FINAL

HISTORICAL SITE ASSESSMENT
and
Addendum to Environmental Condition of Property

WALTER REED ARMY MEDICAL CENTER
WASHINGTON, D.C.

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ACRONYMS AND ABBREVIATIONS

AEC	U.S. Atomic Energy Commission
AFIP	Armed Forces Institute of Pathology
AFSC	U.S. Army Field Support Command
AR	Army Regulation
ARA	Army Radiation Authorization
BRAC	Base Realignment and Closure
CABRERA	Cabrera Services, Inc.
CENAB	U.S. Army Corps of Engineers, Baltimore District
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
cm^2	square centimeter
CSM	Conceptual Site Model
d	day
DC	Washington, D.C.
DCI	Department of Clinical Investigation
DLA	Defense Logistics Agency
DOA	Department of the Army
DOD	Department of Defense
DOIM	Directorate of Information Management
dpm	disintegrations per minute
DPW	Directorate of Public Works and Transportation
DQOs	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
F	degrees Fahrenheit
FOIA	Freedom of Information Act
FSS	Final Status Survey
hr	hour
HPO	Health Physics Office
HSA	Historical Site Assessment
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mCi	milliCurie
µCi	microCurie
MD	Maryland
mph	miles per hour
mR	milliRoentgen
NRC	U.S. Nuclear Regulatory Commission
NUREG	U.S. Nuclear Regulatory Commission Regulation
NW	northwest
PI	principal investigator
RAM	radioactive material
RCC	Radiation Control Committee
RCOPC	radiological contaminant of potential concern
ROPC	radionuclide of potential concern
RSC	Radiation Safety Committee
RSO	Radiation Safety Officer
S	south
SE	southeast
SOP	Standard Operating Procedure
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine

USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
USAIDR	U.S. Army Institute of Dental Research
WRAIR	Walter Reed Army Institute of Research
WRAMC	Walter Reed Army Medical Center
y	year

1.0 EXECUTIVE SUMMARY

The following is a radiological historical site assessment (HSA) prepared by CABRERA Services, Inc. for the Walter Reed Army Medical Center (WRAMC). The Site is located at 6900 Georgia Avenue NW in Washington, D.C. WRAMC has been operational for 97 years.

WRAMC has been identified as one of the military installations in Base Realignment and Closure (BRAC) 2005 (Public Law 101-510 as amended). 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. An Environmental Condition of Property (ECP) assessment is being conducted concurrently for this installation by Shaw Environmental; this HSA will be appended to the Phase I ECP prepared for this installation.

This HSA is being 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 is 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 (Table 4-1; EPA, 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 all buildings and areas where RAM was 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 microCurie (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. These building locations are highlighted in Figure 6-1. Within the seven buildings identified, 102 rooms or laboratories have been classified as "Impacted." These specific rooms are identified in Appendix B. No radiologically impacted outdoor areas or release points were identified for the Main Post.

TABLE 1-1: LIST OF WRAMC MAIN POST BUILDINGS CONSIDERED IMPACTED

Building Number	Original Structure Name	Department(s) / RAM Use(s)	Current Tenant and Conditions
1	Walter Reed General Hospital	Original Hospital Building – Nuclear Medicine, Oncology, Others	WRAMC Administration and post support
2	Heaton Pavilion	Current Hospital Building - Nuclear Medicine, Radiation Oncology, Department of Clinical Investigation (DCI) Research Labs	Same
7	Barracks	DCI - Research Labs	Building extensively renovated over its history. DCI still active in one lab.
41	Red Cross Building	Health Physics Office (HPO) – Rad Waste Storage and Calibration sources	Same
54	Armed Forces Institute of Pathology (AFIP)	AFIP - Research Labs	Same. However, several floors extensively renovated. RAM usage continues in several labs.
91	Former Regional Dental Lab	U.S. Army Institute of Dental Research – Research Labs	Directorate of Information Management / Industrial Hygiene
92	Nuclear Medicine Clinic	Nuclear Medicine Clinic connected to east wing of original hospital	Photo Lab. Renovated in 1984.

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.

Nuclides expected to be 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).

Data quality objectives and recommendations for specific radiological scoping activities to support unrestricted release of these Impacted areas will be developed and submitted in as separate document.

2.0 INTRODUCTION AND OBJECTIVES

Cabrera Services, Inc. (CABRERA) has prepared the following Historical Site Assessment (HSA) for the Main Base of the (former) Walter Reed Army Medical Center (WRAMC) located at 6900 Georgia Avenue, Washington, D.C. 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 (Ref. 002) between the USACE Baltimore District (CENAB) and CABRERA. CENAB is providing contracting and technical support to U.S. Army Environmental Center (USAEC) for conducting evaluations of environmental conditions at this installation. A Final HSA Work Plan, dated June 2006, was prepared by CABRERA and is included as Appendix A to this report (Ref. 041). 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) was the primary guidance document for conducting this HSA (Ref 043).

2.1 Program Objectives

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. Shaw Environmental, Inc. has been tasked by U.S. Army Environmental Center (USAEC), under contract to CENAB, to complete the Phase I ECP for WRAMC. This HSA is being 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, this HSA will be appended to the Phase I ECP prepared for this installation.

2.2 Specific Objectives of this HSA

This HSA is being conducted as part of an overall effort to ensure that WRAMC can be turned over for redevelopment or reuse as part of the BRAC process. Specifically, this HSA is the first step in the process of releasing all facilities and areas at WRAMC Main Post for unrestricted use. Such release will be sought from NRC as appropriate for all radioactive materials (RAM) license(s). In accordance with the MARSSIM (USEPA, 2000), this HSA should accomplish the following:

- Identify current potential sources of radiological and hazardous contamination
- Determine which parts of the facility are impacted (and non-impacted) by previous operations
- Classify areas as Impacted or Non-Impacted as defined in MARSSIM
- Identify any data gaps in Impacted Areas

- Provide input into decisions to perform radiological scoping and characterization surveys

Recommendations for specific radiological scoping or characterization survey design to address all areas characterized as Impacted will be provided in a separate document for evaluation by the Army stakeholders.

2.3 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that clarify the study objective, define the most appropriate type of data to collect, determine the most appropriate conditions for collecting data, and specify limits on decision errors (Ref. 042). DQOs define the performance criteria that limit the probabilities of making decision errors by considering the purpose of collecting the data, defining the appropriate type of data needed, and specifying tolerable probabilities of making decision errors. Project-specific DQOs are developed using the seven-step DQO Process. The DQOs for this HSA are:

Step 1 - State the Problem

Does sufficient information exist to define the nature and extent of radioactive materials at the WRAMC Site and support the decision that areas have or have not been impacted by radiological activities at the Site? The decision makers for this HSA are Department of the Army, specifically USAEC, CENAB, and the Installation. Other stakeholders include the NRC and local communities in Washington, DC and Maryland.

Step 2 - Identify the Decision

The principal study question is: Have areas on the WRAMC Site been impacted by radiological activities on the Site? Potential actions include: additional investigation of radiologically impacted areas (i.e., additional review of existing data, collection of additional environmental data, or additional remediation) or release of non-impacted areas from radiological controls. Impacted areas have a possibility of containing residual radioactivity in excess of natural background (MARSSIM 2000, GL-11). Non-impacted areas have no reasonable possibility of residual radioactivity. All areas are either impacted or non-impacted.

Step 3 - Identify Inputs to the Decision

Inputs to the decision are archival documents provided by the WRAMC Health Physics office. Pertinent information includes radioactive material use authorizations and inventories for various WRAMC facilities permitted to receive, store, and use radiological materials. Additional pertinent document and information locations include the WRAMC Directorate of Public Works and Transportation (DPW).

Step 4 - Define the Boundaries of the Study

Temporal boundaries for the study are defined by the period of use of radiological materials at the WRAMC. Spatial boundaries are defined by the locations of historical radiological materials storage and use.

