

Radiological Decontamination and
Decommissioning
(D&D)

Final Status Survey Report

APRIL 2000



NMRC Rockville Annex
12300 Washington Avenue
Rockville, Maryland 20852

Prepared by
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NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000

TABLE OF CONTENTS

| | | |
|-------|--|----|
| I. | Dedication and Acknowledgements. | 5 |
| II. | Overview. | 7 |
| III. | Abbreviations and Definitions. | 9 |
| | A. Abbreviations and Acronyms. | 9 |
| | B. Key Terms and Definitions. | 10 |
| IV. | Executive Summary. | 15 |
| | A. Purpose. | 15 |
| | B. Plan. | 15 |
| | C. Conclusions | 16 |
| V. | Reason for Decommissioning. | 18 |
| VI. | Guidance for Decommissioning Efforts. | 19 |
| VII. | Conceptual Model and Site Information. | 20 |
| | A. Potential Radioactive Contaminants. | 20 |
| | B. Potential Contaminated Areas. | 21 |
| | C. Impacted Areas - Known and Potential. | 22 |
| | D. Potential Contaminated Media. | 26 |
| | E. Conceptual Model for Decommissioning. | 26 |
| VIII. | Decommissioning Activities. | 28 |
| | A. Objective | 28 |
| | B. Cost Estimates for Decommissioning Activities. | 28 |
| | C. Release Limits and Dose Pathway Modeling. | 29 |
| | D. Criteria for License Termination. | 29 |
| | E. Derived Concentration Guideline Levels (DCGLs). | 30 |
| | F. Pre-Survey Safety Actions. | 33 |
| | G. Background/Baseline Levels. | 33 |
| | H. Survey Units. | 33 |
| | I. Quality Assurance and Quality Control. | 34 |
| | J. Field Measurement Methods and Instrumentation. | 36 |
| | 1. Field Measurements. | 36 |
| | 2. Instruments, Equipment, Measurements and Sampling Techniques | 38 |

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

| | | |
|------|--|----|
| K. | Sampling and Preparation for Laboratory Measurements. | 39 |
| 1. | Field Sample Preparation and Preservation. | 39 |
| 2. | Other Measurements and Sampling Locations. | 40 |
| IX. | Decontamination Procedures. | 41 |
| X. | Final Status Survey. | 42 |
| A. | Overview. | 42 |
| B. | Survey Preparations. | 42 |
| C. | Survey Design. | 44 |
| D. | Conducting Surveys. | 48 |
| E. | Data Conversion. | 49 |
| F. | Evaluating and Documenting Survey Results. | 50 |
| XI. | References. | 52 |
| XII. | Appendices. | 54 |
| A. | Conceptual Model and Floor Diagrams. | 55 |
| A-1. | Conceptual Model. | 56 |
| A-2. | Floor Diagram, First Floor, NMRC Rockville Annex. | 57 |
| A-3. | Floor Diagram, Second Floor, NMRC Rockville Annex. | 58 |
| B. | Documents and Photographs. | 59 |
| B-1. | Documents. | 60 |
| B-2. | Photographs. | 61 |
| C. | Standard Operating Procedures and Quality Assurance Program. | 62 |
| C-1. | Radiological D&D Action Plan Checklist. | 63 |
| C-2. | Checklist for Impacted Class 3 Areas or Survey Units. | 66 |
| C-3. | Checklist for Non-impacted Areas or Survey Units. | 68 |
| C-4. | Sample Collection Procedures. | 70 |
| C-5. | Sample Control. | 72 |
| C-6. | Data Analysis Procedures. | 73 |

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

| | | |
|------|---|-----|
| C-7. | Equipment and Instrument Procedures. . . | 75 |
| C-8. | Source-Standards, Background-Standards, and Reference-Background Measurements. | .77 |
| D. | Quality Assurance Information and Data. . . | .78 |
| D-1. | Training Information and Certificates | .79 |
| D-2. | Service and Calibration Certificates for Instruments, Equipment and Check Sources | 83 |
| D-3. | Instrument and Equipment Quality Control Data | 84 |
| D-4. | Quality Assurance Checklist. | 114 |
| E. | Survey Unit Release Reports (Narratives, Data, Floor Plans, and Grid Maps). | 116 |
| E-1. | Lists of Survey Units, Data Tables, and Figures. | 117 |
| E-2. | Rockville Annex Second Floor, Non-impacted Areas. | 124 |
| E-3. | Rockville Annex First Floor, Non-impacted Areas. | 128 |
| E-4. | Rockville Annex Second Floor, Impacted Class 3 Areas. | 133 |
| E-5. | Rockville Annex First Floor, Impacted Class 3 Areas and other Non-impacted Areas. | 195 |

I. DEDICATION AND ACKNOWLEDGEMENTS

DEDICATION

This work is dedicated in memory of my father, Mr. John S. Gaiter, Sr. (May 1, 1932 - August 19, 1999) and my youngest sister, Bergenia R. Gaiter (June 13, 1967 - October 11, 1999).

