USACHPPM

U.S. Army Center for Health Promotion and Preventive Medicine

HISTORICAL DATA REVIEW
WALTER REED ARMY INSTITUTE OF RESEARCH
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, D.C.
AUGUST - DECEMBER 1997

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DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO
ATTENTION OF

MCHB-TS-OMH (40)

05 FEB 1998

MEMORANDUM FOR Commander, U.S. Army Medical Command,
ATTN: MCHO-CL-W, 2050 Worth Road,
Suite 10, Fort Sam Houston, TX 78234-6010

SUBJECT: Medical Health Physics Radiation Consultation No. 28-ME-6209-98, Historical Data Review, Walter Reed Army Institute of Research, Washington, DC, August - December 1997

1. The enclosed report summarizes the evaluation, conclusions, and recommendations resulting from the subject medical health physics consultation conducted by personnel of this Center.

2. The point of contact is Mr. John Collins at DSN 584-3548 or 410-671-3548.

3. Copies of subject report are enclosed.

FOR THE COMMANDER:

Encl

GARY M. MATCEK
MAJ, MS
Program Manager
Medical Health Physics

CF (w/encl):
CDR, WRAIR, ATTN: WCMR-UWZ
CDR, WRAMC, ATTN: MCHL-HP

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO ATTENTION OF

EXECUTIVE SUMMARY
HISTORICAL DATA REVIEW
WALTER REED ARMY INSTITUTE OF RESEARCH
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC
SEPTEMBER - DECEMBER 1997

1. PURPOSE. The Historical Data Review (HDR) is a preliminary survey to establish the history of the use of radioactive material at Walter Reed Army Institute of Research (WRAIR). The location of radioactive material use, the radioisotopes used, any accidents/incidents or radioactive material leaks that may have resulted in potential radiological contamination in any area, and the general history of all units involved in radiological activities at WRAIR are described in the HDR. This HDR pertains to all properties currently and previously designated as WRAIR property.

2. CONCLUSION. The historical data/record search and interviews (telephonically and in person) with key persons, revealed 11 buildings that used or stored radioactive material. The record search indicated that there was a potential for the existence of radiological contamination from these operations.

3. RECOMMENDATIONS. The 11 buildings (listed below) identified in this HDR should have appropriate radiological surveys performed.

Building 40	Building 511
Building 500	Building 512
Building 506	Gillette Building
Building 508	Taft Building
Building 2802	Building 2805
Building 2813	

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
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REPLY TO
ATTENTION OF

MCHB-TS-OMH

HISTORICAL DATA REVIEW CONSULTATION NO. 28-MF-6209-98
WALTER REED ARMY INSTITUTE OF RESEARCH
WALTER REED ARMY MEDICAL CENTER
AUGUST - DECEMBER 1997

1. REFERENCES. See Appendix A for a list of references.

2. AUTHORITY. Memorandum for Record, 16 July 1997, subject: Transfer of Funding From Walter Reed Army Institute of Research (WRAIR) to the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) to Initiate a Historical Site Assessment in Support of Radiological Decommissioning.

3. ABBREVIATIONS. See Appendix B for a list of abbreviations.

4. PURPOSE. The Historical Data Review (HDR) is a preliminary survey to establish the history of the use of radioactive material at Walter Reed Army Institute of Research (WRAIR). The locations of radioactive material use, the radioisotopes used, any accidents/incidents or radioactive material leaks that may have resulted in potential radiological contamination in any area, and the general history of all activities involved in radiological activities at WRAIR are described in the HDR. This HDR pertains to all properties currently and previously designated as WRAIR property.

5. GENERAL.

a. The services of Mr. Hans Honerlah, Department of the Army Civilian, U.S. Army Corps of Engineers Baltimore District, were requested by the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), Medical Health Physics Program to perform a Historical Site Assessment (HSA) of WRAIR operations (Project number 28-MF-6209-98) not including the U.S. Army Institute of Dental Research (USAIDR). The HSA for the USAIRDR (Project number 27-MH7237-97) was performed by Charles E. Day, III, Health Physics Consultant, Henry M. Jackson Foundation Participant, for the USACHPPM Industrial Health Physics Program. The HSA prepared by Mr. Honerlah is attached as enclosure 1, and the HSA prepared by Charles E. Day, III is attached as enclosure 2. The historians followed the written guidance in the USACHPPM's Historical Site Assessment Protocol.

b. The following individuals provided outstanding support for this HDR:

COL Martin Crumrine, Commander, WRAIR
COL William B. Johnson, Chief WRAMC Health Physics Office
LTC Richard Bond, U.S. Army Health Facilities Planning Office
1LT James Goetschius, U.S. Army Health Facilities Planning Office
CPT Arthur Morton, WRAMC Health Physics Office
Mr. Bert Mueck, WRAIR Safety Office
Mr. David Burton, WRAMC Health Physics Office
Mr. Edward Keiper, WRAIR Facility Planning Office
Dr. Bing Poon, WRAIR Researcher, Building 500
Ms. Tanya Griffea, WRAIR Safety Office
SSG Timothy Mensing, WRAIR Safety Office

6. FINDINGS AND DISCUSSION.

a. General. Outstanding support was provided by the WRAMC Health Physics Office during the course of this HDR.

b. Summary of History. The summary of history is provided in enclosure 1 and enclosure 2 of the HDR.

c. Safety Concerns. Site visits identified a few minor safety concerns within the lab areas of the buildings designated for radiological decommissioning. Because research operations were still in progress at the time of the assessment, numerous containers of chemicals (solids and liquids) were identified as being used in the areas designated for radiological decommissioning. Within a few labs there were boxes containing sharps and an assortment of biohazard products (as indicated on waste receptacles designated for BIO-HAZARD disposal). The entrance to numerous laboratories designated for radiological decommissioning were identified with BIO-HAZARD labels as well as the corresponding radioactive material use labels. Due to unique nature of research involving human pathogens, WRAIR must ensure that potential biological and chemical hazards are addressed prior to initiating radiological surveys in support of radiological decommissioning.

d. Radiological Concerns Addressed.

(1) The use of radioactive materials at WRAIR was in the form of sealed and unsealed sources for the treatment and diagnosis of military personnel, retirees, and their dependents; human and animal research such as Radioimmunoassay (RIA). Some RAM is controlled by the Nuclear Regulatory Commission (NRC) and some is controlled only by the Army. All data and reports reviewed by USACHPPM in support of this review, indicated that radioactive materials used at WRAIR were for the above stated purposes and ultimately for the nation's security.

(2) Radiological use at WRAIR was conducted under NRC License Numbers 08-01738-02, 08-01738-03, and Department of Army Radiation Authorization (DARA) A 08-01-94. The research reactor that was located in the basement of Building 40 was operated under Atomic Energy Commission (AEC) License Number AEC Sub 603 and AEC SNM 472.

(3) The former nuclear reactor area located in the sub basement of Building 40 was decommissioned in 1972. A small portion of former reactor area was entombed in place at the time of decommissioning and remains that way at the present time. The WRAMC Health Physics Office has records of a survey indicating the presence of minor surface contamination on building materials adjacent to the entombed area. The area was resurveyed after remediating, and contamination was not found.

(4) Radioactive material use at WRAIR. The following is a list of the WRAIR buildings reported to have used or stored radioactive materials and which will require follow up surveys:

Building 40	Building 511
Building 500	Building 512
Building 506	Gillette Building
Building 508	Taft Building
Building 2802	Building 2805
Building 2813	

Detailed information on the buildings is provided in the enclosed HSAs.

(5) The classification of areas for radiological decommissioning are described in Appendix C.

8. CONCLUSION. The historical data/record search and interviews (telephonically and in person) with key persons revealed 11 buildings that used or stored radioactive material. The record search indicated that there was a potential for the existence of radiological contamination from these operations.

9. RECOMMENDATIONS.

a. The 11 buildings identified in this HDR should have appropriate radiological surveys performed. The surveys must be capable of characterizing potential contamination that could be present from operations involving the use and storage of radioactive material at WRAIR in accordance with (IAW) U.S. Army regulations, the NRC license and NUREG/CR-5849.

b. In the unlikely event that radiological contamination is found, the contamination should be remediated as soon as possible, and a final status survey should be performed prior to the release of the property for unrestricted use.

c. Initiate a pilot survey to characterize the extent of radiological contamination associated with the entombed area (inner and outer subpile rooms) in the sub basement of Building 40 prior to initiating a full scale radiological decommissioning survey for the entire Building 40 area.

10. The point of contact for this HDR is Mr. John Collins at DSN 584-3548 or 410-671-3548.

JOHN W. COLLINS
Health Physicist
Henry M. Jackson Participant
Medical Health Physics Program

APPROVED:

GARY M. MATCEK
MAJ, MS
Program Manager
Medical Health Physics

APPENDIX A

ABBREVIATIONS

AEC	Atomic Energy Commission
DA	Department of the Army
DARA	Department of Army Radiation Authorization
DAC	Department of the Army Civilian
IAW	in accordance with
HDR	Historical Data Review
HPO	Health Physics Office
HSA	Historical Site Assessment
m	meter
mCi	millicurie
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Document
RPO	Radiation Protection Officer
USACE	U.S. Army Corps of Engineers
USAIDR	U.S. Army Institute of Dental Research
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
µCi	microcurie
WRAIR	Walter Reed Army Institute of Research
WRAMC	Walter Reed Army Medical Center

APPENDIX B

REFERENCES

1. AR 40-5, 15 October 1990, Preventive Medicine.

2. AR 40-14, 30 June 1995, Occupational Ionizing Radiation Personnel Dosimetry.

3. AR 385-11, 1 May 1980, Ionizing Radiation protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

4. Code of Federal Regulations, Title 10, Energy, Parts 0-50, January 1, 1996.

5. Code of Federal Regulations, Title 21, , Subchapter J, January 1, 1996.

6. Code of Federal Regulations, Title 29, Chapter I, Labor, January 1, 1996.

7. Code of Federal Regulations, Title 49, Parts 100-177, Transportation, January 1, 1996.

8. NUREG/CR-5849, ORAU-29/C57. Manual for Conducting Radiological Surveys in Support of License Termination, June 1, 1992. Draft Report for Comment.

9. NUREG 1505. A Nonparametrical Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys. August 1, 1995. Draft Report for Comment.

10. NUREG 1500. Working Draft Regulatory Guide on Release Criteria for Decommissioning: August 1, 1994. NRC Staff's Draft for Comment.

11. Federal Register. Nuclear Regulatory Commission, 10 CFR Part 20, et al Radiological Criteria for Decommissioning; August 22, 1994. Proposed Rule.

12. USACHPPM Historical Site Assessment Protocol.

Historical Data Review No. 28-MF-6209-98, WRAIR, WRAMC, Aug-Dec 97

13. Memorandum, Medical Health Physics Program, MCHB-DC-OMH, 16 July 1997, subject: Transfer of Funding From Walter Reed Army Institute of Research (WRAIR) to the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) to Initiate a Historical Site Assessment in Support of Radiological Decommissioning.

14. Memorandum, Industrial Health Physics Program, MCHB-TS-OIP, 27 January 1998, subject: Industrial Radiation Historical Site Assessment No. 27-MH-7237-A-97, Fort Meade, Maryland, 1 August - 3 October 1997.

APPENDIX C

CLASSIFICATION OF AREAS FOR RADIOLOGICAL DECOMMISSIONING

1. Affected Area(s): Area(s) that have the potential for radioactive contamination (based on facility operating history) or known radioactive contamination (based on past or preliminary radiological survey/surveillance). This would normally include areas where radioactive materials were used and stored, where records indicate spills or other unusual occurrences that could have resulted in the spread of radioactive contamination, and where radioactive materials were buried. Areas immediately surrounding or adjacent to locations where radioactive materials were used or stored, spilled, or buried are included in this classification because of the potential for the inadvertent spread of radioactive contamination. Affected areas are further divided into those areas that are considered to have a potential for containing small areas of elevated residual radioactivity (hot spots) in excess of the regulatory guideline levels and those in which such areas of elevated radioactivity would not be anticipated. (If there is any doubt, the area should be designated as an affected area.)

