and the ability to meet the DQOs.

3.0 SCOPING SURVEY CRITERIA

3.1 Criteria for License Termination

Unrestricted use criteria and methodology considerations will be developed as part of the DQO process during subsequent phases of this investigation. The following technical documents are used by both private contractors and governmental agencies as bases for decommissioning and license termination in order to release buildings that have radiological contamination:

- "Radiological Criteria for License Termination", 10 CFR 20, Subpart E (NRC, 1997)
- NUREG-1757, "Consolidated NMSS Decommissioning Guidance – Decommissioning Process for Materials Licensees." (NRC, 2003)
- NUREG-5512, "Residual Radioactive Contamination from Decommissioning." Volumes 1-3. (NRC, 1999).
- U.S. Army Regulation, AR-11-9, "The Army Radiation Safety Program" (USDOA, 1999)
- MARSSIM (USEPA, 2000)

3.2 Residual Radioactivity Limits

NUREG-1757 provides predetermined 'screening levels' for interior building surfaces [in units of disintegrations per minute (dpm) per 100 cm^2] and surface soils [in units of picoCuries per gram (pCi/g)] as a means for evaluating site contamination levels relative to the NRC's 25 millirem per year (mrem/yr) criterion without development of a site-specific dose assessment. Each screening value provided in NUREG/1757 corresponds to the concentration for each ROPC that would result in 25 mrem/yr. If residual activity does not exceed these values, then the NRC considers that the area does not need further radiological remediation. Building Surface Screening Levels for the Site ROPCs are also provided in Table 3-1. However, if multiple nuclides are present, the 'unity rule' must be used, i.e., a sum of the ratios (SOR) technique to account for the fractions of the dose resulting from each ROPC.

If residual radioactivity is found in an isolated area of elevated activity, in addition to residual radioactivity distributed relatively uniformly across the survey unit, the unity rule, also called the Sum of the Ratios (SOR), will be used to ensure that the total dose is within the release criterion decommissioning guidance (NRC, 2000). When multiple contaminants are present on a site, site radiological conditions are evaluated using the SOR and a $DCGL_w$ of SOR=1.0. The SOR is calculated as follows:

$$SOR = \frac{(C_1)}{(DCGL_1)} + \frac{(C_2)}{(DCGL_2)} + \frac{(C_3)}{(DCGL_3)} + \ldots$$

Where: $C_{1,2,3..}$ = Concentration of Radionuclides

$DCGL_{1,2,3..}$ = DCGL for that Radionuclide

The pCi/g soil criteria will only be applied to volumetric samples collected from building systems during the scoping survey. Examples of these types of samples may be debris from ventilation filters or ductwork or sediment/sludge from floor drains or piping.

A list of potential starting DCGL values for WRAMC building and systems investigations are provided in Table 3-1.

TABLE 3-1: DECOMMISSIONING REGULATORY CRITERIA - WRAMC

Release for Unrestricted Use								
USNRC 10 CFR 20.1402	Total dose to the public after decommissioning of not more than 25 millirem per year							
Acceptable License Termination Screening Values for Building Surface Contamination								
Agency / Reference	**Alpha[1]**				**Beta/Gamma[1]**			
	Total (dpm/100cm^2)		**Removable[2] (dpm/100cm^2)**		**Total (dpm/100cm^2)**		**Removable[2] (dpm/100cm^2)**	
USNRC NUREG 1757, Vol. 1, Table B-1 Building Surface Screening Values, NUREG/CR-5512	H-3: Ca-45: C-14: S-35: Ra-226: U-238:	N/A N/A N/A N/A 1.1E+03 1.0E+02	H-3: Ca-45: C-14: S-35: Ra-226: U-238:	N/A N/A N/A N/A 1.1E+02 1.0E+01	H-3: Ca-45: C-14: S-35: Ra-226: U-238:	1.2 E+08 2.8E+06 3.7 E+06 1.3 E+07 N/A N/A	H-3: Ca-45: C-14: S-35: Ra-226: U-238:	1.2 E+07 2.8E+05 3.7 E+05 1.3 E+06 N/A N/A

Interim Screening Values for Soil Surface (USNRC NUREG 1757, Vol. 1, Table B-2)[3]	
Nuclide	**Concentration (pCi/g)**
H-3	1.1E+02
Ca-45	5.7E+01
C-14	1.2E+01
S-35	2.7E+02
Ra-226	0.7E-01
U-238	1.4E+01

NOTES:
1. Building surface screening values were assigned to the primary decay mode, e.g., alpha,/beta, that will be used for detection during scoping surveys.
2. Removable limits have been set to 10% of the total surface screening level.
3. Interim soil screening values are listed here since they will be used to evaluate bulk system samples, vis a vis, drain sediment and /or other debris.

4.0 PHASE II ECP RECOMMENDATIONS

4.1 Survey Area Breakdown

The HSA provided preliminary determinations of which WRAMC buildings are likely to be impacted due to prior use of RAM. Buildings screened as impacted in the HSA, along with their preliminarily MARSSIM SU classifications, are listed in Table 4-1.