Step 5 - Develop a Decision Rule

If there is reasonable probability or conclusive evidence that an area was impacted (i.e., contaminated) by site activities (i.e., storage, use, disposal) at the WRAMC Site, then the area will be considered radiologically impacted and additional investigations will be performed in that area. All other areas will be considered non-impacted (i.e., non-disturbed); however, additional investigations may be performed in these areas.

Step 6 - Specify Tolerable Limits on Decision Errors

Decision errors occur when an incorrect action based on the decision rules is recommended. Decision errors occur primarily as a result of uncertainty in the data. Most HSA data collected are qualitative or require professional judgment to be interpreted meaningfully, which makes it difficult to assign a quantitative value for decision error rates. All available information, including historical decision errors used to define impacted and non-impacted areas of the Site, have been considered to limit decision errors in the HSA.

Step 7 - Optimize the Design for Collecting Data

The Health Physics Office (HPO) at WRAMC provided access to their archival records maintained in accordance with their NRC licenses and facility requirements. These records, as well as additional documents provided by DPW were reviewed and evaluated to decide if radiological activities have or have not impacted any Site areas. Information on impacted areas was also evaluated for completeness to identify data gaps and support development of additional investigations.

2.4 Report Organization

The WRAMC HSA is organized as follows:

- Section 3.0 of the HSA provides a description of the Site's location and environmental setting, including geology, hydrogeology, surface water, meteorology, seismicity, and cultural resources.

- Section 4.0 summarizes the HSA methodology, including document review, personnel interviews, historical and current photo documentation, and site walkdowns.

- Section 5.0 summarizes the WRAMC Site history from its initial construction to the present day condition, and includes a description of activities in specific Site areas that could have affected its radiological status.

- Section 6.0 discusses the findings of this HSA, discussing impacted or potentially impacted areas, non-impacted areas, and regulatory issues. Appendix B contains a "fact Sheet" summary of findings, including photodocumentation of conditions at the time of investigation, building plans, if available, and other information pertinent to each of the buildings identified as "Impacted."

- Section 7.0 provides a summary of conclusions reached during the HSA.
- Section 8.0 presents the list of references consulted while preparing the HSA.

3.0 PROPERTY IDENTIFICATION

The following is a brief physical description of the subject property location and setting.

3.1 Location

The WRAMC Main Post is located at 6900 Georgia Ave NW, Washington, D.C., approximately 5 miles directly north of the White House. The Main Post section, containing the main hospital complex, is bounded by 16th Street on the northwest and Alaska Avenue (U.S. Route 29), Georgia Avenue, and Fern and Aspen Streets. An aerial photograph showing the extents of the WRAMC Main Post is provided in Figure 3-1.

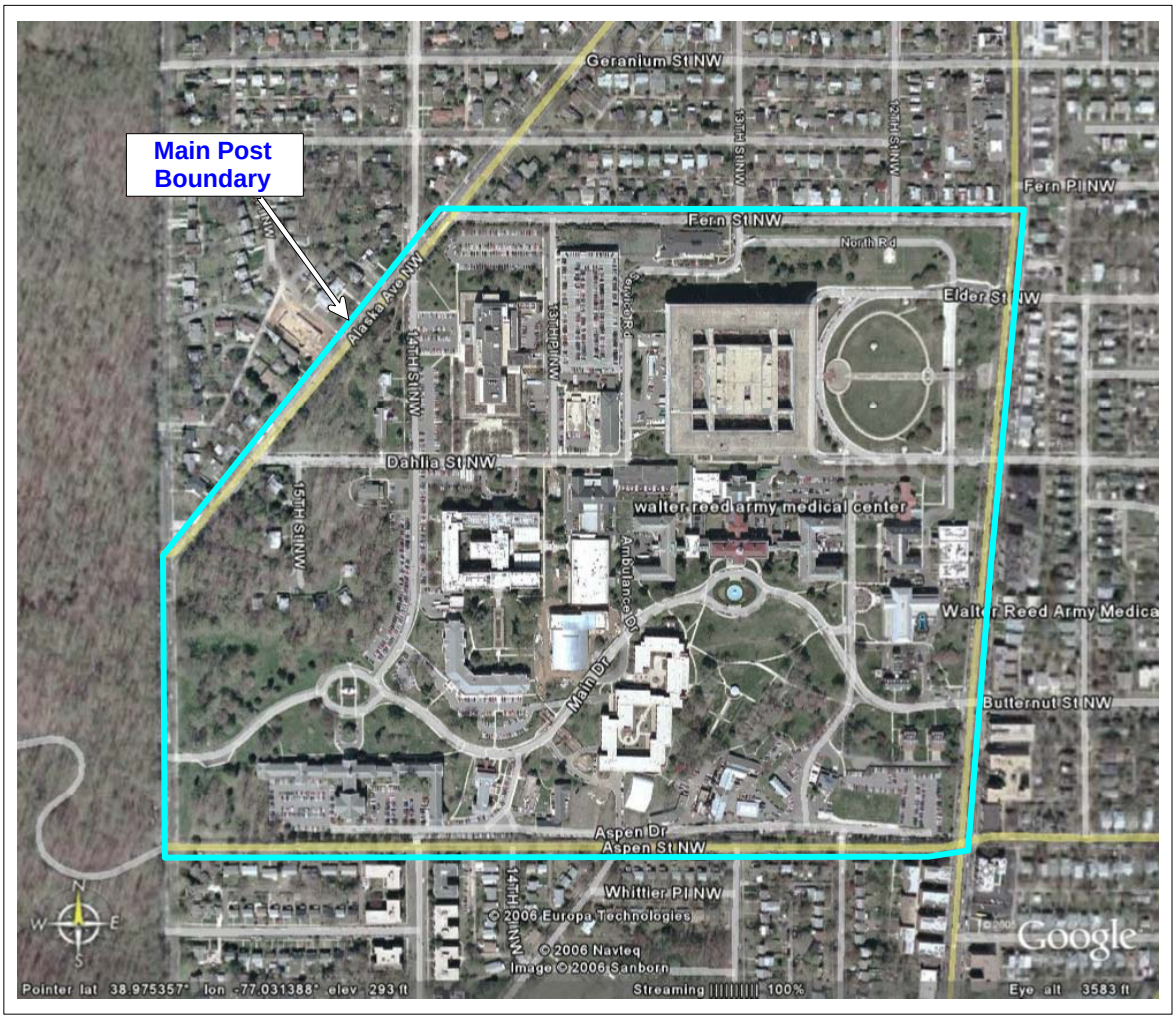


FIGURE 3-1: AERIAL VIEW OF THE WRAMC

WRAMC also controls two noncontiguous properties in Forest Glen, MD and Wheaton, MD (Glen Haven.) As these properties are slated for continued use, they are not evaluated as part of this HSA.

3.2 Environmental Setting

The following information was derived from a document entitled: Environmental Baseline Survey, Enhanced Use Lease Project, Buildings 40 & 18, July 2004.

3.2.1 Climate and Meteorology

WRAMC is geographically located on the transition zone between northern and southern climates of the U.S. Atmospheric conditions are influenced by the Blue Ridge Mountains to the west and the Chesapeake Bay to the east. The prevailing wind is from the northwest during the winter months, and from the southeast in the summer. The maximum wind speed was recorded to be 80 miles per hour (mph) from the southeast. Average wind speed is 9.1 mph. The normal daily mean temperature is 55°F for this area, with recorded extremes of -7°F in the winter and 105°F in the summer. Normal annual precipitation is 40.8 inches and average annual snowfall is 20.4 inches for this area.

For reference, average meteorological data for the Washington, D.C. area is also provided in Table 3-1.