2. Affected/Non-Uniform Area: An area that has the potential for a non-uniform or spotty residual radioactivity pattern. Indoor survey units that are classified as affected/non-uniform will generally consist of a single room. **NOTE:** Any area that has been remediated or decontaminated shall be designated as affected/non-uniform. In general, all areas shall be treated as affected/nonuniform until substantial basis are provided to reclassify them to either affected/uniform, unaffected, or non-impacted area.

3. Affected/Uniform Area: An area with little or no potential for non-uniform or spotty residual radioactivity.

4. Unaffected Area: Any area that is not expected to contain any residual radioactivity, based on a knowledge of site history and previous radiological survey information. The unaffected areas of a facility may consist of a single survey unit of unlimited size.

5. Non-Impacted Area: Any area that has no potential for residual radioactive contamination.

(NUREG 5849)

Historical Site Assessment
WALTER REED ARMY INSTITUTE OF RESEARCH
WALTER REED ARMY MEDICAL CENTER

Prepared for:

Medical Health Physics Program
U.S. Army Center for Health Promotion and Preventive Medicine

Prepared by:

Hans B. Honerlah
U.S. Army Corps of Engineers
Baltimore District

ENCL 1

Historical Site Assessment
WALTER REED ARMY INSTITUE OF RESEARCH
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, D.C.

1. This Historical Site Assessment was conducted by the U.S. Army Corps of Engineers, Baltimore District (USACE) in accordance with (IAW) the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) Historical Protocol and involved reviewing all pertinent documents, personnel interviews, facility walk-throughs and various calculations. The documents and files reviewed include but are not limited to the following: Radiation Control Committee minutes, Nuclear Regulatory Commission (NRC) Inspections, Department of the Army (DA) Radiation Authorizations, DA Radiation Permits, leak tests, monthly surveys, hot sink logs, inventories, special study reports, disposal records, incidents/accidents, licence applications, ventilation studies, approved protocols, dosimetry records, and radiation protection standing operations procedures (SOPs).

2. History and Mission.

a. Site Location. The Walter Reed Army Medical Center (WRAMC) consists of three geographically separate sections. The three sections are within four miles of each other and are identified as the Main Section, Forest Glen Section, and Glen Haven Section.

(1) The Main Section is located in a residential area, within the northern limits of Washington, DC, between Rock Creek Park and Georgia Avenue.

(2) The Forest Glen Section is located near the suburban community of Forest Glen, approximately one and one-half miles north of the District of Columbia and is bounded by the Capital Beltway, main rail line of the CSX rail system, Brookville Road, and Rock Creek Park.

(3) The Glen Haven Section is located north of the Capital Beltway. This Section is east of Route 97 on Windham Road.

b. Site Background. The WRAMC has been operational for 88 years. In nine decades, the WRAMC has grown to a vast medical complex, teaching medical professionals, medical research programs, and treating hundreds of thousands of patients.

(1) The Main Section 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, Armed Forces Pest Management Board, Tri-Service Medical Information Systems, US Army Area Dental Laboratory, US Army Information Systems Command, US Army Institute of Dental Research, and Walter Reed Army Institute of Research(WRAIR).

(2) The Forest Glen Section was acquired in 1942 from the National Park Seminary, a private school for girls. It was activated for use as a convalescent center for the WRAMC and was equipped with clinics and wards. In the early 1950's the Forest Glen Section began to grow with the construction of new facilities and the addition of various activities.

(3) Glen Haven Section. The Glen Haven Section became officially established as a part of WRAMC in 1947 when the buildings and property were transferred by the National Housing Agency to the War Department. The property consisted of 71 dwelling units and in 1977 the units were demolished and replaced with 211 town homes. The new units are designated as family housing for non-commissioned officers and enlisted personnel.

c. WRAIR History.

(1) Established in 1893 under the direction of Surgeon General Sternberg, U.S. Army, as the Army Medical School. The Army Medical School was originally located in downtown Washington and moved to WRAMC in 1923. The original name changed several times until the present name was adopted in 1955. In 1962, a new wing was added to Building 40 incorporating laboratory facilities and a nuclear energy reactor for research. The new wing consisted of five full floors, a partial floor comprising the lower reactor level with a subpile area for the nuclear reactor at still a lower level. The WRAIR has operated laboratories at many buildings on the Main Section of WRAMC and at the Forest Glen Annex. The WRAIR has also leased facilities at several downtown locations and other military posts.

(2) The mission of the WRAIR has been to provide the medical research and professional graduate training required by the Army to fulfill its role in national defense. The WRAIR provides general military medicine research capability and conducts research in the areas of communicable diseases, and immunology, combat surgery, combat psychiatry, drug development, medicine, military hazards of blast over pressure, chemical and nuclear warfare defense, and the biological effects of microwave radiation. The

WRAIR also plans and conducts numerous undergraduate and graduate level educational programs.

(3) The WRAIR has operated within several buildings of the main section of WRAMC. The majority of the laboratory activities were located within Building 40. Other buildings utilized on the main section include Building 83, Walter Reed General Hospital, and Temporary Building 20. The WRAIR activities located on the Forest Glen Annex were within Buildings 500, 501, 502, 503, 504, 506, 508, 509, 512, 101, 189, and 116. The WRAIR utilized two animal care facilities. The first was a leased facility identified as Olney Farms and the second was the WRAIR animal care facility located on Fort Meade, Maryland. The WRAIR has also occupied three leased facilities identified as the Key West Building, Gillette Building, and the Taft Building.

(4) As a leader in medical research and development, WRAIR expanded into many medical research arenas to include the use of radioactive materials and other radiation sources. The WRAIR remained at the prior mentioned locations with additions of buildings and movement of activities such as laboratories within the WRAMC facilities and Forest Glen Annex. The WRAIR is preparing to move a large portion of their activities to a new facility that is under construction at the Forest Glen Annex. The new facility is expected to be complete and ready for move-in sometime in 1998.

3. RADIATION ACTIVITIES.

a. Licenses. Radiological use at the WRAIR was conducted under Nuclear Regulatory Commission(NRC) Licenses, Atomic Energy Commission(AEC) Licenses and Department of the Army Radioactive Authorizations(DARA) issued to the WRAMC. The use of radioactive material for research applications is controlled under NRC License Number 08-01738-02. The use of animal irradiators at the WRAIR was authorized by NRC License Number 08-01738-03. The use of radioactive material not controlled by NRC licenses was authorized by DARA number A 08-17-01. 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. Copies of the current licenses are attached in appendix I.

b. Laboratories. The WRAIR had several laboratory users of radioactive material (RAM). They include but are not limited to the following activities; Experimental Therapeutics, Neuroscience, Virus Diseases, Nephrology, Surgery, Bacterial Diseases, Clinical Physiology, Pathology, Gastroenterology, Hematology, Biochemistry, Immunology, Enteric Infections, Clinical Investigations, Membrane Biochemistry, Retrovirology, Neuroscience, Pharmacology and others.

c. Waste disposal.

(1) Solid radioactive waste was held by the waste generator and delivered periodically to several specific locations controlled by the WRAMC Health Physics Office(HPO). The WRAMC HPO collected and moved the waste to a waste handling facility, Building 516, located on the Forest Glen Annex. Prior to the opening of Building 516, the waste was handled at Building 149A. The radioactive waste was transported to these facilities using a dedicated vehicle. Control measures are in place to assure that contamination is not spread during movement of waste.

(2) Liquid radioactive waste was either delivered to the HPO designated location or disposed of by sanitary sewer. Hot sinks were identified for the use of radioactive material in various locations by the WRAMC authorizations. Documentation indicates that the use of radioactive sinks within the WRAIR 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. Recommend the survey of sinks within laboratories identified as users of radioactive material. These surveys should include surface area samples and sink trap samples.

(3) Ventilation hoods were approved for radioisotope use in various locations. The documented use of radioisotope ventilation hoods was almost exclusively for iodine isotopes. Ventilation hoods were used with various chemicals tagged with radioisotopes. The documentation of this use was limited. Recommend that ventilation hoods within laboratories that used radioisotopes be surface area sampled and filter screens sampled for possible contamination.

d. Health Physics Office.

(1) The HPO is responsible for the safe use, storage and disposal of RAM. The HPO coordinates waste handling as well as source ordering. The use of RAM was controlled by issuing specific authorizations to users. The authorizations identified use locations and isotopes used. Documentation and interviews indicated that RAM use was moved to adjacent laboratories and authorizations without regard to HPO authorization controls. The HPO SOP's for radiation protection and authorization are enclosed in Appendix I.

(2) The HPO conducted semiannual leak tests of all sealed sources possessed by the WRAIR. Documentation indicated that no sealed sources were found to be leaking in excess of applicable limits.

(3) The HPO conducted periodic surveys of radioactive materials used in areas IAW Title 10, Code of Federal Regulations and the NRC License. Documentation indicated that contamination was found in several areas of the WRAIR. The HPO coordinated the decontamination of identified areas as necessary.

(4) Documentation indicated that all required special surveys (i.e., ventilation surveys) were completed as required by regulation and their NRC license.

(5) Documentation indicated that there were numerous small spills through out the WRAMC. Documentation also indicated that the HPO controlled, cleaned, and surveyed the cleaned areas to assure no residual contamination was missed.

4. Radiological Concerns Addressed. The remodeling of buildings, movement of activities, changing of room numbers, and changing of activity names complicated this assessment. The following is a list of buildings, associated with the WRAIR, reported to have used or stored radioactive materials(RAM)/commodities in them:

a. Buildings.

(1) Building 40. Currently authorized to use RAM. A permanent five story steel and concrete structure, consisting of four pavilions. Three of the pavilions were constructed during the 1923-34 and the fourth being constructed around 1962. The majority of the first floor was used for office space with a few laboratories being utilized. The basement and second through fourth floors were used primarily for laboratories with some office space being utilized as well. Documentation indicated that the movement between laboratories and offices occurred many times during the occupation by the WRAIR. Records also indicated that RAM and radioactive counting instrumentation was in the several hallways. The fourth floor in the Siler Pavilion was utilized for animal rooms and cage washing facilities. The nuclear reactor was located in the basement area, subbasement area, and sub subbasement area of the new wing and will be addressed as a separate area. Records indicated the use of radioactive sinks and ventilation hoods. Recommend that Building 40 be classified as outlined in Appendix D. Also that all sinks and ventilation hoods within rooms that used RAM be included in biased surveys to assure no residual radioactivity.

(2) Building 40 (former reactor area). The WRAIR reactor was designed in the late 1950's as a part of the new west wing addition to Building 40. Construction of the new west wing was completed in the spring of 1962 with the reactor going critical on September 22, 1962. The reactor was incorporated in three levels

of the new west wing; the subpile rooms located in the sub subbasement level; the core assembly, shielding, and associated experimental areas located at the subbasement level; the control and observation rooms were located at basement level overlooking the exposure areas and the reactor floor. A reactor report detailing the facility operations and a detailed drawing of the former reactor area is located in Appendix H. The reactor was a homogenous solution-type reactor, designed to operate at 50 kilowatts of thermal power and produce a maximum thermal neutron flux of about 10^{12} neutrons/cm^2-sec at the center of the reactor core. The reactor consisted of a core assembly, gas handling system, fuel handling systems and cooling systems, a control and safety rod system, and a reflector assembly, together with instrumentation and sheilding for a safe and efficient operation. The fuel was enriched uranium in the form of uranyl sulphate, dissolved in ordinary water, which served as a moderator, and graphite as the reflector. The WRAIR reactor was scheduled for decommissioning in the late 1960's. The reactor operated for a total integrated power of 186 Megawatt hours. The 15 liter reactor fuel solution was removed on August 1, 1971 and the decontamination was completed by January 1, 1972. The reactor dismantling and decontamination was accomplished with virtually no disruption to normal institute operations. During the decommissioning of the reactor there were two fission chambers, containing 0.69g of U^{235}, were misplaced. It was assumed that the fission chambers were mistakenly shipped with one of the other radioactive waste shipments. The AEC licenses associated with the WRAIR reactor were decommissioned to the standards in place at the time of decommissioning. Enclosed in Appendix H are the surveys completed at the time of decommissioning.