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

ACKNOWLEDGMENTS

Without the noteworthy contributions, support and assistance of numerous persons, this work would not have been possible.

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**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

II. OVERVIEW

This document, the Naval Medical Research Center (NMRC) Rockville Annex Radiological Decontamination and Decommissioning (D&D) Final Status Survey Report, was prepared in support of NMRC's decommissioning efforts. This report includes all survey results, reference background readings, check-source evaluations, calculations, procedures, problems/deviations from plans, recommendations for survey-site status, and other pertinent information.

This report describes the actions and levels of effort that NMRC undertook to demonstrate to regulatory authorities that the vacated NMRC Rockville Annex site meets the release criteria for unrestricted future use. To achieve this objective, guidance provided in the Multi-Agency Survey and Site Investigation Manual (MARSSIM, ref 11.1) and other regulatory documents were followed and parameters chosen to meet or exceed the release criteria.

The NMRC Historical Site Assessment (HSA, ref 11.2) served as the primary document for information regarding potential contaminants, potential contaminated areas, and potential contaminated media.

Since 1986, the NMRC leased the privately held industrial property from a commercial realty management group. The NMRC Rockville Annex is located at 12300 Washington Avenue, Rockville, Maryland 20852 and is housed in a 10,717-square foot, two-story masonry building. The first floor contained administrative offices and research laboratories. The second story comprised research laboratories, offices and common areas. The Annex housed laboratories involved in enteric and malarial research. Medical studies and biomedical research were conducted which involved the use of chemicals and other hazardous materials, biological materials, animals and animal products, and radiological materials. All the surrounding properties are located within Rockville city limits and are predominantly for industrial and commercial uses (ref 11.3, ESA 1997).

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

NMRC's history of military medical research during 1986 to 1999 at the Annex site included the use of sealed and unsealed radioactive materials. The sealed-source use involved the use of a single, 300-Curie, Cesium-137 gamma irradiator. Required, semi-annual leak test results for the gamma irradiator provided assurance of no residual Cesium-137 contamination at the Annex. The use of unsealed radioactive materials in laboratories, rooms, and areas dictated that some level of decommissioning was required for each area of radioactive material use to ensure and document compliance with the regulatory release criteria for unrestricted use.

The radioactive contaminants of concern were Hydrogen-3, Carbon-14, Phosphorus-32, Sulfur-35, and Chromium-51.

The examination for potential radioactive contaminants included surveys, direct measurements, sampling and analysis, and scanning with appropriate instruments and equipment. The examinations included:

- (1) all accessible floor space,
- (2) the lower half of all walls extending up approximately two meters from the floor, and
- (3) other selected locations.

The survey units were classified as either Impacted Class 3 or Non-impacted. There were no survey sites classified as Impacted Class 1 or Class 2, which are the two remaining classifications requiring the most extensive decommissioning effort. Selected Annex common areas, restrooms, and non-impacted areas were evaluated for potential radioactive contamination. After equipment, materials and wastes were removed from radioactive-materials-use areas, residual contamination was confined to small areas within a small percentage of the survey units.

The 4-month decommissioning period began in January 2000 and was concluded in April 2000. The cost of performing the necessary decommissioning efforts included instrument and equipment costs, materials, supplies and contracted labor.

NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000

III. Abbreviations and Definitions

A. ACRONYMS AND ABBREVIATIONS

| | |
|------------------|---|
| μCi | Micro-Curie |
| $\mu\text{R/hr}$ | Micro-Roentgens per hour (exposure rate) |
| Annex | NMRC Rockville Annex Laboratories, Washington Avenue, Rockville, MD |
| BRAC | Base Realignment and Closure |
| BUMED | Bureau of Medicine and Surgery |
| CFR | Code of Federal Regulations |
| cpm | Counts per minute |
| D&D | decontamination and decommissioning |
| DOD | Department of Defense |
| DOT | Department of Transportation |
| dpm | Disintegrations per minute |
| Gy | Gray, SI unit of absorbed dose, 1 Gy = 100 rads |
| Irradiator | Sealed-source, Cesium-137 gamma irradiator |
| MDA | Minimum detectable activity |
| NEHC | Navy Environmental Health Center |
| NMRC | Naval Medical Research Center, formerly NMRI |
| NMRI | Naval Medical Research Institute |
| NNMC | National Naval Medical Center |
| NRC | U. S. Nuclear Regulatory Commission |
| NRMP | NMRC's Navy Radioactive Materials Permit |
| NUREG | Nuclear Regulatory Guide |
| R, R/hr | Roentgen (exposure), Roentgens per hour |
| Rad, Rad/hr | Rad (dose), Rads per hour (dose rate) |
| RAM | Radioactive materials |
| Rem, Rem/hr | Rem (dose equivalent), Rem per hour |
| SOP | Standard operating procedure |
| Sv | Sievert, SI unit of dose equivalent, 1 Sv = 100 rems |
| US | United States |
| USN | United States Navy |
| WSSC | Washington Suburban Sanitary Commission |

NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000

B. KEY TERMS AND DEFINITIONS (reference 11.1, MARSSIM)

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| α , Alpha | The specified maximum probability of Type I error; i.e.; the maximum probability of rejecting the null hypothesis when it is true. Alpha is referred to as the size of the test. Alpha reflects the amount of evidence the decision maker would like to see before abandoning the null hypothesis. |
| Area | A term referring to any portion of a site, up to and including the entire site. |
| Background radiation | Radiation from cosmic sources, naturally occurring radioactive material, radon, and global fallout as it exists in the environment from testing of nuclear explosive devices or from nuclear accidents. Background radiation does not include radiation from source, byproduct, or special nuclear materials regulated by the Federal or State agency. |
| Becquerel (Bq) | The unit of radioactivity equivalent to one nuclear transformation per second. |
| β , Beta | The probability of a Type II error, i.e., the probability of accepting the null hypothesis when it is false. The compliment of beta ($1-\beta$) is referred to as the power of test. |
| Beta emitter | A radioactive material emitting beta particles. Beta particles are electrons emitted from the nucleus during radioactive decay. |
| Byproduct material | Licensed or radioactive material regulated by the NRC. |
| Class 1 areas | Impacted areas with the highest potential for contamination or insufficient evidence to support reclassification as Class 2 or 3. |
| Class 2 areas | Impacted areas with low potential for delivering a dose above the release criterion and little or no potential for small areas of elevated activity. |

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

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| Class 3 areas | Impacted areas with little or no potential for delivering a dose above the release criterion and little or no potential for small areas of elevated activity. |
| Classification | The act or result of separating areas or survey units into one of the three designated classes: Class 1 area, Class 2 area, or Class 3 area. |
| Cleanup standard | A numerical limit set by a regulatory agency as a requirement for releasing a site after cleanup. |
| Contamination | The presence of residual radioactivity in excess of levels which are acceptable for release of a site or facility for unrestricted use. |
| Curie | A unit of radioactivity equal to 37 billion becquerels. |
| Derived Concentration Guideline Level (DCGL) | A derived, radionuclide-specific activity concentration within a survey unit corresponding to the release criterion. The DCGL is based on the spatial (uniform) distribution of the contaminant and hence is derived differently for the non-parametric statistical test (DCGL _w) and the elevated measurement comparison (DCGL _{EMC}). DCGLs are derived from activity/dose relationships through various exposure pathway scenarios. |
| Decommission | To remove (as a facility) safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the Nuclear Regulatory Commission license or Navy radioactive material permit. |
| Decommissioning | The process of removing a facility or site from operation, followed by decontamination, and license termination (or termination of authorization for operation) if appropriate. |
| Decontamination | The removal of radiological contaminants from persons, objects, or areas to within regulatory levels. |

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

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| Direct measurement | Radioactivity measurement obtained by placing the detector near the surface or media being surveyed. An indication of the resulting radioactivity level is read out directly. |
| Final status survey | Measurements and sampling to describe the radiological conditions of a site, following completion of decontamination activities (if warranted) in preparation for release. |
| Gamma (γ) radiation | Penetrating high-energy, short-wavelength electromagnetic radiation (similar to X-rays) emitted during radioactive decay. Gamma rays are very penetrating and require dense materials (such as lead or steel) for shielding. |
| Impacted areas | Any area that is not classified as non-impacted. Areas with a possibility of containing residual radioactivity in excess of natural background or fallout levels. |
| Investigation level | A derived media-specific, radionuclide-specific concentration or activity level of radioactivity that is based on the regulatory release criteria and triggers a response that further investigation or action is necessary if exceeded. |
| MARSSIM | Multi-Agency Radiation Survey and Site Investigation Manual (DOE, DOD, EPA, NRC); provides for conducting decommissioning activities to satisfy regulatory release criteria. |
| Non-impacted areas | Areas where there is no reasonable possibility (extremely low probability) of residual contamination. |
| Non-parametric test | A test based on relatively few assumptions about the underlying probability distributions of the measurements. As a consequence, non-parametric tests are generally valid for a fairly broad class of distributions. The Wilcoxon Rank Sum test and the Sign test are examples of non-parametric tests. |