TABLE 3-1: AVERAGE METEOROLOGICAL DATA - WASHINGTON, D.C. AREA

	January	February	March	April	May	June	July	August	September	October	November	December
High Temp (°F)	42	46	56	67	76	85	89	87	80	69	58	47
Low Temp (°F)	27	29	38	46	57	67	71	70	62	50	41	32
Precipitation (Inches)	3	3	3	3	4	3	4	4	3	3	3	3
Snow (Inches)	4	4	Trace	-	-	-	-	-	-	-	Trace	1
Wind Speed (mph)	10	11	11	11	10	9	9	9	9	9	10	10
Wind Direction	NW	NW	NW	S	S	S	S	S	S	S	S	NW

The humid continental climate for the area allows for a large variance in weather conditions and temperatures. There is a difference of 42.8 °F from the coldest month of the year, January, to the warmest month of the year, July. WRAMC receives an average of 39.54 inches of rain per year, with an average of 12 inches of snow per year. No wet and dry seasons exist since rainfall is well distributed throughout the year. The greatest rainfall for a 24-hour period was 7.31 inches, on August 11-12, 1928. The greatest snowfall ever recorded in the area was 28 inches, which occurred in January of 1922. The average annual relative humidity for the area is 63% and the average annual wind speed is 9.4 miles per hour (mph).

3.2.2 Geology

WRAMC is located at the junction of the Atlantic Coastal Plain and the Piedmont Plateau physiographic provinces. The Piedmont Plateau is comprised of granites and other crystalline rocks and is defined by greater surface relief. The Coastal Plain province consists of sands, gravels, and clays of recent deposition, which overlap the older Piedmont surface to the west.

Rivers such as the Potomac and large estuaries have drowned the submerged landscapes of the northern Coastal Plain region. Glaciofluvial outwash channels have dissected the Coastal Plain surface, creating numerous terraced regions. One such terrace, the Columbia Formation, which covers most of the area presently occupied by WRAMC, was formed as a thin veneer of stream-laid material and presently occupies the higher elevations in the area. Directly underlying the Columbia Formation are the unconsolidated deposits of the Potomac Group, which occupy the lower elevations and the exposed shoreline at WRAMC. This group of sandstone, clay and conglomerate has a thickness of 450 to 500 feet and has a slight southeasterly dip. Below the Potomac Group lies bedrock of granites and schists.

3.2.3 Hydrology

No groundwater supplies are used at the Main Post. Public groundwater supplies provide less than 3 percent of the water currently consumed in this region, and for economic reasons, it is likely to remain a minor supplement. The amount of water that can be stored underground depends on the porosity of the underlying rocks, which, in the situation at Main Post, involves hard crystalline rocks of low porosity. From available data, the water table is estimated to exist within the bedrock and near bedrock surface. The source of groundwater recharge is precipitation, and the groundwater gradient at Main Post roughly parallels local surface topography. Building foundations and drainage systems alter some of the local gradients. The depth of the seasonal high water table is from 5 to 6 feet. The average yield of area wells developed in crystalline rock is 10 to 20 gallons per minute from bedrock aquifers 40 to 140 feet below the surface.

There are no streams on the Main Post; however, Rock Creek is located a short distance to the west of WRAMC Main Post. The District of Columbia groups waters of the District into Beneficial Use Classes. Rock Creek is classified as a Class B and C stream by the District of Columbia. Class B waters are protected for secondary contact recreation and aesthetic enjoyment. Class C waters are protected for aquatic life, waterfowl, shore birds, and water-oriented wildlife.

Rock Creek is also designated as an anti-degradation segment. Under this designation, the following requirements apply: (1) new point source discharges are prohibited; (2) non-point discharges shall be controlled to the extent feasible, with best management practices and regulatory programs; (3) construction projects shall be considered on a case-by-case basis to ensure that there will be no long-term adverse water quality effects; and (4) short-term water quality effects on anti-degradation segments, resulting from construction projects, shall be subject to intergovernmental coordination and public participation requirements. The entire installation is outside the 100-year flood plain of Rock Creek.

The storm water drainage system for the Main Post consists of catch basins, curb inlets, yard drains, manholes, sand filters, and 10- to 36-inch-diameter pipelines that discharge to the District of Columbia's Luzon Avenue storm drainage tunnel. The tunnel, which enters the Main Post at Georgia Avenue and Dahlia Street, runs southwest under the Rose Garden and discharges into Rock Creek Park across 16th Street. Based on evaluation conducted as part of the accompanying Environmental Condition of Property assessment by Shaw, the system is in fair condition, is adequate for drainage of the Main Post at this time, and meets state and local quantity and quality requirements. (Shaw, 2006)

3.2.4 Seismicity

The history of this area shows a low probability of an earthquake of sufficient magnitude to cause damage to structures. Only one earthquake of moderate intensity has ever been reported in the area. This incident occurred on August 31, 1861, with the epicenter located at 38.8 degrees north latitude and 77 degrees west longitude, which is approximately 12 miles south of WRAMC. The intensity of this shock was listed as a 5 on the Rossi-Forel scale ("shock of moderate intensity…felt generally by everyone; disturbance of furniture, beds, etc., ringing of some bells"). The U.S. Geological Survey (USGS) reports that no seismic shocks have originated in the WRAMC area since the above-mentioned earthquake.

4.0 HISTORICAL SITE ASSESSMENT METHODOLOGY

This section summarizes the methodology and decision criteria for the WRAMC HSA as detailed in the HSA Work Plan (Appendix A; Cabrera, 2006c).

4.1 Approach and Rationale

This HSA is being conducted as part of an overall effort to terminate the WRAMC NRC radioactive material licenses and safely release the facility and grounds for future use. The purpose of the radiological HSA is to collect and organize information describing radiological activities at WRAMC from the onset of the first radioactive material license until cessation of operations. This HSA reviews historical information to determine if there is sufficient data to declare buildings as "Impacted" or "Not Impacted" in accordance with MARSSIM methodology (Table 4-1; EPA, 2000). The HSA also evaluates migration of contamination in the environment and makes recommendations for future surveys. To achieve this goal, a systematic approach was developed for screening the WRAMC facilities. Each building was screened using the questions found in the decision trees in Figure 4-1. There are no areas outside of buildings where radiological contamination is suspected.

TABLE 4-1: HSA RADIOLOGICAL RISK CATEGORIES

Category	Description
Impacted (Additional Surveys Needed)	There is a reasonable probability that the building or area was impacted by WRAMC radiological activities
Non-Impacted	There is a very low probability that building/area was impacted radiologically during WRAMC operations. This was determined either through: a) No documented use of RAM; or b) Records indicate that area was used for radiological operations or storage, but survey records exist documenting decontamination and/or free release.