(a) A limited remediation of the basement and subbasement areas took place during the decommissioning process. The concrete bioshield and graphite moderators were dismantled and removed using splitters and conventional pavement breakers. Documentation indicated decontamination was completed to levels less than 0.5 mR/hr residual activity. The basement level and subbasement level have since been remolded and are currently being utilized by WRAIR activities. The subbasement area consisted of a patient and animal preparation room, mechanical room, utility room, source storage pits, reactor laboratory, and the reactor. Documentation indicated that close-out surveys were only completed in the area where the reactor and reactor bioshield were located. Recommend that the reactor area subbasement be classified as affected and surveyed to assure there is no residual radioactivity that may become an issue during the renovation of Building 40.

(b) There was limited decontamination in the sub subbasement area, which contained the inner and outer subpile rooms. This area contained auxiliary support equipment such as

coolant pumps, access ports, valves, gas recombiners, waste gas storage tanks, and other reactor service equipment. Documentation indicated that at the time of decommissioning there was removable radioactive contamination that was fixed in-place with paint. The air lock door that provides entrance to the inner subpile room has been welded shut since the late 1970's. There has also been indications of removable radioactive activity outside the inner subpile room. There have been several incidents in the subbasement of Building 40 that have caused flooding in the outer subpile room. Currently, it is not known if the flooding was isolated to the outer subpile room. The available floor plans reviewed indicated that there is no ventilation into the inner subpile room. Documentation indicated that close-out surveys were only completed in the inner subpile room. Records indicated, in 1996, 6,500 pCi Cs^{137} was discovered on wipes in the outer subpile room. Recommend the inner and outer subpile rooms be classified as affected and characterized to determine if remedial action is necessary. Special consideration should be given to the ceiling of the inner subpile room and any piping entering or exiting the inner subpile room. Special safety controls shall be utilized prior to entering the inner subpile room.

(3) Building 500. Currently authorized to use RAM. A permanent one story brick structure with a basement. The basement was used for mechanical equipment and storage. The first floor was constructed for general laboratory research purposes. Radioactive material was used extensively within the first floor of this building. There was RAM stored in the hallways and RAM movement between laboratories. Records indicated the use of radioactive sinks and ventilation hoods. Recommend that Building 500 be classified as outlined in Appendix D. Also that all sinks and ventilation hoods within rooms that used RAM be bias surveyed to assure no residual radioactivity.

(4) Building 501. A permanent one story concrete structure constructed for laboratory research purposes. Documentation indicated that RAM was used in room 23. The isotopes used were P^{32}, P^{33}, and S^{35}. The longest half-life of the isotopes used within Building 501 is 87.5 days. The RAM was moved from the building in December 1992. Recommend that Building 501 be classified as non-impacted and requires no further action.

(5) Building 502, 503, 505, 507, and 509. There was no radioisotope use indicated within these facilities. These buildings have been demolished to allow for construction of the new WRAIR facilities. Recommend the buildings be classified as non-impacted and requires no further action.

(6) Building 504. The Respiratory Research Facility utilized radioisotopes in one room of Building 504. This Building

was decommissioned in July 1994 and then demolished to allow for construction of the new WRAIR facilities. Recommend the building be classified as non-impacted and requires no further action.

(7) Building 506. A permanent one story brick structure constructed for laboratory research purposes. There is documented radioisotope use within the chemical room, counting room and the back cubical area. There was documented use of a radioisotope sink in the main laboratory area. If activities are scheduled to relocate, not currently using RAM, or there are no plans for future use of RAM decommissioning surveys may be required. Recommend that Building 506 be classified as outlined in Appendix D.

(8) Building 508. A permanent one story brick structure constructed for laboratory research purposes. There is documented use of radioisotopes within the laboratories. If activities are scheduled to relocate, not currently using RAM, or there are no plans for future use of RAM decommissioning surveys may be required. Recommend that Building 508 be classified as outlined in Appendix D.

(9) Building 511. A permanent one story structure that has been recently renovated (1992). The facility acts as an animal care building for the WRAIR research. The only documented use of radioisotopes within the building is in Room 114. The isotopes authorized for use within this building were H^3, C^{14}, P^{32}, S^{35}, Co^{57}, I^{125}, I^{131}, and Hg^{203}. Recommend the that room 114 be classified as affected and the rest of the building be classified as non-impacted and requiring no further action.

(10) Building 512. A permanent structure for the breeding of laboratory animals. This facility had documented use of RAM in Rooms 4, 6 and 30. The isotopes utilized were H^3 and C^{14}. The building has been reconditioned and turned over to another activity of the WRAMC. Recommend the building be studied to assess the possibility of residual radioactive contamination after the rooms were reconditioned. If it is determined that flooring our laboratory equipment was not completely removed the area should have radiological surveys conducted.

(11) Building 101. There has been no documentation indicating the use of RAM within this building. Documentation indicated the use of H^3 and Cd^{109} in gas chromatography and a lead paint analyzer utilized by the Industrial Hygiene Section. Records indicated that all required leak tests were performed and there were no reports of leaking sources. Recommend the building be classified as non-impacted and requires no further action.

(12) Building 189. The building is currently being utilized by WRAIR activities. There has been no documented use of

RAM within Building 189. Recommend the building be classified as non-impacted and requires no further action.

(13) Building 83. WRAIR utilizes this building for computer support and information systems management. Recommend the building be classified as non-impacted and requires no further action.

(14) Building T-20. WRAIR utilizes this building for logistics support and personnel functions. Recommend the building be classified as non-impacted and requires no further action.

(15) Gillette Building (leased facility located in Rockville, MD). This facility is currently an active user of RAM. Recommend the Gillette Building be classified as outlined in Appendix D.

(16) Taft Court Building (leased facility located in Rockville, MD). This facility is currently an active user of RAM. Recommend the Taft Court Building be classified as outlined in Appendix D.

(17) Key West Building (leased facility). This facility was an active user of RAM. The facility was decommissioned by the HPO and removed from the NRC License. Recommend the area be classified as non-impacted and requires no further action.

(18) Fort Meade Animal Care Facility. These facilities operated from the mid 1960's to the late 1980's. The facilities were comprised of pasture land and buildings for the care of large animals. The only indicated use of radioisotopes was in the mid 1980's and the isotopes were identified as I-125 and I-131. Interviews indicated the buildings associated with the facility were burned in the late 1980's. Due to the short half-life of the isotopes used recommend the area be classified non-impacted and request for removal from the NRC license.

(19) Olney Farm Animal Care Facility. A leased facility of 174 acres with 12 buildings, located near Olney, MD., 23 miles from WRAMC. The facility was moved to the Fort Meade Animal Care Facilities sometime in the mid 1960's. There was no documentation that indicated the use of RAM. Recommend the area be classified as non-impacted and requires no further action.

(20) HPO facilities. Buildings 149A, 186, 188, 513, 516 and 41 have been identified as facilities utilized by the WRAMC HPO. Building 149A, 188, and 513 used/stored RAM and have been recently decommissioned. The records for the decommissioning of these buildings are on file at the WRAMC HPO. Building 516 is

currently being used as a collection point for radioactive waste and storage facility for short half-life radioisotopes.

b. Safety Concerns. Site visits identified a few major safety concerns within the lab areas of the buildings that may require radiological surveys. Prior to any radiological surveys the laboratories shall have all chemicals, sharps, and there containers removed. All areas containing blood and tissue products will be cleaned with appropriate methods. Many laboratories and associated equipment are marked with BIO-HAZARD and other labels. Documentation of these areas shall be provided showing they were cleaned using appropriate methods and labeling removed.

c. Recommend that all sinks and ventilation hoods within the laboratories of Building 40 and 500, that utilized RAM be surveyed as biased samples due to the frequency and movement of RAM during the use at the WRAIR facilities.

d. The WRAIR has had many space constraints during there occupation of the facilities located at WRAMC, Forest Glen Annex and other leased properties. The space constraints led to the storage and use of RAM within hallways of the facilities. Refrigerator and freezer units were used to store RAM in hallways. Walk-through also indicated the use of radioactive counting instruments located in hallways. Recommend that the hallways in the laboratory areas of the WRAIR facilities be surveyed for residual radioactivity.

e. Environmental contamination from the radiological activities at the WRAIR is extremely unlikely.

5. Recommendations. The buildings and areas identified in paragraph 4 should have appropriate radiological surveys performed if there is no future radioisotope activity in identified areas.

HANS HONERLAH
Health Physicist
USACE, Baltimore District

APPENDIX A
ABBREVIATIONS AND REFERENCES

1. ABBREVIATIONS.

bkg	background
BRAC	Base Realignment and Closure
DA	Department of the Army
DAC	Department of the Army Civilian
IAW	in accordance with
EPA	Environmental Protection Agency
HPO	Health Physics Office
m	meter
mCi	millicurie
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Document
RAM	Radioactive Material
RPO	Radiation Protection Officer
SN	serial number
SOP	standing operating procedure
TBD	To Be Determined
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
μCi	microcurie
WRAIR	Walter Reed Army Institute of Research
WRAMC	Walter Reed Army Medical Center

2. REFERENCES.

a. AR 40-5, 15 October 1990, Preventive Medicine.

b. AR 40-14, 30 June 1995, Occupational Ionizing Radiation Personnel Dosimetry.

c. AR 385-11, 1 May 1980, Ionizing Radiation protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, CFR, Chapter I, Nuclear Regulatory Commission.

e. Title 21, CFR, Subchapter J.

f. Title 29, CFR, Chapter I, Department of Labor.

g. Title 49, CFR, Parts 100-177, Transportation.

h. NUREG/CR-5849, ORAU-29/C57, 1 June 1992, Manual for Conducting Radiological Surveys in Support of License Termination. Draft Report for Comment.

i. NUREG 1505, 1 August 1995, A Nonparametrical Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys. Draft Report for Comment.

j. NUREG 1500, 1 August 1994, Working Draft Regulatory Guide on Release Criteria for Decommissioning: NRC Staff's Draft for Comment.

k. Federal Register, 22 August 1994, Nuclear Regulatory Commission, 10 CFR Part 20, et al Radiological Criteria for Decommissioning; proposed rule.

l. USACHPPM Historical Site Assessment Protocol.

APPENDIX B
TYPICAL INTERVIEW QUESTIONS

1. What is your name and what is/was your job title/position?

2. During what span of years have you worked at this installation?

3. How many years have you worked with radioactive materials?

4. Were you provided radiation protection training; how involved was the training? Who provided the training? Was there documentation of training?

5. Were you provided personnel monitoring dosimeters, medical examinations, personnel protection equipment, or RADIAC survey meters?

6. Did your supervisors participate in the training? In what way?

7. What type or kinds of radiation protection procedures were provided to you and your fellow workers?

8. What is/was your connection with radioactive material use? What isotopes are/were involved?

9. Describe a typical day involving radioactive material in your work area.

10. Can you name or identify the radioactive items or commodities you or anyone else might have worked with at WRAIR?

11. Can you identify any locations of known use or storage of radioactive material on the WRAIR?

12. Are you aware of any other areas or buildings posted with a radioactivity warning sign on the installation?

13. Are you aware of the presence of any exit signs bearing a radioactivity warning label?

14. Did any of the radioactive commodities have radium-226, cesium-137, or cobalt-60? How did you handle items that contained radium-226?

15. Did your SOP address disposal of radioactive materials or contaminated material/waste? Are you aware of any disposal of, or

incineration, of radioactive material onsite? Was it ever buried onsite or transferred to a landfill as normal trash?

16. Were coal or coal products used onsite?

17. Was animal research, with radioactive material, ever performed at the site?

18. Describe what would happen if a radioactive item or commodity was damaged or broken. Whom would you tell? What special procedures would have been implemented?