TABLE 4-1: PRELIMINARY CLASSIFICATION OF IMPACTED BUILDINGS AT WRAMC

Building Number	Department(s) / RAM Use(s)	Current Tenant and Conditions	Preliminary MARSSIM Classification
1	Original Hospital Building – Nuclear Medicine, Oncology, Others	WRAMC Administration and post support	3
2	Current Hospital Building - Nuclear Medicine, Radiation Oncology, DCI Research Labs	Hospital Building	2 / 3
7	DCI - Research Labs	Building extensively renovated over its history. DCI still active in one lab.	3
41	HPO – Rad Waste Storage and Calibration sources	HPO - Storage	2
54	AFIP - Research Labs	AFIP Labs. However, several floors extensively renovated. RAM usage continues in several labs. No evidence found during HSA record searches.	2 / 3
91	U.S. Army Institute of Dental Research – Research Labs	Directorate of Information Management / Industrial Hygiene. No closeout surveys available.	3
92	Nuclear Medicine Clinic connected to east wing of original hospital	Photo Lab. Renovated in 1984. No closeout surveys available.	2

4.2 Building Specific Recommendations

Building 1 Classification of Building 1 as impacted is the result of a shared corridor with the nuclear medicine clinic and pharmacy in Building 92. No specific information was found regarding Building 1, so the adjoining corridor with Building 92 on the basement level was assigned as Impacted. It is recommended that scan surveys be performed on the original flooring and wall surfaces (if attainable), with focus on the passageway with Building 92.

Building 2 Much of the RAM use in Building 2 is associated with the active Nuclear Medicine Clinic. However, Building 2 also has active and inactive Clinical Investigation laboratories and waste storage rooms that may have longer-lived isotopes present. All present and retired labs should be surveyed as MARSSIM Class 3 with a focus on original surfaces, if possible. It is also recommended that the mechanical systems (sinks, drains, hoods) in all research laboratory areas be investigated for residual contamination. The radioactive waste rooms (7544, 7545) should be classified as MARSSIM Class 2 and thoroughly surveyed.

Building 7 Most of the radioisotope use in Building 7 has been abandoned, with Room G026 the only remaining active laboratory. All other former labs (2nd floor) have undergone extensive renovation. All present and retired labs should be surveyed as MARSSIM Class 3 with a focus on original surfaces, if possible. It is also recommended that the mechanical systems (sinks, drains, hoods) in all research laboratory areas be investigated for residual contamination.

Building 41 Rooms 39 and 42 are the only impacted areas of Building 41 as per the HSA. The condition of these rooms should allow MARSSIM Class 2 surveys to be performed as-is. Particular focus should be placed on storage locations and mechanical systems since these rooms were used for sample preparation and radioactive waste storage.

Building 54 Building 54 has had the widest array of RAM use for the remaining WRAMC buildings. The 4th and 5th floors have undergone renovation while the 3rd and 2nd floors are scheduled for renovation. All present and retired laboratory spaces on floors 2 through 5 should be surveyed as MARSSIM Class 3 with a focus on original surfaces, if possible. It is also recommended that the mechanical systems (sinks, drains, hoods) in all research laboratory areas be investigated for residual contamination. Rooms on the Basement level may have been used as an indoor firing range with 50-caliber depleted uranium rounds fired. No evidence of this was found during the records search, so additional surveys in these areas would be warranted to address this claim. Rooms with electron microscopes should be surveyed for alpha contamination due to the potential for uranyl acetate, a slide contrasting agent that contains uranium. It is recommended that the scan portions of the basement and uranyl acetate based surveys be performed as Class 2, with increased coverage requirements to help identify potentially impacted areas. Floor drains and utility sinks in custodial areas should also be investigated as potential disposal pathways with biased sampling and scans.

Building 91 The only known use of RAM in Building 91 is the former Room 2. This room has undergone significant renovation since the room was retired by the Army Institute of Dental Research. A MARSSIM Class 3 survey should be performed on as many of the original surfaces as possible. It is also recommended that the mechanical systems (sinks, drains, hoods) in all research laboratory areas be investigated for residual contamination.

Building 92 Building 92 is the former location of the WRAMC Nuclear Medicine Clinic. No background information was found during preparation of the HSA beyond drawings labeling the clinic and treatment rooms. All rooms and passageways should be surveyed as MARSSIM Class 2, with all superficial flooring and wall materials removed and screened prior to survey. It should be assumed that there is a potential to find Ra-226 or other long-lived radioisotopes in Building 92. For this reason, alpha surveys should also be performed in all areas. It is also recommended that the mechanical systems (sinks, drains, hoods) in all research laboratory areas be investigated for residual contamination.