In order to answer the questions in the referenced decision trees, the following information sources were investigated or used:

- WRAMC operating history records, including radioactive materials licenses, permits, and use authorizations and protocols;
- Minutes of the WRAMC Radiation Control Committee for references to any spills, releases of radioactive material to the environment surrounding the WRAMC during facility operations, or onsite disposals of radioactive or hazardous materials;
- Surveys performed by WRAMC HPO for radioactive and hazardous materials present in the WRAMC Main Base;

- Final status survey reports and records of disposal of radioactive waste to offsite licensed facilities for previously decommissioned facility areas (Buildings 40 and T-2);

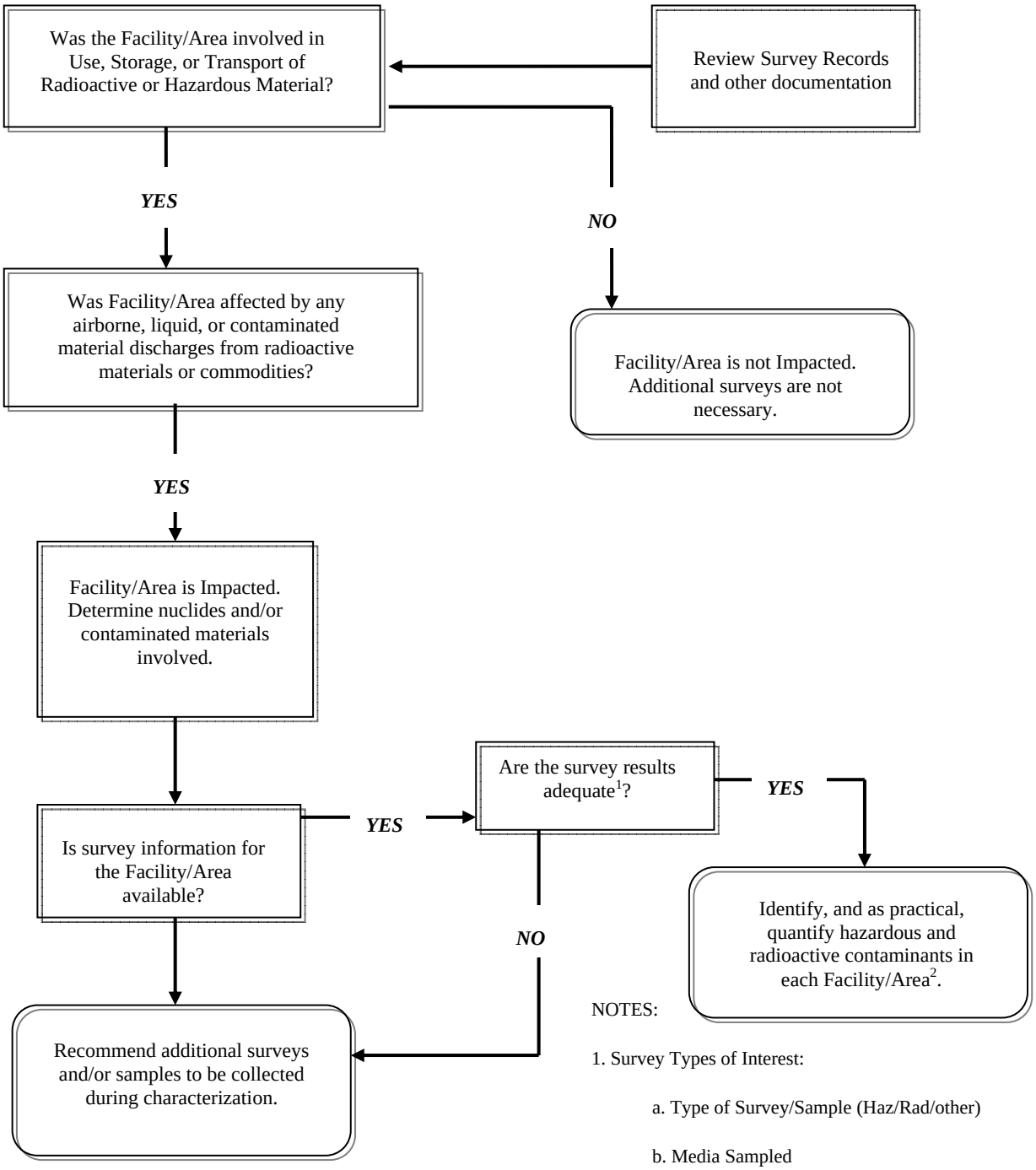
- Physical tours of the WRAMC facilities expected to be impacted due to both current and former RAM usage;

- Off-installation document repositories including U.S. Nuclear Regulatory Commission (NRC), U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), and U.S. Army Field Support Command (AFSC).

- Interviews with:

  - Staff responsible for ongoing WRAMC site control and surveys

  - Previous WRAMC personnel, including operators and training personnel, and personnel who performed previous radiological surveys, if available



NOTES:

1. Survey Types of Interest:

   a. Type of Survey/Sample (Haz/Rad/other)

   b. Media Sampled

   c. Depth and extent/number

   d. Post-Survey Contamination Potential

2. If a Facility/Area has been demolished or removed, consider a survey of the site of the former building, as appropriate.

FIGURE 4-1: FLOWCHART OF HSA RADIOLOGICAL DECISION METHODOLOGY

4.2 Documents Reviewed

4.2.1 Government Supplied Information

The majority of the records available were stored at the Health Physics Office (HPO) in Building 41, administered by Colonel Mark Melanson, WRAMC Radiation Safety Officer (RSO), and assisted by Mr. David Burton, WRAMC Licensing Branch Chief and Assistant RSO. The HPO is responsible for administration and maintenance of WRAMC's NRC Broad Scope RAM license as well as issuing base-level RAM use authorizations for biomedical treatment and research activities performed at WRAMC. The HPO contains more than 60 file drawers with records documenting radiological matters dating back to the 1970s.

The types of documents supplied by the HPO include:

NRC License(s) – A copy of the current NRC Broad Scope RAM License, detailing which radioactive isotopes may be possessed at WRAMC and in what quantities, was provided. The NRC License also contains a chronological account of all license amendments made by WRAMC since its inception.

Authorizations – A RAM authorization is essentially a permit granted to a principal investigator (PI) from the WRAMC Radioisotope Control Committee (RCC). The authorization contains all relevant information regarding use of RAM in the PI's laboratories. The authorization details what isotopes may be used and in what quantities, buildings and rooms authorized, as well as secondary investigators who may use RAM. Authorizations are active for a three year period and may be transferred, combined, or terminated.

Protocols – Protocols are accompanying documents to Authorizations. Protocols detail the specific experiments for which a PI requires RAM. Protocols are useful as they detail how much of which isotopes were used in each room.

Inventory Records – Each Authorization also has accompanying inventory records, which details all RAM inventories on a given Authorization. The inventory records include all RAM purchases, results of the quarterly audits performed by the HPO, and any waste turn-in records. Inventories of all sealed sources administered by the HPO and their leak-test records were also reviewed to capture any reports of leaks. Sealed source leak test reports over the previous 15+ years do not indicate sealed sources having leaked in Building T-2. Mr. Dave Burton, a nineteen-year veteran of the WRAMC HPO, also does not recall any reports of sealed source leakage. Going back as far as 1963, WRAMC standard procedures for quarterly leak tests of sealed sources required source removal if leakage was in excess of 0.005 microCuries (µCi). Sealed alpha sources less than 10 µCi and sealed beta-gamma sources less than 100 µCi did not require leak testing.

RCC Meeting Minutes – Quarterly Radiation Safety Committee (RSC) (previously known as the Radiation Control Committee) meeting minutes for the last 15 years were reviewed. RAM spills, changes to specific authorizations, and other general information may be found in these minutes.

Routine Survey Results and Templates - In 1974, the WRAMC standard operating procedure (SOP) for weekly and monthly contamination surveys, conducted by the Health Physics Office,

specified requirements for decontamination for any area found to exceed 100 disintegrations per minute per 100 square centimeters (dpm / 100cm^2). By 1996, the SOP had been modified such that unrestricted areas required decontamination below 200 dpm/100 cm^2 and restricted areas required decontamination below 1000 dpm/100 cm^2.

The routine survey packages used by the HPO are a quick reference to which radiological contaminants of potential concern (RCOPCs) are used in that room under which Authorization.

4.2.2 Internet Review

Internet searches were conducted to determine if there was any pertinent information not available through other sources. General information was available describing the WRAMC history and facilities, but no additional information pertinent to this HSA was discovered.

4.2.3 NRC Document Repositories

No records pertaining to WRAMC licenses or inspection reports were directly obtained from the NRC during the preparation of this HSA. The NRC required submission of a Freedom of Information Act (FOIA) request to the agency in order to request any WRAMC-specific NRC documents. Due to the volume of documents requested, the request is still currently in the process of being fulfilled; however, based on documentation received to-date, no pertinent new information is expected. Once records are received in-full and evaluated, this report can be revised or amended as necessary.