19. Do you recall any instance of some broken or leaking sources or any other contamination incidents or accidents?

20. Were any foreign materials ever handled/stored in your work area or elsewhere on the installation?

□

APPENDIX C
SUMMARY OF INTERVIEWS

PERSONS CONTACTED OR INTERVIEWED DURING THIS REVIEW

NAME	TITLE	PHONE OR LOCATION	REMARKS
Billy Bass, PhD	WRIAR,RPO	202-877-8025	1959-1992
Michael Koenig	WRAIR, Asst RPO/Researcher	Bldg 40 202-782-7517	1987 - Current
Mary Kay Gentry	WRAIR Research Chemist	Bldg 40/500	1968 - Current
Authur Morton CPT	WRAMC, HPO Chief Op's	202-356-0058	1995 - Current
Claude Wilblin CHP	WRAMC, HPO	301-428-9681	
Gordon Ladde LtC. Ret.	WRAMC, HPO	410-671-3548	
1Lt, James Goetschius	WRAIR Transition Off	301-295-8316	Current
David Burton	WRAMC, HPO	202-356-0058	1987 - Current
David Alberth	WRAMC, HPO	410-671-3548	1981 - 1987
Dr. Luther Lindler	WRAIR, Researcher	202-782-3601	1989 - Current
Robert Miller	Research Chemist	410-962-6744	1966 - 1974
Jim Writer	WRAIR, Researcher	202-782-1310	
Marvin Rogul	WRAIR, Researcher	202-782-7580	
Tony Borra	WRAIR, Maintenance	202-782-3612	1962 - Current
OTHERS			

□

APPENDIX D

TABLES OF WRAIR BUILDINGS

BUILDING 40				
ROOM #	Classification	Sq Meters	Isotope authorized for use by HPC	Authorization #
1004	AFF	TBD	H3, C14, P32, Cr51, I125	628
1006	AFF	TBD	H3, C14, S35, I125	655
1007-A	UNAFF	TBD	from isotope list	
1007-B	UNAFF	TBD	from isotope list	
1007-C	UNAFF	TBD	from isotope list	
1009	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125	639, 643
1012	AFF	TBD	H3, C14, P32, P33, S35, I125	643
1014	AFF	TBD	H3, C14, P32, S35, Cr51, I125	632, 574, 635
1016	AFF	TBD	H3, C14, P32, P33, S35, I125	574, 643
1017	AFF	TBD	H3, C14, P32, S35, Cr51, I125	698, 664, 671
1020	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125, I131	644, 639, 671
1021	AFF	TBD	H3, C14, P32, S35	525
1022	AFF	TBD	H3, C14, P32, S35, Cr51, I125	645, 676
1023	AFF	TBD	H3, C14, P32, S35, I125	525
1023H	UNAFF	TBD	from isotope list	
1026	AFF	TBD	H3, C14, P32, S35, I125, (Ra226 sealed)	606, 676
1027	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125	525, 699
1028	AFF	TBD	H3, C14, P32, S35, I125	606, 647
1030	AFF	TBD	H3, C14, P32, I125	647
1031	AFF	TBD	H3, C14, P32, S35, I125, (Ra226 sealed)	
1032	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125	632, 559, 525
1033	AFF	TBD	H3, C14, P32, S35, Cr51	559, 671
1034	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125, I131	632, 644, 525
1035	AFF	TBD	H3, C14, P32, S35, I125	559
1038	AFF	TBD	H3, C14, P32, S35, Co57, I125	626
1039	AFF	TBD	H3, C14, P32, P33, S35, Ca45, I125	636
1040	AFF	TBD	H3, C14, P32, S35, Co57, I125	626
1041	AFF	TBD	H3, C14, P32, S35, I125 (Renovated 1991)	606
1042	AFF	TBD	H3, C14, P32, S35, Cr51, Ga67, In111, I125	605, 647, 676
1043	AFF	TBD	H3, C14, P32, S35, I125	606
1044	AFF	TBD	H3, C14, P32, S35,Cr51, Ga67, In111, I125	606, 605, 647, 676
1045	AFF	TBD	H3, C14, P32, P33, S35, Ca45, I125	606, 636
1046	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Fe55 Co57, Co60, Fe59, I125	626, 631
1047	AFF	TBD	H3, C14, P32, S35, I125	606, 653, 586

1049	AFF	TBD	H3, C14, P32, P33, S35, Ca45, I125 (Ra226 sealed)	606, 636
1049A	AFF	TBD	H3, C14, P32, P33, S35, I125	604
1051	AFF	TBD	H3, C14, P32, P33, S35	604
1053	AFF	TBD	H3, C14, P32, P33, S35	604
1055	AFF	TBD	H3, C14, P32, S35, I125	606
1059	AFF	TBD	H3, C14, P32, S35, Cr51, Co57, In111, I125, I131	626, 631
1061	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Fe55 Co57, Co60, Fe59, I125	601, 626, 631
1063	AFF	TBD	H3, C14, P32, S35, Cr51, Co57, In111, I125, I131	631
1065	AFF	TBD	H3, C14, P32, S35, Cr51, Co57, In111, I125, I131	576, 631
1069	UNAFF	TBD	from isotope list	
1073	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Fe55 Co57, Co60, Fe59, I125	601, 626, 631
2006	UNAFF	TBD	from isotope list	
2006B	AFF	TBD	H3, S35, Cr51, I125, (Cs137 sealed)	398
2020	AFF	TBD	H3, C14, S35, Cr51, I125, (Cs137, I129, Ba133, Ni63 sealed)	398, 572
2021	UNAFF	TBD	from isotope list	
2022	AFF	TBD	H3, C14, P32, S35, Cr51, I125	559, 664, 671
2022A	AFF	TBD	P32, P33, S35	663
2022B	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639
2024	AFF	TBD	H3, C14, P32, S35, Cr51, I125	559, 671
2026	AFF	TBD	H3, S35, Cr51, I125, (Cs137 sealed)	398
2028	AFF	TBD	H3, C14, S35, Cr51, I125 (I129, Ba133, Ni63 sealed)	572
2029	AFF	TBD	H3, S35, Cr51, I125, (Cs137 sealed)	398
2031	AFF	TBD	H3, S35, Cr51, I125, (Cs137 sealed)	398
2032	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2034	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2036	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2037	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2038	UNAFF	TBD	from isotope list	
2039	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2040	UNAFF	TBD	from isotope list	
2041	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503, 636
2043	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Cr51, Zn65, Rb86, I125, I131	617, 503
2045	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2047	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Cr51, Zn65, Rb86, I125, I131	617,632,644,559,574
2048	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2049	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2050	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503

2051	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2052	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2053	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2055	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131	503
2058	AFF	TBD	H3, C14, P32, P33, S35	577
2058A	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2059A	AFF	TBD	H3, C14, P32, P33, S35	667
2060	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2061	AFF	TBD	H3, C14, P32, P33, S35	667
2063	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Cr51, I125	617, 667
2064	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2065	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Cr51, I125	617, 667
2066	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2067	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Cr51, I125	617, 667
2068	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2069	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Cr51, I125	617, 667
2070	UNAFF	TBD	from isotope list	
2073	AFF	TBD	H3, C14, P32, P33, S35	667
2075	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2077	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2078	AFF	TBD	H3, C14, P32, S35, Ca45, Cr51, Co57, I125	661, 566
2082	AFF	TBD	H3, C14, Na22, S35, Cl36,	610
2084	AFF	TBD	H3, C14, P32	566
2085	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2086	AFF	TBD	H3, C14, Na22, S35, Cl36	610, 611
2088	AFF	TBD	H3, C14, P32, S35, I125	661
2092	AFF	TBD	H3, C14, P32, Cl36, Ca45, Cr51, Co57, I125	661, 566, 610, 611
2093	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2097	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2099	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2101	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617, 585
2103	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Cr51, I125 (Ra226 sealed)	617, 577, 585
2113	AFF	TBD	H3, C14, P32, S35, Cl36, Ca45, Cr51, I125	617
2119	AFF	TBD	H3, C14, P32, S35, Ca45, Cr51, Co57, I125	566
2121	AFF	TBD	H3, C14, Na22, S35, Cl36	610, 611
3002 a	AFF	TBD	H3, C14, P32, S35, Sc46, Cr51, Ga67, Sr85, Nb95, Tc99m, In111, I125, Ce141, Au198	576, 645
3004 a	AFF	TBD	H3, C14, P32, S35, Sc46, Cr51, Ga67, Sr85, Nb95, Tc99m, In111, I125, Ce141, Au198	576

3006 a	AFF	TBD	H3, C14, P32, S35, Sc46, Cr51, Ga67, Sr85, Nb95, Tc99m, In111, I125, Ce141, Au198	576
3011B a	AFF	TBD	H3, C14, P32, S35, Sc46, Cr51, Ga67, Sr85, Nb95, Tc99m, In111, I125, Ce141, Au198	576
3014 a	AFF	TBD	H3, C14, P32, S35, Sc46, Cr51, Ga67, Sr85, Nb95, Tc99m, In111, I125, Ce141, Au198	576
3016	UNAFF	TBD	from isotope list	
3017	AFF	TBD	H3, C14, Na22, P32, P33, S35, I125	600
3018	AFF	TBD	H3, C14, P32, S35, Sc46, Cr51, Ga67, Sr85, Nb95, Tc99m, In111, I125, Ce141, Au198	576
3019	AFF	TBD	H3, C14, P32, P33, S35, Sc46, Cr51, Ga67, Sr85, Nb95, Tc99m, In111, I125, Ce141, Au198	576
3019A	AFF	TBD	C14, P32, S35	604
3021 a	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Sc46, Cr51, Ga67, Sr85, Rb86, Nb95, Tc99m,	507, 576, 600, 645
			Ru103, In111, I125, Ce141, Au198	
3024	AFF	TBD	H3, C14, P32, S35, Cr51, Co57, In111, I125, I131	631
3028	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Rb86, Ru103, I125	507
3035	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Rb86, Ru103, I125	507
3037	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Rb86, Ru103, I125	507
3039	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Rb86, Ru103, I125	601, 507
3041	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Rb86, Ru103, I125	507
3043	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Rb86, Ru103, I125	507
3045	AFF	TBD	H3, C14, Na22, P32, S35, Cl36, Ca45, Rb86, Ru103, I125	507
3048 a	AFF	TBD	H3, C14, S35, I125	645
3051	UNAFF	TBD	from isotope list	
3053	AFF	TBD	H3, C14, Na22, P32, P33, S35, Cl36, Ca45, Rb86, Ru103, I125	518,215,507,643,694
3055	AFF	TBD	H3, C14, P32, S35, Ca45, I125	499, 692
3057	AFF	TBD	H3, C14, P32, S35, Ca45, I125	518, 499
3061	AFF	TBD	H3, C14, I125	518, 694
3063	AFF	TBD	H3, C14, I125 (Ra226 sealed)	518, 694
3065	AFF	TBD	H3, C14, I125	518, 215, 694
3067	AFF	TBD	H3, C14, P32, S35, Ca45, I125	518, 499
3069	AFF	TBD	H3, C14, P32, S35, Ca45, I125	518, 215, 499
3074	AFF	TBD	I125	601
3075 a	AFF	TBD	H3, C14, P32, S35, I125	518, 645
3077 a	AFF	TBD	H3, C14, P32, S35, I125	645
3079	UNAFF	TBD	from isotope list	
3080	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639
3081 a	AFF	TBD	H3, C14, P32, S35, I125	645
3111	AFF	TBD	H3, C14, P32, S35, Ca45, I125	499, 692
3113 a	AFF	TBD	H3, C14, P32, S35, I125	645
3117	UNAFF	TBD	from isotope list	