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

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| Outlier | Measurements that are unusually large or small relative to the rest and therefore are suspect of misrepresenting the population from which they were collected. |
| Radioactive material (RAM) | Solid, liquid or gaseous material that contains radionuclides regulated by the NRC. |
| Radioactive waste | Solid or liquid trash or excess material that contains radionuclides regulated by the NRC. |
| Release criterion | A regulatory limit expressed in terms of dose or risk; compliance demonstration is simply a decision as to whether or not a survey unit meets the release criterion. |
| Residual radioactivity | Radioactivity in structures, materials, soil, groundwater, and other media at a site resulting from activities under the cognizant organization's control. |
| Scanning | An evaluation technique performed by moving a detection device over a surface at a specified speed and distance above the surface to detect radiation. |
| Sign test | A non-parametric statistical test used to demonstrate compliance with the release criterion when the radionuclide of interest is not present in background and the distribution of the data is not symmetric. |
| Site | Any installation, facility, or discrete, physically separate parcel of land, or any building or structure or portion thereof, that is being considered for survey and investigation. |
| Survey | A systematic evaluation and documentation of radiological measurements with a correctly calibrated instrument or instruments that meet the sensitivity required by the objective of the evaluation. |

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

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| Survey unit | A geographical area consisting of a room, hallway, structures or land areas of specified size and shape for which a separate decision will be made whether the unit attains the cleanup standard; are established to facilitate the survey process and the statistical analysis of the survey data. |
| Wilcoxon test | A non-parametric statistical test used to demonstrate compliance with the release criterion when the radionuclide of interest is present in background and the distribution of the data is not symmetric. |

NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000

IV. EXECUTIVE SUMMARY

A. PURPOSE

A final status decommissioning survey was conducted to determine the presence and extent of any radiological health hazards in the building used by NMRC at the National Naval Medical Center (NNMC) Bethesda campus and at the Rockville Annex. All necessary actions were taken to verify that any residual radioactivity in the vacated NMRC buildings was in compliance with regulatory guidelines for the decontamination of facilities prior to release for unrestricted use.

B. PLAN

- Develop and implement an approved decontamination and decommissioning plan.
- Stop all work involving the use of radioactive materials.
- Dispose, remove or transfer all licensed, radioactive materials and equipment to authorized recipients.
- Minimize hazardous and low-level radioactive waste generated.
- Decontaminate known areas of contamination to background levels.
- Meet regulatory radiological, environmental, and safety regulations.
- Control costs and complete closure within the allocated timeframe.
- Prepare final status survey reports.

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

A radiological survey plan was developed to survey over 10,000 square feet with portable instrumentation and to take and analyze over 2,000 swipe samples and more than 150 direct readings throughout the Rockville Annex. The work history and probability of residual radioactive material were used to identify areas selected for surveying and sampling. The closure operations used basic engineering principles and common industrial practices.

Those few areas where low-level radioactivity in excess of permissible limits was detected were remediated and released for unrestricted use. The results of final status surveys for all but one survey area revealed no detectable radiation level greater than background.

A double sink in room 115 was used to dispose of radioactive liquid wastes in accordance with 10 CFR 20. Because residual radioactivity (tritium) was detected in the sink and drain, the drain assembly and pipes and were removed and disposed as solid radioactive (tritium) waste. The drainpipe was cut nearly flush with the wall beneath the sink. The interior and exterior surfaces of the drainpipe stub were decontaminated on numerous occasions and radioactivity levels were greatly reduced.

After completing final status survey efforts for this drain stub, it was determined that no further decontamination efforts were necessary and that the residual-radioactivity level was approximately 20 times lower than the NRC screening values for residual contamination.

C. CONCLUSIONS

The plan described in item B above has been fully implemented, completed, and documented.

The decontamination and decommissioning efforts involved the satisfactory performance of final status

**NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000**

surveys for 100% (29 of 29) Impacted Class 3 units and 100% (38 of 38) Non-impacted units.

Operations involving the use of licensed, radioactive materials at the NMRC Rockville Annex have had no adverse effect on the leased commercial building. All radioactive materials as a result of NMRC operations have been removed from the building. Regulatory agency criteria for release of the building for unrestricted use have been fulfilled.

NMRC Rockville Annex Radiological (D&D)
Final Status Survey Report, April 2000

V. REASON FOR DECOMMISSIONING

Base Realignment and Closure (BRAC) legislation passed and signed into law in 1995 mandated that the Naval Medical Research Center (NMRC) relocate some of its programs and research efforts and cease operations at the NNMC campus in Bethesda, Maryland and at the NMRC Rockville Annex in 1999.

NMRC, the Navy's largest medical research facility, opened its doors in Bethesda on October 27, 1942 to conduct research, development, tests, and evaluations to enhance the health, safety, and readiness of Navy and Marine Corps personnel in the effective performance of peacetime and contingency missions. NMRC had specific environmental obligations to fulfill before terminating the lease of the NMRC Rockville Annex building. These obligations involved the completion of biological, chemical, environmental and radiological decommissioning efforts.