4.2.4 Other Document Repositories

Inquiries were also made at the following facilities concerning availability of radiological or hazardous material use and storage records at WRAMC:

- U.S. Army Field Support Command (AFSC), Rock Island, IL
- Humphreys Engineering Center, Ft. Belvoir, VA.
- Defense Logistics Agency (DLA), New Cumberland Depot, PA.

No records pertaining to RAM use or storage at WRAMC were identified from any of these sources.

4.3 Property Inspections

Review of the RAM authorizations and protocols provided by the HPO resulted in a list of WRAMC buildings that have used or are currently using radioactive materials. Each of these buildings was toured, if accessible, to gain building-specific information relevant to assigning risk categories and planning of future MARSSIM related activities. Photographs were taken in areas approved by Installation personnel and are included in Appendices B and D.

4.4 Personnel Interviews

CABRERA personnel worked closely with Mr. David Burton, the WRAMC Licensing Branch Chief, during the two site visits conducted on June 20 to 23 and July 7 to 9, 2006. Appendix C contains the completed interview form from Mr. Burton.

5.0 WRAMC HISTORY AND CURRENT USAGE

5.1 Installation History

The WRAMC has been operational for 97 years. In ten decades, the WRAMC has grown to a vast medical complex, teaching medical professionals, medical research programs, and treating hundreds of thousands of patients.

The Main Post was established by Congressional Legislation in 1905 as Walter Reed General Hospital. Construction was completed in 1909 and the first patients were admitted. The Hospital started as a small 80 bed facility and from this modest beginning has emerged the present day Walter Reed General Hospital which is world acclaimed as one of the finest military medical facilities. The tenant activities associated with WRAMC include but are not limited to the following: Armed Forces Institute of Pathology (AFIP), Armed Forces Pest Management Board, Tri-Service Medical Information Systems, U.S. Army Area Dental Laboratory, U.S. Army Information Systems Command, U.S. Army Institute of Dental Research (USAIDR), and Walter Reed Army Institute of Research (WRAIR). (USACHPPM, 1997)

5.2 Overview of Radiological Operations

The use of RAM in affected buildings 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 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.

5.2.1 Permits and Licenses

Radioactive materials use at the WRAMC Main Post is conducted under NRC Licenses, and Department of the Army Radioactive Authorizations (ARA) issued to the WRAMC. The following is a list of active and terminated licenses and permits issues to WRAMC:

- NRC License No. 08-01738-02, Expiration Date 30 April 2015 (original Atomic Energy Commission License dates to 1957). Operations are conducted at the Main Post in the District of Columbia, the Forest Glen Annex in Maryland, and at leased facilities (laboratories) in Rockville, Maryland. License 08-01738-02 allows possession and use of any byproduct radionuclide with mass number between 1 and 83 up to 400 mCi each, plus many nuclide-specific possession and use limits pertaining to nuclear medicine and bio-medical research activities. A copy of NRC License Number 08-01738-02 is provided in Appendix E.

- Terminated NRC License No. 08-01738-03, terminated on 17 August 2004 (possession and use of gamma cell irradiators transferred to NRC License No. 08-01738-02).]

- U.S. Army Radiation Authorization (ARA) No. 08-01-97, Expiration Date 30 June 2004 (under timely renewal dated 1 June 2004). [Use of radium in medical treatment and research predates the 1957 AEC License and multiple ARAs through the years.] The new ARA No. 08-01-15 was approved on 30 November 2005 and will expire 30 November 2015.

- Historically, prior to obtaining its own NRC License during the 1990s, the U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Maryland, was also listed as a facility user on the WRAMC NRC License.

- U.S. Army Reactor Office Reactor Permit No. DORF-1-97, issued to Director, Army Research Laboratory, for the Diamond Ordnance Radiation Facility, Building 516, Forest Glen Annex, WRAMC. The permit retains control of the building to ensure that the building's residual radioactivity remains fixed in place and does not become loose or airborne. The reactor facility was never fully decommissioned in 1978, when WRAMC continued to use this building under its NRC License No. 08-01738-02 for its radioactive waste operations from medical procedures and research. There are unknown materials under the 20 feet of concrete in the reactor pool area, as well as neutron activation of the concrete walls of the exposure cells and other areas in the former reactor building.

Correspondence from the NRC was provided to document that certain buildings formerly used for radioactive materials use under NRC License No. 08-01738-02, are now "released for unrestricted use." These include:

- Decommissioned Building 40, Main Post (NRC Letter dated 26 May 2004)

- Decommissioned Building T-2, Main Post (NRC Letter dated 10 March 2005)

- Decommissioned U.S. Army Medical Laboratory Building, Fort Meade, MD (NRC Letter dated 24 April 2005)

- The research reactor that was located in the basement of the Building 40 was operated under Atomic Energy Commission (AEC) license Number AEC Sub 603 and AEC SNM 472. The Building 40 Research Reactor was de-fueled in 1971 and partially decontaminated in 1972. The AEC license was terminated at this time. Complete decommissioning of the sub-basement and basement levels of Building 40 was completed in 2001.

5.2.2 Authorizations and Protocols

The WRAMC HPO has issued over 700 RAM use and possession Authorizations, as described in Section 4.2.1, since this method of tracking was instituted. From this extensive list, 30 Authorizations had direct ties to Main Post buildings where RAM use was performed. Of the 30, only 6 are currently active. Many Authorizations used at the Main Post were used in Buildings

40 and T-2, which were previously decommissioned. The list of Authorizations researched as part of this HSA is provided in Section 8.0.

5.2.3 Waste Handling Procedures

Dry active radioactive wastes are held by the waste generating laboratory or facility and delivered periodically to several specific locations controlled by the WRAMC Health Physics Office (HPO). Building 2 Rooms 7574/7545 and Building 41 Room 42 are used for this purpose. The HPO has occupied Building 41 since 1996. The WRAMC HPO collects and moves waste to a waste handling facility located at Building 516 on the Forest Glen Annex. Prior to the opening of Building 516, the waste was handled at other buildings at Forest Glen. All radioactive wastes are transported between these facilities using a dedicated vehicle. Control measures are in place to assure that contamination is not spread during movement of waste. (USACHPPM, 1997)

Liquid radioactive wastes are either delivered to the HPO designated location or disposed of via sanitary sewer. Hot sinks are identified for the use of radioactive material in various locations by the WRAMC authorization process. Documentation indicates that the use of radioactive sinks within the WRAMC facilities was extensive. Many laboratories utilized sinks identified as hot sinks and then removed the hot sinks from service. The identification and termination of hot sinks was a frequent occurrence, with the HPO office completing random surface area surveys upon termination. (USACHPPM, 1997).

6.0 FINDINGS

A review of the documentation described in Section 6, as well as interviews with personnel familiar with RAM practices and procedures at the installation suggests that there are potentially impacted areas on the WRAMC Main Post due to the use of RAM. The following sections describe the findings of this HSA, including radiological contaminants of potential concern, potentially impacted Buildings and Rooms within each, and potential regulatory issues.

All of the necessary information to complete this HSA came from documentation available at the WRAMC Main Post. Inquiries into the offsite Army document repositories in Section 4.2.4 did not provide any additional information. Inquiries to the U.S. Nuclear Regulatory Commission (NRC) resulted in the submission of a Freedom of Information Act (FOIA) request, which is still pending as of the publication date of this HSA.