3119	AFF	TBD	H3, C14, S35, I125, I131	630
3119A	UNAFF	TBD	from isotope list	
4005	AFF	TBD	AINMAL ROOM	576
4007	AFF	TBD	ANIMAL ROOM	576
4010	AFF	TBD	C14, ANIMAL ROOM	576
4019	AFF	TBD	ANIMAL ROOM	576
4023	AFF	TBD	ANIMAL ROOM	576
4059	AFF	TBD	ANIMAL ROOM	576
B020	AFF	TBD	H3, C14, P32, P33, S35, I125	525, 667
B026	AFF	TBD	H3, C14, P32, S35, I125	658
B027	AFF	TBD	H3, C14, P32, P33, Ca45, S35, Cr51, I125, I131	632, 625 ,644, 649
B035	AFF	TBD	H3, C14, P32, P33, S35, Ca45, I125	636
B036	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	637, 699
B037	AFF	TBD	H3, C14, P32, S35, Cr51, I125, I131	632, 644
B038	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	586, 637, 699
B039	AFF	TBD	H3, C14, P32, S35, Cr51, I125	632
B040	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	606, 586, 637, 699
B044	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Fe55 Co57, Co60, Fe59, In111, I125, I131	625, 601, 626, 631
B045	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	586, 637, 658
B046	AFF	TBD	H3, C14, P32, P33, Ca45, I125	625, 601
B047	AFF	TBD	H3, C14, P32, S35, I125	586
B048	AFF	TBD	H3, C14, P32, S35, Cr51, Co57, In111, I125, I131	631
B049	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	586, 637
B051	AFF	TBD	H3, C14, P32, S35, I125	586
B053	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	586, 637
B055	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	586, 637
B057	AFF	TBD	H3,C14, P32, S35, Cl36, Cr51, I125,	652, 649, 671, 676
B058	AFF	TBD	H3, C14, S35, Cr51, I125	559, 585
B059	AFF	TBD	H3, C14	596
B060	AFF	TBD	H3, C14, S35, Cr51, I125	585
B061	AFF	TBD	H3, C14	596
B063	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	586, 637, 658
B075	UNAFF	TBD	from isotope list	
B079	AFF	TBD	H3, C14, P32, S35, Cr51, Co57, I125, I131	644, 649
B087	AFF	TBD	H3, C14, P32, S35, Cl36	652, 649
B089	AFF	TBD	H3, C14, S35, Cr51, I125	559, 585
B091	AFF	TBD	H3, C14, P32, S35, Cr51, I125, I131	644, 585

B097	AFF	TBD	H3, C14, P32, P33, S35, Cl36, Ca45, Fe55 Co57, Co60, Fe59, In111, I125, I131	601, 631
B099	AFF	TBD	Co60 8000Ci / Cs137 3700 Ci / U238 85LBS (IRRADIATORS)	430
B101	AFF	TBD	Ga67, Tc99, I125, Xe133, Cs137, Tl201, (Co60 sealed)	495
B204 a	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125, I131 (Ra226 sealed)	644, 632, 645
B205	AFF	TBD	H3, C14, Na22, P32, S35, Ca45, I125	632, 637, 699
W024 a	AFF	TBD	H3, C14, P32, S35, I125	645
W025	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125	632, 644, 525
WB1	AFF	TBD	H3, C14, S35, Cr51, Ga67, In111, I125	605
WB2	AFF	TBD	H3, C14, S35, Cr51, Ga67, In111, I125	605
WB3	AFF	TBD	H3, C14, S35, Cr51, Ga67, In111, I125	605
SB1	AFF	TBD	H3, C14, P32, S35, I125	658
SB2	AFF	TBD	H3, C14, P32, S35, I125	658
SB4	AFF	TBD	H3, C14, P32, S35, I125	658
AFF = AFFECTED, UNAFF = UNAFFECTED, NON-IM = NONIMPACTED				
a = (Sc46, Sr85, Ce141 Microspheres)				

OTHER AREAS OF BLDG. 40

Hallways	AFF	TBD	from isotope list	Any hallway adjacent to RAM labs
4 th Fl. Animal care rooms	AFF	TBD	from isotope list	Cs-137, C-14, H-3, and others administered to animals
Sub subbasement area	AFF	TBD	from isotope list	activation products
Subbasement area	AFF	TBD	from isotope list	activation products
Ventalitaion hoods	AFF		from isotope list	hoods used in RAM labs
Hot Sinks	AFF		from isotope list	sinks used in RAM labs
AFF = AFFECTED, UNAFF = UNAFFECTED, NON-IM = NONIMPACTED				

BUILDING 500

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1B-1	UNAFF [a]	TBD	H3, C14	
11	AFF	TBD	H3, C14	454
29	AFF	TBD	H3, C14	
30	AFF	TBD	H3, C14, (Ra226, Cs137 & Ni63 sealed)	696
31	AFF	TBD	H3, C14 (Cs137)	454, 696
34	AFF	TBD	H3, C14, Ni63(sealed)	699
35	AFF	TBD	H3, C14(Ra226 sealed)	454
36	AFF	TBD	H3, C14, P32, P33, K42, Ca45, Rb86, I125, I131	625
37	AFF	TBD	H3, C14, (Ra226 sealed)	454
38	AFF	TBD	H3, C14, Na22, P32, P33, K42, Ca45, Rb86, I125, I131, (Ra226 sealed)	658, 668, 625
39	AFF	TBD	H3, C14, Na22, P32, P33, K42, Ca45, Rb86, I125, I131,	669, 625
40	AFF	TBD	H3, C14, (Cs137 sealed)	696
41	AFF	TBD	H3, C14	454, 696
41A	AFF	TBD	H3, C14, (Cs137 sealed)	696
42	AFF	TBD	H3, C14, P32, P33, S35	668
63	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125, (Cs137 sealed)	416, 668
63B	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125	416
66	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125, (Cs137 sealed)	416, 668
67	AFF	TBD	C14, Sr90, (Am241 sealed)	416, 623
68	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125, (Ba133, Cs137 sealed)	416
69	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125, (Cs137 sealed)	416, 623, 668
70	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125	
71	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125, (Cs137 sealed)	416, 623, 669
71A	AFF	TBD	H3, C14, P32, P33, S35, I125, (Cs137 sealed)	416
72	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125, (Cs137 sealed)	416
74	AFF	TBD	H3, C14, P32, P33, S35, CR51, Se75, Sb125, I125, (Cs137, Ra226 sealed)	416, 454
75	AFF	TBD	H3, C14, I125, (Ra226 sealed)	658
78	AFF	TBD	H3, C14, I125	658, 659
hallways	AFF	TBD	any from the above mentioned	
basement	UNAFF	TBD	any from the above mentioned	
AFF = AFFECTED, UNAFF = UNAFFECTED, NON-IM = NONIMPACTED				
a - suggestions were made, that this room would become a active user of RAM during temporary movement of labs.				

BUILDING 508

1	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131, [1987]	
2	AFF	TBD	I125	669
4	AFF	TBD	H3, C14, P32, P33, S35, Ca45, Cr51, Zn65, Rb86, I125, I131, [1987]	
7	AFF	TBD	I125	624
10	AFF	TBD	H3, C14, P32, S35, Cr51, I125	624, 662
14	AFF	TBD	H3, C14, P32, S35, Cr51	662
17	AFF	TBD	H3, C14, P32, S35, Cr51	662
18	AFF	TBD	H3, C14, P32, S35, Cr51	662
19	AFF	TBD	H3, C14, P32, S35, Cr51	662
20	AFF	TBD	H3, C14, P32, S35, Cr51	662
21	AFF	TBD	H3, C14, P32, S35, Cr51	662
106	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639, 699
108A	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639, 664, 644
114	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639
115	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639
116	AFF	TBD	H3, C14, P32, I125	669, 699
117	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639, 664
124	AFF	TBD	H3, C14, P32, S35, Cr51, I125	639, 664
136	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125	699
137	AFF	TBD	H3, C14, P32, P33, S35, Cr51, I125	699
hallways	UNAFF	TBD	Any of the above listed isotopes	
AFF = AFFECTED, UNAFF = UNAFFECTED, NON-IM = NONIMPACTED				

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	AFF	TBD	H3, C14, P32, S35, I125	672, 700
5	AFF	TBD	H3, C14, P32, S35, I125	678, 700
6	AFF	TBD	H3, C14, P32, S35	700
7	AFF	TBD	H3, C14, P32, S35, Ca45, Cr51, I125	78, 672, 679, 70
9	AFF	TBD	H3, C14, P32, S35, I125	678, 672, 700
10	AFF	TBD	H3, C14, P32, S35, I125	678, 672, 700
11	AFF	TBD	H3, C14, P32, S35, I125	678, 672 700
14	AFF	TBD	H3, C14, P32, S35, Ca45, Cr51, I125	672,679
15	AFF	TBD	H3, C14, P32, S35, Ca45, Cr51, I125	672, 679
16	AFF	TBD	H3, C14, P32, S35, Ca45, Cr51, I125	672, 679
18	UNAFF	TBD	from isotope list	
20	AFF	TBD	H3, P32, Ca45, Cr51, I125	679
21	AFF	TBD	H3, P32, Ca45, Cr51, I125	679
24	AFF	TBD	H3, P32, Ca45, Cr51, I125	679
129	UNAFF	TBD	from isotope list	

AFF = AFFECTED, UNAFF = UNAFFECTED, NON-IM = NONIMPACTED

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	UNAFF	TBD	from isotope list	
1205	AFF	TBD	H3, I125	650
1206	AFF	TBD	H3, I125	650
1207	AFF	TBD	H3, I125	650
1066	AFF	TBD	Cr51, Tc99m, I125, (Co57Co60I129Cs137 sealed)	H05
1082	AFF	TBD	Cr51, Tc99m, I125, (Co57Co60I129Cs137 sealed)	H05
1097	UNAFF	TBD	from isotope list	
2143	UNAFF	TBD	from isotope list	

AFF = AFFECTED, UNAFF = UNAFFECTED, NON-IM = NONIMPACTED

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
	No				
	No				
	Yes				
01_1082	Yes				
02_2121	No				
02_MEDICAL_EXA	No				
099_105	No				
099_106	No				
099_108	No				
099_MOBL	No				
21	No				
37_XRAY	Yes				
425_022	No				
425_307	No				
425_309	No				
425_MM	No				
425_MOBL	No				
49A	Yes				
56_1	No				
86	No				
88_8	Yes				
88_9	Yes				
88_CONFERENCE	Yes				
88_EXITS	Yes				
88_FLOORS	Yes				
88_RESTROOMS	Yes				
2	No				
39_6	No				
480_1	No				
480_2	No				
480_3	No				
480_4	No				
480_5	No				
480_E16	No				
480_MAMMO1	No				
480_MAMMO2	No				
480_MOBILE	No				
490_101	Yes				
490_102	Yes				
490_105	Yes				
490_107	Yes				
490_108/109	Yes	Schofield, Matthew	I-129	RIA, solid, sea	Clinical testin
		Schofield, Matthew	I-125	unsealed- liqui	Clinical Testin
490_217/218	Yes	Schofield, Matthew	I-129	RIA, solid, sea	Clinical testin
		Schofield, Matthew	I-125	unsealed- liqui	Clinical Testin
490_218	No				
490_221	Yes	Fentress, Herman	Ni-63	sealed & foils	GC foil, R & D
490_EXITS	Yes				
490_FLOORS	Yes				
490_ROOF	Yes	Schofield, Matthew	I-129	RIA, solid, sea	Clinical testin

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Schofield, Matthew	I-125	unsealed- liqui	Clinical Testin
2802_1	Yes				
2802_3	Yes				
2804_1	No				
2804_2	No				
2805_3	Yes				
2813_1_MAIN	Yes				
2813_2A_CLEAN	Yes				
2813_2B_CLEAN	Yes				
2_1C60	Yes	Fudge, Raymond	X-Ray	SOL	Human Use
2_1D28	Yes				
2_1D30	Yes				
2_1D46	No				
2_1D47	Yes				
2_1D63	Yes				
2_1D79	Yes				
2_1D85	No				
2_1E63	Yes				
2_1F19	No				
2_1H25	Yes				
2_1H27	Yes				
2_1H28A	Yes	Goldsmith, Brian	Sr-90	Sealed sources,	Beta ray treatm
		Goldsmith, Brian	Cs-137	sealed sources,	Interstitial an
		Goldsmith, Brian	Ra-226	Sealed sources,	Interstitial an
		Goldsmith, Brian	I-125	Sealed sources,	Interstitial tr
		Goldsmith, Brian	Pd-103	Sealed Sources	Interstitial tr
		Goldsmith, Brian	Ir-192	Sealed sources,	Interstitial an
		Goldsmith, Brian	Ta-182	Sealed sources,	Interstitial an
		Goldsmith, Brian	U-DEPL	solid metal	Sheilding for l
2_1H29	Yes				
2_1H30	Yes				
2_1H33	Yes				
2_1J39	Yes	Salata, Kalman	I-125	unsealed - prot	antibody assay
		Salata, Kalman	H-3	unsealed - thym	lymphocyte cult
		Salata, Kalman	P-32	unsealed, dCTP,	DNA RADIOLABELI
		Salata, Kalman	Ra-226	sealed sources	LSC source
2_1J39A	Yes	Salata, Kalman	I-125	unsealed - prot	antibody assay
		Salata, Kalman	H-3	unsealed - thym	lymphocyte cult
		Salata, Kalman	P-32	unsealed, dCTP,	DNA RADIOLABELI
		Salata, Kalman	Ra-226	sealed sources	LSC source
2_1J43	Yes	Salata, Kalman	I-125	unsealed - prot	antibody assay
		Salata, Kalman	H-3	unsealed - thym	lymphocyte cult
		Salata, Kalman	P-32	unsealed, dCTP,	DNA RADIOLABELI
		Salata, Kalman	Ra-226	sealed sources	LSC source
2_1J48	No				
2_1X02	Yes	Fudge, Raymond	X-Ray	SOL	Human Use
2_1X06	Yes	Fudge, Raymond	X-Ray	SOL	Human Use
2_1X08	No				
2_1X16	Yes	Fudge, Raymond	X-Ray	SOL	Human Use
2_1X20	Yes	Fudge, Raymond	X-Ray	SOL	Human Use