4.3 Rationale for Scoping Surveys

The recommendations provided herein center around the fact that the Site may be occupied during survey execution. As such, surveys should concentrate on areas, facilities, equipment, and systems that represent the highest probability of displaying residual contamination. Examples of these 'biased' areas include lab sinks and accompanying piping, lab countertops, hood surfaces and ventilation equipment, and RAM storage / waste areas. The remainder of scoping survey efforts should focus on randomly sampling the surfaces on each floor of each presumed impacted building to test assumptions outlined in the DQOs.

Several buildings were screened as impacted in the HSA due to the lack of closeout survey information. Many of these buildings have undergone substantial renovation and internal remodeling after the WRAMC HPO performed their surveys. It is understood that the probability of finding residual contamination in these areas is small. However, scoping surveys of the original building surfaces and systems should still be performed at some level to provide assurance that these buildings are suitable for unrestricted release. These operations may include the following:

- Removal of surficial flooring materials, e.g, vinyl tiles, carpeting, etc.
- Removal of cosmetic wall materials such as drywall so surveys can be performed on surfaces that were consistent when area had RAM use.
- Tracing building mechanical lines to get an understanding of where former floor drains or sinks may have been so that appropriate piping can be sampled for RAM.

Preliminary design recommendations for all scoping surveys in impacted WRAMC areas are summarized in Table 4-2.

TABLE 4-2: SCOPING SURVEY RECOMMENDATIONS FOR IMPACTED WRAMC BUILDINGS

			Direct Measurements and Sample Collection Minimum Number and Type (see Table Notes for descriptions and assumptions)				Measurement Type and Analysis (see Table Notes for descriptions and assumptions)		
Survey Area Type	**Survey Area Information & Comments**	**Preliminary MARSSIM SU Classification**	**Surface Scan Survey**	**Removable Contamination (Note D)**	**Dose Rates**	**Surface and System Samples**	**Surface Scan Survey**	**Removable Contamination (Note D)**	**System Sample**
Low Priority	Used for floors (or individual rooms) with either (a) historical use of radioactive materials with no documented release surveys or (b) Areas documented as only using short-lived nuclides.	3	C	At least 10 per area, randomly chosen	E	G	H	I, J	J
Moderate Priority	Used for floors (or individual rooms) with known use or storage of RAM where residual contamination may exist.	2	B	One smear per 50 m^2 or a minimum of 10 per area on a systematic grid, whichever is greater	E	F	H	I, J	J
High Priority	Used for floors (or individual rooms) with known radioactive material use or spills where residual contamination may exceed a DCGL.	1	A	One smear per 10 m^2., or a minimum of 10 per area on a systematic grid, whichever is greater	E	F	H	I, J	J

* MARSSIM defined survey unit designations are not necessary at the scoping survey stage. Preliminary classifications may change based on the scoping survey results.

TABLE NOTES

General Note: The extent of the survey will be determined by accessibility and current operations in the individual laboratories.

A High Priority Areas: Perform 100% scan survey on accessible floors and bench tops, and at least 25% scan of lower wall surfaces (up to 6'). Scans on upper wall surfaces (> 6') and accessible ceiling areas are performed at the judgment of the survey team.

B Moderate Priority Areas: Perform 50% scan survey on accessible floors and bench tops, and at least 10% scan of lower wall surfaces (up to 6'). Scans on upper wall surfaces (> 6') and accessible ceiling areas are performed at the judgment of the survey supervisor.

C Low Priority Areas: Perform 10% scan survey on floors, bench tops, and lower wall surfaces (up to 6').

D Smears should be taken at the minimum number of locations listed in the table. The locations will be determined during generation of Scoping Survey Work Plan and on the judgment of the survey supervisor, and will generally be taken at the locations of the fixed static-count measurements. An additional biased smear will be performed at the location of the highest scan survey result.

E Perform general area dose rate measurement within all rooms or areas. General guideline: walkthrough all areas with high sensitivity gamma detector, use professional judgment to check in the most likely locations for contamination, and record at least one reading per survey area, and record any readings significantly above background.

F Collect representative sample(s) of all systems in each Impacted Area (e.g. accessible ventilation ducting, hoods, and drains) if in an area where radioactive material was used. Scrapings and material samples should be taken of representative residues or debris where visible (e.g., hoods, pipe chase). Samples may be composited if individual sample quantities are small.

G Collect representative samples from systems that are suspect based on professional judgment in each Low Priority Survey Area (e.g. accessible ventilation ducting, hoods, and drains), even though radioactivity is not expected in these areas. One composite scraping of each type of material may be taken of representative materials or debris.

H Gross alpha-beta measurement performed.

I Smear samples, scrapings, and systems samples should be counted for gross beta and H-3/C-14 contamination via liquid scintillation counting. In addition, any samples with gross alpha-beta results above release limits of Table 3-1 should also be screened for gamma contamination.

J Bulk system matrix samples should be analyzed using liquid scintillation and gamma spectroscopy counting. Any questionable results should be evaluated on a per-sample basis to gauge whether additional analyses are warranted.

5.0 REFERENCES

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APPENDIX A

IMPACTED BUILDING FACT SHEETS

WALTER REED ARMY MEDICAL CENTER