6.1 Summary of Potential Radiological Contaminants

A list of radionuclides used at the WRAMC Main Post is shown in Table 6-1. These nuclides were listed in Authorizations pertaining to biomedical research, nuclear medicine, and radiation diagnostics and treatment. This list is in no way a comprehensive list of all radionuclides used at WRAMC. However, it does represent the most commonly encountered isotopes listed in the Authorizations. Generally, nuclides with half-lives greater than 6 months were retained as RCOPCs, as they have the greatest potential to be remaining post facility closure. One exception to this philosophy is calcium-45 (Ca-45), which was also retained despite its shorter half-life (162.2 days) since it is currently in use within research labs at WRAMC. It is anticipated that a 3-6 month dormancy period will occur at WRAMC between end of all active RAM usage and commencement of decommissioning activities.

The Radionuclide of Potential Concern (ROPC) list also contains sealed sources used for instrument calibrations, brachytherapy, and radiology procedures. These nuclides will not trigger Final Status Survey (FSS) on their own since all sealed source leak tests at WRAMC have shown satisfactory results.

Nuclides expected to be considered RCOPCs for future surveys are shown in bold in Table 6-1.

TABLE 6-1: PRIMARY RADIOACTIVE NUCLIDES USED AT WRAMC MAIN POST

Nuclide	Name	Half-Life	Notes Regarding Future Surveys	Future RCOPC?
C-14	**Carbon-14**	**5700 y**	**Primary RCOPC**	**Yes**
Ca-45	**Calcium-45**	**162.2 d**	**May still be present in small quantities**	**Yes**
Cr-51	Chromium-51	27.7 d	Should be completely decayed away	No
Cs-137	Cesium-137	30.1 y	Sealed Source Use Only	No
Co-60	Cobalt-60	5.2 y	Sealed Source Use Only	No
H-3	**Hydrogen-3 (tritium)**	**12.3 y**	**Primary RCOPC**	**Yes**
I-125	Iodine-125	59.4 d	Should be completely decayed away	No
I-129	**Iodine-129**	**1.57E+7 y**	**Potential radioimmunoassay kit nuclide**	**Yes**
I-131	Iodine-131	8.02 d	Should be completely decayed away	No
Ni-63	Nickel-63	100.1 y	Sealed source use only	No
P-32	Phosphorus-32	14.2 d	Should be completely decayed away	No
P-33	Phosphorus-33	25.3 d	Should be completely decayed away	No
Ra-226	**Radium-226**	**1600 y**	**Potential historical nuclear medicine usage in Bldg. 1 and Bldg. 92.**	**Yes**
S-35	Sulfur-35	87.3 d	Should be completely decayed away	No
Sc-46	Scandium-46	83.8 d	Should be completely decayed away	No
U-238	**Uranium-238**	**4.47E+9 y**	**Potential uranyl acetate use in labs containing electron microscopes. Uranyl acetate is non-licensed material so it is not noted on Authorizations or Protocol documents.**	**Yes**

6.2 Summary of Potential Contaminated Areas

Eight buildings have been identified on the WRAMC Main Post for use or storage of RAM based on reviews of HPO Authorizations, RCC Minutes, survey records, Real Property Inventory records, and historical drawings. A summary of these buildings is provided in Table 6-2. Specific findings for each building are provided in the HSA Building Fact Sheets provided in Appendix B.

TABLE 6-2: LIST OF BUILDINGS WITH RAM USE AT WRAMC MAIN POST

Building Number	Original Structure Name	Department(s) / RAM Use(s)	Current Tenant and Conditions
1	Walter Reed General Hospital	Original Hospital Building – Nuclear Medicine, Oncology, Others	WRAMC Administration and post support
2	Heaton Pavilion	Current Hospital Building - Nuclear Medicine, Radiation Oncology, DCI Research Labs	Same
7	Barracks	DCI - Research Labs	Building extensively renovated over its history. DCI still active in one lab.
38	Guardhouse	DCI – Research Labs	Building recently gutted. Slated for renovation. No access available. **NOTE: Bldg 38 has been screened as Non-Impacted due to the presence of HPO Closeout Surveys.**
41	Red Cross Building	HPO – Rad Waste Storage and Calibration sources	Same
54	Armed Forces Institute of Pathology (AFIP)	AFIP - Research Labs	Same. However, several floors extensively renovated. RAM usage continues in several labs.
91	Former Regional Dental Lab	U.S. Army Institute of Dental Research – Research Labs	Directorate of Information Management / Industrial Hygiene
92	Nuclear Medicine Clinic	Nuclear Medicine Clinic connected to east wing of original hospital	Photo Lab. Renovated in 1984.

Locations of the buildings classified as Impacted are shown on WRAMC Main Post map in Figure 6-1.

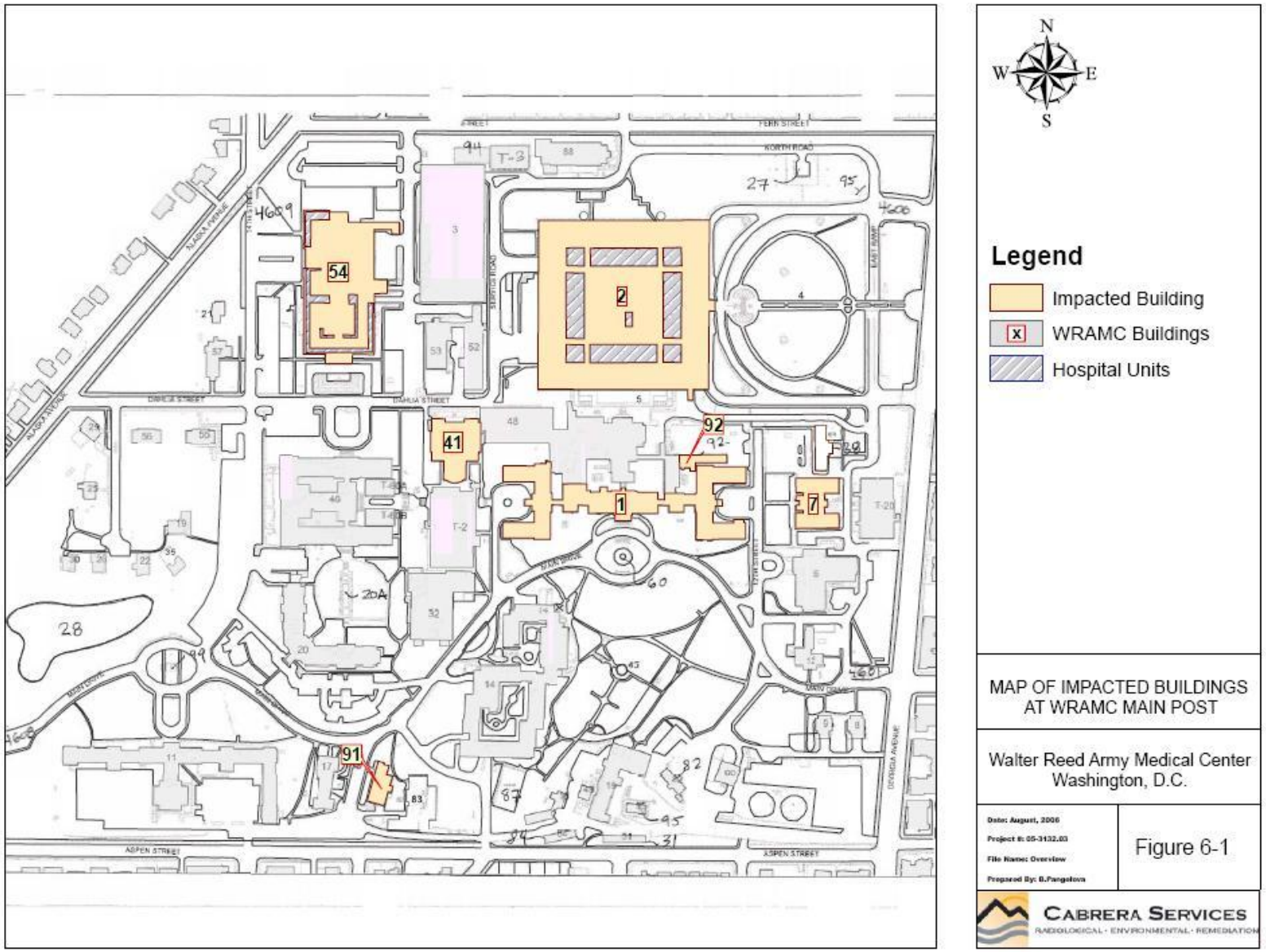


FIGURE 6-1: LOCATIONS OF IMPACTED BUILDINGS ON THE WRAMC MAIN POST

6.3 Location-Specific Findings

The permit and authorization process that implements WRAMC's broad scope RAM license allows a breakdown of individual rooms or areas within buildings that may be impacted due to RAM usage. If this level of information is available, follow-up investigations can be focused on areas where they are required (i.e. room-level) rather than requiring entire buildings be investigated. For the seven buildings identified as Impacted in Table 6-2, only Building 92 lacked sufficient information to narrow down the potentially impacted areas located within.