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
2_1X22	No				
2_1X26	Yes	Fudge, Raymond	X-Ray	SOL	Human Use
2_1X36	No				
2_1X40	No				
2_1X42	Yes	Fudge, Raymond	X-Ray	SOL	Human Use
2_1X46	No				
2_1X51	No				
2_1X52	Yes	Fudge, Raymond	X-Ray	SOL	Human Use
2_1X54	No				
2_1X54A	No				
2_1X54B	No				
2_1X56B	No				
2_1X58	No				
2_2B42	No				
2_2B51	Yes				
2_2B52	No				
2_4117	No				
2_47	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
2_4726	No				
2_4751	Yes				
2_4754	Yes	Shields, Mark	Cs-137	Sealed sources	Irradiation of
2_4B01AP	Yes	Duhan, Jill	X-Ray	SOL	Human Use
2_4B01LA	Yes	Duhan, Jill	X-Ray	SOL	Human Use
2_4B03	Yes	Duhan, Jill	X-Ray	SOL	Human Use
2_4C07B	No				
2_4D30	No				
2_4D38	No				

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
_4F05	No				
_4F11	No				
_4F19	No				
_4F23	No				
_4F29	No				
_4F36	No				
_4X01	No				
_4X09	No				
_4X11	No				
_5A	No				
_5A26	No				
_5A27	No				
_6Z70	Yes	Tuttle, R.	S-35	dATP	in vitro studie
		Tuttle, R.	P-33	unsealed, dATP	label and seque
		Tuttle, R.	P-32	dATP(gamma & al	DNA, Kinase la
		Tuttle, R.	C-14	unsealed - Ster	RIA, dilution a
		Tuttle, R.	H-3	STEROIDS, VITAM	RIA, DILUTION A
		Tuttle, R.	I-125	NaI, LABELED ST	RIA, PROTEIN IO
_7544	Yes	Burton, David	I-131	any	Medical
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
_7545	Yes	Burton, David	I-131	any	Medical
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
_7A07	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
_7A08	Yes				
_7A09	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
2_7A14	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
2_7A16	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
?_7A18	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
?_7A20	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
2_7B02	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
2_7B03	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
!_7C01	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
2_7C05	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
2_7C06	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
2_7C07	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
2_7C08	Yes	Rodriguez, Ana	Co-58	unsealed, Cyano	Laboratory
		Rodriguez, Ana	P-32	unsealed, Sodiu	Therapy
		Rodriguez, Ana	Xe-127	unsealed, Xenon	Imaging
		Rodriguez, Ana	Ga-67	unsealed, Galli	Imaging
		Rodriguez, Ana	In-111	unsealed, Indiu	Imaging
		Rodriguez, Ana	Cr-51	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	Sr-89	Strontium Sr-89	Palliation of b
		Rodriguez, Ana	Co-60	Sealed sources	Instrument cali
		Rodriguez, Ana	Tl-201	unsealed, Thall	Imaging
		Rodriguez, Ana	Mo-99	unsealed, 99Mo/	Imaging
		Rodriguez, Ana	Cs-137	Sealed sources	Instrument cali
		Rodriguez, Ana	I-131	unsealed, Sodiu	Imaging, Therap

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Rodriguez, Ana	I-129	Sealed sources	Instrument cali
		Rodriguez, Ana	Yb-169	unsealed, Ytter	Imaging
		Rodriguez, Ana	Co-57	unsealed, Cyano	Laboratory
		Rodriguez, Ana	Fe-59	unsealed, Ferro	Laboratory
		Rodriguez, Ana	U-DEPL	Plated metal	Sheilding
		Rodriguez, Ana	Xe-133	Xenon	Imaging
		Rodriguez, Ana	Tc-99m	unsealed, Sodiu	Imaging
		Rodriguez, Ana	Se-75	unsealed, Selen	Imaging
		Rodriguez, Ana	Co-57	Sealed sources	Instrument cali
		Rodriguez, Ana	Ba-133	Sealed sources	Instument calib
		Rodriguez, Ana	I-125	unsealed, Sodiu	Laboratory
		Rodriguez, Ana	I-123	unsealed, Sodiu	Imaging
?_7E10A	Yes	Tuttle, R.	S-35	dATP	in vitro studie
		Tuttle, R.	P-33	unsealed, dATP	label and seque
		Tuttle, R.	P-32	dATP(gamma & al	DNA, Kinase la
		Tuttle, R.	C-14	unsealed - Ster	RIA, dilution a
		Tuttle, R.	H-3	STEROIDS, VITAM	RIA, DILUTION A
		Tuttle, R.	I-125	NaI, LABELED ST	RIA, PROTEIN IO
		Tuttle, R.	Eu-152	sealed sources	LSC sources
		Tuttle, R.	Ra-226	sealed sources	LSC sources
?_7F53	No				
?_7Z60	Yes				
?_7Z68	Yes	Tuttle, R.	Eu-152	sealed sources	LSC sources
		Tuttle, R.	P-32	dATP(gamma & al	DNA, Kinase la
?_ELEVATORS	Yes				
?_ER	No				
?_EXITS	Yes				
?_FLOORS	Yes				
?_LOBBY	No				
?_MOBILE	No				
?_OR	No				
?_RESTROOMS	No				
?_STAIRS	Yes				
?_WD65	No				
51	No				
60-COMMON	No				
60_1004	Yes				
60_1007-A	No				
60_1007-B	No				
60_1007-C	No				
60_1009	Yes	Lanar, David	S-35	unsealed - meth	Labeling protei
		Lanar, David	P-33	unsealed, label	in vitro labell
		Lanar, David	P-32	unsealed - nucl	DNA labeling
		Lanar, David	H-3	unsealed liquid	Invitro labelin
60_1012	Yes	Lanar, David	S-35	unsealed - meth	Labeling protei
		Lanar, David	P-33	unsealed, label	in vitro labell
		Lanar, David	P-32	unsealed - nucl	DNA labeling
		Lanar, David	H-3	unsealed liquid	Invitro labelin
		Lanar, David	C-14	unsealed, Leuci	invitro labelin
60_1016	Yes	Lanar, David	S-35	unsealed - meth	Labeling protei

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Lanar, David	P-33	unsealed, label	in vitro labell
		Lanar, David	P-32	unsealed - nucl	DNA labeling
		Lanar, David	H-3	unsealed liquid	Invitro labelin
		Lanar, David	I-125	unsealed, unbou	Iodinations
40_1017	Yes	Krzych, Ursula	Cr-51	Sodium Chromate	Tissue Culture
		Krzych, Ursula	H-3	H3-Thymidine li	In vitro tissue
40_1020	Yes	Krzych, Ursula	Cr-51	Sodium Chromate	Tissue Culture
		Krzych, Ursula	H-3	H3-Thymidine li	In vitro tissue
40_1026	Yes	Matyas, Gary	S-35	Amino acids	Labeling of pro
		Matyas, Gary	P-32	Phosphate, ATP	Labeling of lip
		Matyas, Gary	C-14	Phospholipids,	Labeling of lip
		Matyas, Gary	I-125	NaI and Iodinat	Labeling of pro
		Matyas, Gary	H-3	inositol, phosp	labeling of lip
		Matyas, Gary	Cr-51	Sodium Chromate	label cells
		Matyas, Gary	Ba-133	sealed source	LSC source
40_1027	Yes	Ockenhouse, Christia	Cr-51	unsealed, Sodiu	Cytotoxic assay
		Ockenhouse, Christia	S-35	unsealed, label	Labeled amino a
		Ockenhouse, Christia	H-3	unsealed, Label	Metabolic label
		Ockenhouse, Christia	I-125	unsealed, NaI a	Radioiodination
		Ockenhouse, Christia	P-32	unsealed, ATP	DNA/RNA labelin
		Ockenhouse, Christia	P-33	Any	Medical
40_1038/40	Yes				
40_1039	Yes	Jett, Marti	P-32	ATP, inorganic	phosphorylation
		Jett, Marti	H-3	unsealed - prot	labelling
		Jett, Marti	C-14	unsealed - prot	labeling
		Jett, Marti	I-125	unsealed - NaI,	iodination of p
		Jett, Marti	Ca-45	unsealed liquid	measure calcium
		Jett, Marti	Ra-226	sealed sources	LSC sources
40_1042	Yes	Matyas, Gary	S-35	Amino acids	Labeling of pro
		Matyas, Gary	P-32	Phosphate, ATP	Labeling of lip
		Matyas, Gary	C-14	Phospholipids,	Labeling of lip
		Matyas, Gary	I-125	NaI and Iodinat	Labeling of pro
		Matyas, Gary	H-3	inositol, phosp	labeling of lip
		Matyas, Gary	Cr-51	Sodium Chromate	label cells
		Matyas, Gary	Ba-133	sealed source	LSC source
40_1042/44	Yes	Matyas, Gary	S-35	Amino acids	Labeling of pro
		Matyas, Gary	P-32	Phosphate, ATP	Labeling of lip
		Matyas, Gary	C-14	Phospholipids,	Labeling of lip
		Matyas, Gary	I-125	NaI and Iodinat	Labeling of pro
		Matyas, Gary	H-3	inositol, phosp	labeling of lip
		Matyas, Gary	Cr-51	Sodium Chromate	label cells
		Matyas, Gary	Ba-133	sealed source	LSC source
40_1046	Yes	Reid, Thomas	P-32	unsealed	
		Reid, Thomas	I-125	unsealed - NaI,	In vitro labeli
40_1049	Yes	Jett, Marti	P-32	ATP, inorganic	phosphorylation
		Jett, Marti	H-3	unsealed - prot	labelling
		Jett, Marti	C-14	unsealed - prot	labeling
		Jett, Marti	I-125	unsealed - NaI,	iodination of p
		Jett, Marti	Ca-45	unsealed liquid	measure calcium
		Jett, Marti	Ra-226	sealed sources	LSC sources

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
40_1051	Yes	Neill, Roger	C-14	unsealed liquid	For labeling of
		Neill, Roger	H-3	unsealed liquid	For Labeling of
		Neill, Roger	S-35	unsealed liquid	DNA probe, nick
		Neill, Roger	P-32	unsealed liquid	DNA probe, nick
40_1059	Yes				
40_1061	Yes				
40_1063/65	Yes				
40_1073	Yes	Reid, Thomas	P-32	unsealed	
		Reid, Thomas	I-125	unsealed - NaI,	In vitro labeli
40_2006	No				
40_2020	Yes	Jackson, Joan	Sr-90	sealed source	calibration sou
		Jackson, Joan	C-14	unsealed	radiorespiromet
		Jackson, Joan	Am-241	sealed source	calibration sou
		Jackson, Joan	C-14	sealed source	calibration of
40_2021	No				
40_2022	Yes				
40_2022A	Yes	Hartman, Antoinette	S-35	unsealed- dNTP'	sequencing
		Hartman, Antoinette	P-32	unsealed - dNTP	nick translatin
		Hartman, Antoinette	P-33	unsealed	Medical
40_2024	Yes				
40_2028	Yes				
40_2031	No				
40_2034	Yes	Putnak, J.	S-35	unsealed - amin	labeling
		Putnak, J.	C-14	unsealed-amino	labeling protei
		Putnak, J.	P-32	unsealed - Phos	labeling
40_2034/36	Yes	Putnak, J.	S-35	unsealed - amin	labeling
		Putnak, J.	C-14	unsealed-amino	labeling protei
		Putnak, J.	P-32	unsealed - Phos	labeling
40_2036	Yes	Putnak, J.	H-3	unsealed - Amin	labeling protei
		Putnak, J.	S-35	unsealed - amin	labeling
		Putnak, J.	Rb-86	unsealed - Na o	labeliong
		Putnak, J.	Ca-45	CaCl2	Radioisotope la
		Putnak, J.	I-125	unsealed - Na o	labeling
		Putnak, J.	Cs-137	sealed source	external standa
		Putnak, J.	Zn-65	unsealed - meta	labeling
		Putnak, J.	C-14	unsealed-amino	labeling protei
		Putnak, J.	P-33	unsealed - Phos	labeling
		Putnak, J.	Cr-51	unsealed Na or	labeling
		Putnak, J.	I-131	unsealed - Na o	labeling
		Putnak, J.	P-32	unsealed - Phos	labeling
40_2038/40	Yes	Putnak, J.	S-35	unsealed - amin	labeling
		Putnak, J.	C-14	unsealed-amino	labeling protei
		Putnak, J.	P-32	unsealed - Phos	labeling
40_2041/43	Yes	Putnak, J.	C-14	unsealed-amino	labeling protei
		Putnak, J.	S-35	unsealed - amin	labeling
		Putnak, J.	P-32	unsealed - Phos	labeling
40_2047	Yes	Putnak, J.	S-35	unsealed - amin	labeling
		Putnak, J.	C-14	unsealed-amino	labeling protei
		Putnak, J.	P-32	unsealed - Phos	labeling
40_2048/50	No				

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
;0_2050/48	No				
;0_2052	No				
;0_2058	Yes	Lindler, Luther	P-32	unsealed, nucle	gene sequencing
		Lindler, Luther	P-33	unsealed	DNA Sequencing
		Lindler, Luther	C-14	unsealed, prote	metabolism
		Lindler, Luther	S-35	unsealed,nucleo	gene sequencing
		Lindler, Luther	H-3	unsealed, nucle	tracer use in v
40_2059A	Yes	Hartman, Antoinette	S-35	unsealed- dNTP'	sequencing
		Hartman, Antoinette	P-32	unsealed - dNTP	nick translatin
		Hartman, Antoinette	P-33	unsealed	Medical
40_2063/65	Yes	Hartman, Antoinette	S-35	unsealed- dNTP'	sequencing
		Hartman, Antoinette	P-32	unsealed - dNTP	nick translatin
		Hartman, Antoinette	P-33	unsealed	Medical
40_2065	No				
40_2067/69	Yes				
40_2070	No				
40_2082	Yes	Tai, Yuan-Heng	C-14	unsealed - vari	perfusion studi
		Tai, Yuan-Heng	Cl-36	unsealed - HCl	perfusion studi
		Tai, Yuan-Heng	Na-24	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	Na-22	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	H-3	unsealed, vario	perfusion studi
		Tai, Yuan-Heng	Ra-226	sealed sources	LSC source
40_2086	Yes	Tai, Yuan-Heng	C-14	unsealed - vari	perfusion studi
		Tai, Yuan-Heng	Cl-36	unsealed - HCl	perfusion studi
		Tai, Yuan-Heng	Na-24	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	Na-22	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	H-3	unsealed, vario	perfusion studi
		Tai, Yuan-Heng	Ra-226	sealed sources	LSC source
40_2092	Yes	Tai, Yuan-Heng	C-14	unsealed - vari	perfusion studi
		Tai, Yuan-Heng	Cl-36	unsealed - HCl	perfusion studi
		Tai, Yuan-Heng	Na-24	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	Na-22	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	H-3	unsealed, vario	perfusion studi
		Tai, Yuan-Heng	Ra-226	sealed sources	LSC source
40_2101	Yes				
40_2103	Yes				
40_2121	Yes	Tai, Yuan-Heng	C-14	unsealed - vari	perfusion studi
		Tai, Yuan-Heng	Cl-36	unsealed - HCl	perfusion studi
		Tai, Yuan-Heng	Na-24	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	Na-22	unsealed - NaCl	perfusion studi
		Tai, Yuan-Heng	H-3	unsealed, vario	perfusion studi
		Tai, Yuan-Heng	Ra-226	sealed sources	LSC source
		Tai, Yuan-Heng	S-35	unsealed	
40_3002	Yes				
40_3004	Yes				

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
40_3006	Yes				
40_3011B	Yes				
40_3016	No				
40_3018	No				
40_3019	No				
40_3021	Yes	Pearce, Frederick	Ba-133	solid	LSC standard
		Pearce, Frederick	C-14	amino acids,car	flux and uptake
40_3024	Yes				
40_3028	Yes	Nelson, Lee	Ra-226	sealed source	LSC Rm 3041
		Nelson, Lee	C-14	unsealed - Enzy	Renal metabolis
		Nelson, Lee	I-125	unsealed - RIA	RIA analysis, R
		Nelson, Lee	H-3	unsealed - Trit	Renal distribut
		Nelson, Lee	Cs-137	sealed sources	R & D
40_3037	Yes				
40_3039	Yes	Nelson, Lee	Ra-226	sealed source	LSC Rm 3041
		Nelson, Lee	C-14	unsealed - Enzy	Renal metabolis
		Nelson, Lee	I-125	unsealed - RIA	RIA analysis, R
		Nelson, Lee	H-3	unsealed - Trit	Renal distribut
		Nelson, Lee	Cs-137	sealed sources	R & D
40_3041	Yes	Nelson, Lee	Ra-226	sealed source	LSC Rm 3041
		Nelson, Lee	C-14	unsealed - Enzy	Renal metabolis
		Nelson, Lee	I-125	unsealed - RIA	RIA analysis, R
		Nelson, Lee	H-3	unsealed - Trit	Renal distribut
		Nelson, Lee	Cs-137	sealed sources	R & D
40_3043	Yes	Nelson, Lee	Ra-226	sealed source	LSC Rm 3041
		Nelson, Lee	C-14	unsealed - Enzy	Renal metabolis
		Nelson, Lee	I-125	unsealed - RIA	RIA analysis, R
		Nelson, Lee	H-3	unsealed - Trit	Renal distribut
		Nelson, Lee	Cs-137	sealed sources	R & D
40_3045	Yes	Nelson, Lee	Ra-226	sealed source	LSC Rm 3041
		Nelson, Lee	C-14	unsealed - Enzy	Renal metabolis
		Nelson, Lee	I-125	unsealed - RIA	RIA analysis, R
		Nelson, Lee	H-3	unsealed - Trit	Renal distribut
		Nelson, Lee	Cs-137	sealed sources	R & D
40_3051	No				
40_3053	Yes	Saviolakis, George	Ra-226	sealed sources	Medical, R&D, i
		Saviolakis, George	C-14	catecholamines,	catecholamine a
		Saviolakis, George	I-125	NaI, labeled pe	radioimmunoassa

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Saviolakis, George	H-3	Catecholamines,	catecholamine t
40_3055	Yes	Anderson, Sally	H-3	Neuroactive com	IN VITRO measur
		Anderson, Sally	I-125	neuroendocrine	in vitro & in s
		Anderson, Sally	Cs-137	sealed sources	LSC source
40_3057	Yes	Yourick, Debra	S-35	unsealed, ADP b	binding studies
		Yourick, Debra	Ca-45	Neurochemicals	Radioassays
		Yourick, Debra	Cs-137	sealed	LSC check sourc
		Yourick, Debra	H-3	unsealed - neur	Radioassays
40_3061	Yes	Saviolakis, George	Ra-226	sealed sources	Medical, R&D, i
		Saviolakis, George	C-14	catecholamines,	catecholamine a
		Saviolakis, George	I-125	NaI, labeled pe	radioimmunoassa
		Saviolakis, George	H-3	Catecholamines,	catecholamine t
40_3063	Yes	Saviolakis, George	C-14	catecholamines,	catecholamine a
		Saviolakis, George	I-125	NaI, labeled pe	radioimmunoassa
		Saviolakis, George	H-3	Catecholamines,	catecholamine t
		Saviolakis, George	Ra-226	sealed sources	Medical, R&D, i
40_3065	Yes	Saviolakis, George	C-14	catecholamines,	catecholamine a
		Saviolakis, George	I-125	NaI, labeled pe	radioimmunoassa
		Saviolakis, George	H-3	Catecholamines,	catecholamine t
40_3067	Yes	Yourick, Debra	S-35	unsealed, ADP b	binding studies
		Yourick, Debra	Ca-45	Neurochemicals	Radioassays
		Yourick, Debra	Cs-137	sealed	LSC check sourc
		Yourick, Debra	H-3	unsealed - neur	Radioassays
40_3069	Yes	Yourick, Debra	S-35	unsealed, ADP b	binding studies
		Yourick, Debra	Ca-45	Neurochemicals	Radioassays
		Yourick, Debra	Cs-137	sealed	LSC check sourc
		Yourick, Debra	H-3	unsealed - neur	Radioassays
40_3074	Yes	Fisher, Carolyn	H-3	unsealed - atro	Drug metabolism
		Fisher, Carolyn	C-14	unsealed - Hip-	enzyme kinetics
		Fisher, Carolyn	P-32	unsealed - dATP	Label&sequence
		Fisher, Carolyn	S-35	unsealed - Meth	invitro studies
40_3077/9/81	Yes	Dave, Jitendra	P-32	unsealed liquid	Nucleicacid lab
		Dave, Jitendra	C-14	Chloramphenicol	HIV LTR directe
		Dave, Jitendra	H-3	unsealed - liqu	biochem. assays
40_3080	Yes	Lyon, Jeffrey	S-35	unsealed - nucl	nucleic acid la
		Lyon, Jeffrey	P-32	unsealed - nuce	nucleic acid la
		Lyon, Jeffrey	I-125	unsealed - prot	immunoassays
		Lyon, Jeffrey	C-14	protein standar	electrophoresis
		Lyon, Jeffrey	H-3	unsealed - gluc	protein labelin
		Lyon, Jeffrey	P-33	unsealed	DNA assays
		Lyon, Jeffrey	Ra-226	sealed sources	Instr check, ca
		Lyon, Jeffrey	Cr-51	unsealed	Assays
40_3111	Yes	Anderson, Sally	H-3	Neuroactive com	IN VITRO measur
		Anderson, Sally	C-14	neurotransmitte	substrates used
		Anderson, Sally	I-125	neuroendocrine	in vitro & in s
		Anderson, Sally	Cs-137	sealed sources	LSC source
40_3117	Yes	Gist, Irene	C-14	unsealed - vari	Radiochemical a
		Gist, Irene	Na-22	NaCl	Uptake assays
		Gist, Irene	H-3	unsealed - atro	radioimmunoassa
		Gist, Irene	I-131	unsealed - NaI	In Vitro studie