The rooms or areas originally identified as potentially impacted were then screened against available closeout survey information or known radionuclide use characteristics to see if any of the identified rooms could be screened out as previously released. Where documented, credit was taken for closeout surveys performed by WRAMC HPO when a lab or room was abandoned. Closeout surveys of this kind are the *status quo* at hospital and biomedical research facilities operating under a broad-scope materials license. One limitation to this approach is that document retention protocols at WRAMC only require routine survey packages to be retained for 3 to 5 years (Ref. 040). Closeout survey packages generated when an Authorization was terminated were primarily stored with the routine surveys. For this reason, many of the surveys performed in buildings prior to renovation were not available for review during this investigation. These rooms have thus been screened as potentially impacted since no permanent record of closure can be produced. Records of closeout surveys were found for rooms 1028, 1030, 2018, 3012, 5007, 5044, and 5050 in Building 54 and Rooms 221, 223, and 224 in Building 38.

Discovery of closeout surveys in Building 38 conducted prior to the major renovation led to the conclusion that it may be classified as Non-Impacted with no further surveys required (Ref 033). Each of the other seven buildings listed in Table 6-2 have been classified as Impacted with additional surveys and/or samples required to show closure.

A summary of location-specific findings is provided in Table 6-3. Appendix B provides Building Fact Sheets that provide greater detail of the radiological information, photographs, floorplans, and square footage by building and area for all locations evaluated as part of this HSA.

TABLE 6-3: SUMMARY OF LOCATION-SPECIFIC FINDINGS

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
38	Guard House – Detention Ward	Medical Outpatient Clinic (future, currently undergoing renovation)	• RCOPCs: C-14, Ca-45, Cl-36, Cr-51, H-3, I-125, I-131, K-42, Na-22, P-32, Rb-86, Tc-99 • Impacted Rooms: None Rooms 221, 223, 224 screened as non-impacted due to documented HPO closeout surveys (Ref. 033) or extensive renovation (Doc 35 - Burton Interview). No other documentation found. The interior of Building 38 could not be toured since it is in the midst of a complete renovation.	Non-Impacted
41	Red Cross Building	Instructional, Outpatient Clinic, Health Physics Offices	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

6.4 Summary of Potential Contaminated Media

The only potentially contaminated media at WRAMC are the internal surfaces of buildings. No exterior areas were found to be impacted at the WRAMC Main Post.

6.5 Criteria for License Termination

Unrestricted use criteria and methodology considerations will be developed as part of the Data Quality Objective (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 (EPA, 2000)

6.6 Radiological Conceptual Site Model

A conceptual site model (CSM) is a basic description of how radiological contaminants enter a system, how they are transported around within the system, and where routes of exposure to organisms and humans occur. As such, it is used to assess the nature and extent of contamination, to identify potential contaminant sources, release mechanisms, exposure pathways, human and/or environmental receptors, and to develop exposure scenarios.

6.6.1 Known and Potential Release Mechanisms

The following mechanisms are proposed for possible contaminant release at WRAMC:

- Leaks and/or spills: this possibility could result laboratory accidents or the transfer of contamination from unsealed radiological sources and research compounds.
- Storage/disposal activities: materials that have been disposed down laboratory sinks could then contaminate areas apart from where they were in active use. Radioactive wastes are temporarily stored in designated areas, but no onsite disposal was ever undertaken.

Primary transport mechanisms include surface contamination of building materials (work surfaces, shelves, floors, walls, ceilings, etc.) and internal contamination of building piping and drains resulting from licensed disposal of RAM into sanitary sewer.

6.6.2 Known and Potential Migration Pathways

The following potential exposure pathways are proposed:

- Inhalation, ingestion, and/or dermal contact with contaminants found on building materials and/or transfer of contamination following dermal contact to other materials;
- Ingestion and/or inhalation of leachate in surface water and sediment present in contaminated building drains and piping;

6.6.3 Known and Potential Human and Environmental Receptors

Human receptors potentially include WRAMC occupational workers who are in daily contact with radiological materials or work in and around potentially contaminated buildings. In addition, any construction workers at the site who are involved in building remediation or demolition activities would be potential receptors. Base and off-site local residents are potentially impacted via transfer of contamination obtained through contact with building materials or debris during remediation or demolition activities. No ecological receptors of consequence have been identified for WRAMC.

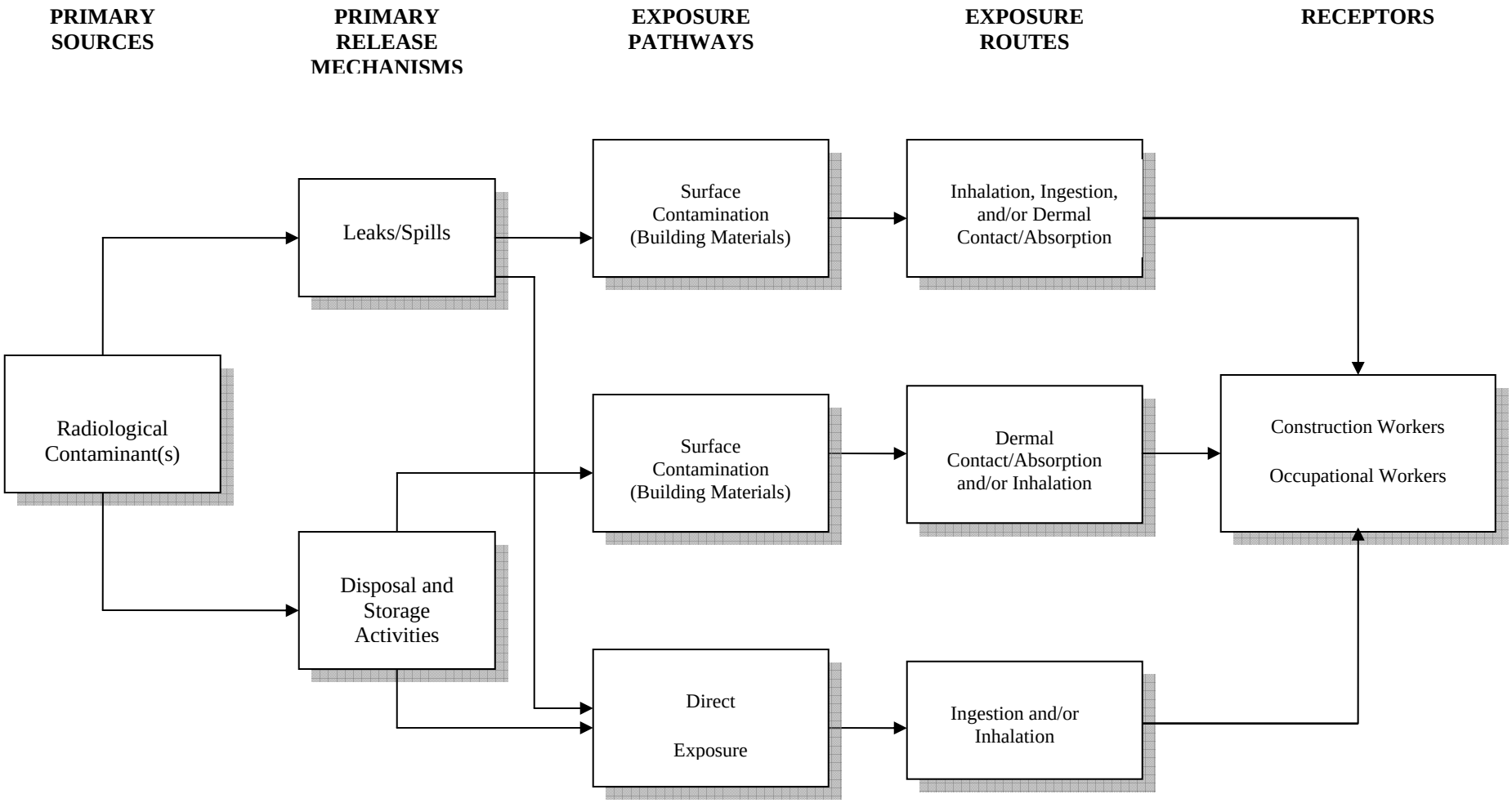


FIGURE 6-2: CONCEPTUAL SITE MODEL (CSM) FOR WRAMC

7.0 CONCLUSIONS

Using the survey methods outlined in Section 4.0, seven buildings on the WRAMC Main Post were found to be impacted from historical use of RAM. Within the seven buildings identified, 102 rooms or laboratories have been classified as "Impacted." Specific rooms are identified on detailed drawings included in Appendix B for each of the seven impacted buildings. No radiologically impacted outdoor areas or release points were identified for the Main Post during this HSA.

Many of the buildings identified during records searches have had extensive renovations performed since the use or possession of RAM was terminated. The WRAMC 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.

The WRAMC Main Post is an active military installation and hospital with four of the seven buildings identified as impacted in this HSA having active RAM use authorizations in place. Therefore, it must be noted that the information provided in this HSA should be viewed as a "snapshot" of current conditions and that these conditions may change in the time between publication of this HSA and final decommissioning of these facilities.

Based on currently available information, as summarized herein, additional radiological survey activities, including direct measurements and/or discrete sampling will be required in order to support request for license termination and unrestricted release from applicable regulatory agencies. DQOs will be developed to support investigative path forward, and details of recommended scoping/characterization survey activities to support the DQOs will be provided in a separate document to be provided to the Army. All proposed tasks will be in accordance with MARSSIM for the purpose of achieving unrestricted release of impacted areas.

8.0 REFERENCES

(Note: All numbered documents are provided in the Electronic Document Library in Appendix E)

1		WRAMC U.S. NRC Radioactive Materials License No. 08-01738-02.
2	USACE, 2006	Statement of Work - *Historical Site Assessment in Support of the Environmental Condition of Property Phase I for Selected Base Reallignment and Closure Installations,* U.S. Army Corps of Engineers, Baltimore District. 22 March 2006.
3	WRAMC, 1989	Memorandum to WRAMC Fire Department from WRAMC Health Physics. "Rooms using Radioactive Material at WRAMC. Ref. HSHL-H-HP (340a). 6 November 1989.
4	WRAMC, 2004a	Memorandum for Record from LTC John Mercier, Chief Health Physics. "WRAMC Building T-2 Radiological Historical Site Assessment." 7 May 2004.
5		Authorization to Use Radioactive Material No. H01. WRAMC Health Physics Office
6		Authorization to Use Radioactive Material No. H02. WRAMC Health Physics Office.
7		Authorization to Use Radioactive Material No. H03. WRAMC Health Physics Office.
8		Authorization to Use Radioactive Material No. 221. WRAMC Health Physics Office
9		Authorization to Use Radioactive Material No. 511. WRAMC Health Physics Office
10		Authorization to Use Radioactive Material No. 557. WRAMC Health Physics Office
11		Authorization to Use Radioactive Material No. 569. WRAMC Health Physics Office
12		Authorization to Use Radioactive Material No. 571. WRAMC Health Physics Office
13		Authorization to Use Radioactive Material No. 572. WRAMC Health Physics Office
14		Authorization to Use Radioactive Material No. 577. WRAMC Health

Physics Office

15 Authorization to Use Radioactive Material No. 613. WRAMC Health Physics Office

16 Authorization to Use Radioactive Material No. 615. WRAMC Health Physics Office

17 Authorization to Use Radioactive Material No. 633. WRAMC Health Physics Office

18 Authorization to Use Radioactive Material No. 638. WRAMC Health Physics Office

19 Authorization to Use Radioactive Material No. 642. WRAMC Health Physics Office

20 Authorization to Use Radioactive Material No. 651. WRAMC Health Physics Office

21 Authorization to Use Radioactive Material No. 657. WRAMC Health Physics Office

22 Authorization to Use Radioactive Material No. 660. WRAMC Health Physics Office

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24 Authorization to Use Radioactive Material No. 670. WRAMC Health Physics Office

25 Authorization to Use Radioactive Material No. 676. WRAMC Health Physics Office

26 Authorization to Use Radioactive Material No. 689. WRAMC Health Physics Office

27 Authorization to Use Radioactive Material No. 691. WRAMC Health Physics Office

28 Authorization to Use Radioactive Material No. 692. WRAMC Health Physics Office

29 Authorization to Use Radioactive Material No. 693. WRAMC Health Physics Office

30 Authorization to Use Radioactive Material No. 701. WRAMC Health Physics Office

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32 Inactive Sealed Source Inventory Records. WRAMC Health Physics Office

33 Closeout Survey Records for Building 38, Rooms 221 and 223. October 2005.

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36 DPW, 2006 Main Section Real Property Inventory. WRAMC Directorate of Public Works, July 2006.

37 Shaw, 2005 "U.S. Army BRAC 2005 Environmental Condition of Property Report." Walter Reed Army Medical Center, Washington, D.C. Draft as of 22 August 2005.

38 WRAMC, 2004b Walter Reed Army Medical Center Building T-2 Radiological Decommissioning Final Status Survey. WRAMC Health Physics Office. 14 October, 2004.

39 NWT, 2001 Walter Reed Army Institute of Research Building 40 Former Research Reactor Rooms Decommissioning. Final Report. New World Technology. 10 April 2001

40 Cabrera, 2006b Site Trip Report – Follow-up Site Visit to WRAMC. Contract W912-DR-05-D-0024, Delivery Order 0003. June 20-23, 2006.

41 NRC, 2006 Index of Documents Received by Cabrera Services, Inc. in Response to Freedom of Information Act Request

42 WRAMC, 2006 Building Floor Plan Inventories

43 NRC, 1992 Old U.S. Nuclear Regulatory Commission License, 08-01738-02 and Notice of Violation

44 Package of NRC Inspection Reports

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46 NRC Package of Medical Broad-Scope Inspection Field Notes

47 Nuclear Medicine Inspection Field Notes

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APPENDIX A

HSA WORK PLAN

(Provided on Accompanying Compact Disc)

APPENDIX B

HSA BUILDING FACT SHEETS (FACT SHEETS, PHOTOS, FLOOR PLANS, ETC)

(Provided on Accompanying Compact Disc)

APPENDIX C

PERSONNEL INTERVIEW FORMS

(Provided on Accompanying Compact Disc)

APPENDIX D

ADDITIONAL PHOTODOCUMENTATION AND FLOOR PLANS

(Provided on Accompanying Compact Disc)

APPENDIX E

ELECTRONIC DOCUMENT LIBRARY

(Provided on Accompanying Compact Disc)