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Gist, Irene	I-125	unsealed - NaI	iodinations, ra
		Gist, Irene	S-35	Labeled precurs	identify and qu
		Gist, Irene	Cs-137	sealed sources	LSC source
40_3119	Yes	Fisher, Carolyn	C-14	unsealed - Hip-	enzyme kinetics
		Fisher, Carolyn	P-32	unsealed - dATP	Label&sequence
		Fisher, Carolyn	S-35	unsealed - Meth	invitro studies
40_3119A	Yes	Fisher, Carolyn	C-14	unsealed - Hip-	enzyme kinetics
		Fisher, Carolyn	P-32	unsealed - dATP	Label&sequence
		Fisher, Carolyn	S-35	unsealed - Meth	invitro studies
40_4010	Yes				
40_B020	Yes	Hartman, Antoinette	S-35	unsealed- dNTP'	sequencing
		Hartman, Antoinette	P-32	unsealed - dNTP	nick translatin
		Hartman, Antoinette	P-33	unsealed	Medical
40_B026	Yes	Gentry, Mary	C-14	unsealed - vari	protein labelin
		Gentry, Mary	H-3	unsealed - vari	protein and nuc
		Gentry, Mary	I-125	unsealed, NaI	Protein labelin
		Gentry, Mary	P-32	ATP, unsealed	Nucleotide labe
40_B035	Yes	Jett, Marti	P-32	ATP, inorganic	phosphorylation
		Jett, Marti	H-3	unsealed - prot	labelling
		Jett, Marti	C-14	unsealed - prot	labeling
		Jett, Marti	I-125	unsealed - NaI,	iodination of p
		Jett, Marti	Ca-45	unsealed liquid	measure calcium
		Jett, Marti	Ra-226	sealed sources	LSC sources
40_B036	Yes	Gordon, Richard	Ba-133	LSC Source	Medical
		Gordon, Richard	C-14	any	Medical
		Gordon, Richard	Ca-45	Any	Medical
		Gordon, Richard	H-3	any	Medical
		Gordon, Richard	I-125	any	Medical
		Gordon, Richard	Na-22	Any	Medical, R&D
		Gordon, Richard	P-32	any	Medical
		Gordon, Richard	Ra-226	sealed sources	Medical, R&D, i
		Gordon, Richard	S-35	any	Medical
40_B038/40	Yes	Gordon, Richard	Ba-133	LSC Source	Medical
		Gordon, Richard	C-14	any	Medical
		Gordon, Richard	Ca-45	Any	Medical
		Gordon, Richard	H-3	any	Medical
		Gordon, Richard	I-125	any	Medical
		Gordon, Richard	Na-22	Any	Medical, R&D
		Gordon, Richard	P-32	any	Medical
		Gordon, Richard	Ra-226	sealed sources	Medical, R&D, i
		Gordon, Richard	S-35	any	Medical
40_B045	Yes	Gentry, Mary	C-14	unsealed - vari	protein labelin
		Gentry, Mary	H-3	unsealed - vari	protein and nuc
		Gentry, Mary	I-125	unsealed, NaI	Protein labelin
		Gentry, Mary	P-32	ATP, unsealed	Nucleotide labe
40_B053	Yes	Chiang, Peter	I-125	unsealed - amin	metaolic, enzym
		Chiang, Peter	P-32	unsealed - lipi	metaolic, enzym
		Chiang, Peter	Na-22	Unsealed liquid	Cell labeling a
		Chiang, Peter	H-3	unsealed - prot	metaolic, enzym
		Chiang, Peter	C-14	unsealed - prot	metaolic, enzym

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Chiang, Peter	Ca-45	unsealed, liqui	Medical
		Chiang, Peter	S-35	unsealed - prot	metaolic, enzym
		Chiang, Peter	Ba-133	sealed source	LSC source
		Chiang, Peter	Ra-226	sealed sources	LSC source
0_B053/55	Yes	Chiang, Peter	I-125	unsealed - amin	metaolic, enzym
		Chiang, Peter	P-32	unsealed - lipi	metaolic, enzym
		Chiang, Peter	Na-22	Unsealed liquid	Cell labeling a
		Chiang, Peter	H-3	unsealed - prot	metaolic, enzym
		Chiang, Peter	C-14	unsealed - prot	metaolic, enzym
		Chiang, Peter	Ca-45	unsealed, liqui	Medical
		Chiang, Peter	S-35	unsealed - prot	metaolic, enzym
		Chiang, Peter	Ba-133	sealed source	LSC source
		Chiang, Peter	Ra-226	sealed sources	LSC source
0_B057	Yes	Matyas, Gary	S-35	Amino acids	Labeling of pro
		Matyas, Gary	P-32	Phosphate, ATP	Labeling of lip
		Matyas, Gary	C-14	Phospholipids,	Labeling of lip
		Matyas, Gary	I-125	NaI and Iodinat	Labeling of pro
		Matyas, Gary	H-3	inositol, phosp	labeling of lip
		Matyas, Gary	Cr-51	Sodium Chromate	label cells
		Matyas, Gary	Ba-133	sealed source	LSC source
0_B063	Yes	Chiang, Peter	I-125	unsealed - amin	metaolic, enzym
		Chiang, Peter	P-32	unsealed - lipi	metaolic, enzym
		Chiang, Peter	Na-22	Unsealed liquid	Cell labeling a
		Chiang, Peter	H-3	unsealed - prot	metaolic, enzym
		Chiang, Peter	C-14	unsealed - prot	metaolic, enzym
		Chiang, Peter	Ca-45	unsealed, liqui	Medical
		Chiang, Peter	S-35	unsealed - prot	metaolic, enzym
		Chiang, Peter	Ba-133	sealed source	LSC source
		Chiang, Peter	Ra-226	sealed sources	LSC source
0_B075	No				
0_B079	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M-6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
0_B097	Yes				
0_B099	Yes	Griffea, Tanya	Co-60	Sealed source	AECL Gammacell
		Griffea, Tanya	Cs-137	Sealed source	AECL Gammacell
		Griffea, Tanya	U-DEPL	Plated metal	Attenuators
0_B204	Yes	Dave, Jitendra	P-32	unsealed liquid	Nucleicacid lab
		Dave, Jitendra	C-14	Chloramphenicol	HIV LTR directe
		Dave, Jitendra	H-3	unsealed - liqu	biochem. assays

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
40_B205	Yes	Gordon, Richard	S-35	any	Medical
		Gordon, Richard	P-32	any	Medical
40_ELEVATORS	No				
40_EXITS	Yes				
40_FLOORS	Yes				
40_LOBBY	Yes				
40_RESTROOMS	Yes				
40_SB1	Yes	Gentry, Mary	C-14	unsealed - vari	protein labelin
		Gentry, Mary	H-3	unsealed - vari	protein and nuc
		Gentry, Mary	I-125	unsealed, NaI	Protein labelin
		Gentry, Mary	P-32	ATP, unsealed	Nucleotide labe
40_STAIRS	No				
40_VENDING	Yes				
41_39	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M 6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
41_42	Yes	Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	H-3	Any	R & D
		Burton, David	I-125	any	Medical
		Burton, David	C-14	any	Medical
		Burton, David	Na-22	Any	Medical, R&D
		Burton, David	P-32	any	Medical
		Burton, David	S-35	any	Medical
		Burton, David	Ca-45	Any	Medical
		Burton, David	Mn-54	Any	Medical
		Burton, David	Cd-109	Any	Medical
		Burton, David	Ce-141	Any	Medical
		Burton, David	Cl-36	Any	Medical
		Burton, David	Cr-51	any	Medical
		Burton, David	Fe-59	Any	Medical
		Burton, David	Ga-67	Any	Medical, R&D
		Burton, David	Gd-153	sealed sources	Medical
		Burton, David	I-123	Any	Medical, R&D
		Burton, David	I-125	AECL or Amersha	Medical
		Burton, David	I-129	Any	Medical
		Burton, David	I-131	any	Medical
		Burton, David	In-111	Any	Medical, R&D
		Burton, David	Ir-192	any	Medical
		Burton, David	Mo-99	Any	Medical
		Burton, David	Nb-95	Any	Medical

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burton, David	P-33	Any	Medical
		Burton, David	Rb-86	Any	Medical, R&D
		Burton, David	Ru-103	Any	Medical
		Burton, David	Sb-125	Any	Medical
		Burton, David	Sc-46	Any	Medical
		Burton, David	Se-75	Any	Medical
		Burton, David	Sr-85	Any	Medical
		Burton, David	Sr-89	Any	Medical
		Burton, David	Ta-182	Any	Medical
		Burton, David	Tl-201	Any	Medical, R&D
		Burton, David	Xe-127	Any	Medical, R&D
		Burton, David	Xe-133	any	Medical
		Burton, David	Yb-169	Any	Medical
		Burton, David	Zn-65	Any	Medical
		Burton, David	U-NAT	Any	Research
		Burton, David	Tc-99m	any	Medical
41_DOOR	Yes				
454	No				
455	No				
500_11	Yes				
500_1B-1	Yes				
500_30	Yes	Peggins, James	Ba-133	sealed source,	Packard Tri-car
		Peggins, James	C-14	unsealed, Organ	Drug metabolism
		Peggins, James	H-3	unsealed, Organ	Analytical meth
500_31	Yes	Peggins, James	Ba-133	sealed source,	Packard Tri-car
		Peggins, James	C-14	unsealed, Organ	Drug metabolism
		Peggins, James	H-3	unsealed, Organ	Analytical meth
500_34	Yes	Zamani, Kaveh	H-3	any	Research Medica
		Zamani, Kaveh	C-14	any	Medical Researc
500_35	Yes	Karle, Jean	H-3	Organic compoun	Receptor bindin
		Karle, Jean	C-14	Organic compoun	Drug metabolism
		Karle, Jean	Ra-226	sealed souce, e	LKB 1217 Rackbe
500_37	Yes	Karle, Jean	H-3	Organic compoun	Receptor bindin
		Karle, Jean	C-14	Organic compoun	Drug metabolism
		Karle, Jean	Ra-226	sealed souce, e	LKB 1217 Rackbe
500_38	Yes	Ray, Prabhati	H-3	unsealed - QNB	receptor bindin
		Ray, Prabhati	C-14	unsealed - L-va	protein labelin
		Ray, Prabhati	I-125	unsealed - RIA	cAMP
		Ray, Prabhati	Ra-226	sealed sources	Medical, R&D, i
500_39	Yes	Karle, Jean	H-3	Organic compoun	Receptor bindin
		Karle, Jean	C-14	Organic compoun	Drug metabolism
		Karle, Jean	Ra-226	sealed souce, e	LKB 1217 Rackbe
500_40	Yes	Peggins, James	C-14	unsealed, Organ	Drug metabolism
500_41	Yes	Karle, Jean	H-3	Organic compoun	Receptor bindin
		Karle, Jean	C-14	Organic compoun	Drug metabolism
		Karle, Jean	Ra-226	sealed souce, e	LKB 1217 Rackbe
500_41A	Yes	Peggins, James	C-14	unsealed, Organ	Drug metabolism

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
500_42	Yes				
500_63	Yes				
500_66	Yes				
500_67	Yes	Jackson, Joan	Sr-90	sealed source	calibration sou
		Jackson, Joan	C-14	unsealed	radiorespiromet
		Jackson, Joan	Am-241	sealed source	calibration sou
		Jackson, Joan	C-14	sealed source	calibration of
500_68	Yes	Hudson, Thomas	H-3	Organic Compoun	In Vitro protei
		Hudson, Thomas	Ra-226	External sealed	Packard 3320 li
		Hudson, Thomas	S-35	unsealed, Methi	DNA sequencing,
		Hudson, Thomas	Sb-125	Antimony Trichl	In vitro labell
		Hudson, Thomas	P-32	Organic Cpd	In vitro labell
		Hudson, Thomas	Ba-133	Sealed source,	Searle Delta 30
500_69	Yes	Hudson, Thomas	H-3	Organic Compoun	In Vitro protei
		Hudson, Thomas	Ra-226	External sealed	Packard 3320 li
		Hudson, Thomas	S-35	unsealed, Methi	DNA sequencing,
		Hudson, Thomas	P-32	Organic Cpd	In vitro labell
		Hudson, Thomas	Ba-133	Sealed source,	Searle Delta 30
		Hudson, Thomas	P-33	Unsealed Tripho	Med. Research
		Hudson, Thomas	Cs-137	sealed sources	R & D
500_71	Yes				
500_71A	Yes				
500_72	Yes	Hudson, Thomas	H-3	Organic Compoun	In Vitro protei
		Hudson, Thomas	Ra-226	External sealed	Packard 3320 li
		Hudson, Thomas	S-35	unsealed, Methi	DNA sequencing,
		Hudson, Thomas	Sb-125	Antimony Trichl	In vitro labell
		Hudson, Thomas	P-32	Organic Cpd	In vitro labell
		Hudson, Thomas	Ba-133	Sealed source,	Searle Delta 30
500_74	Yes				
500_75	Yes	Ray, Prabhati	P-32	unsealed labele	Botulinum Toxin
		Ray, Prabhati	Ca-45	unsealed - CaCl	uptake by cells
		Ray, Prabhati	H-3	unsealed - QNB	receptor bindin
		Ray, Prabhati	C-14	unsealed - L-va	protein labelin
		Ray, Prabhati	I-125	unsealed - RIA	cAMP
500_B-1	Yes	Ray, Prabhati	H-3	unsealed - QNB	receptor bindin
		Ray, Prabhati	C-14	unsealed - L-va	protein labelin
		Ray, Prabhati	I-125	unsealed - RIA	cAMP
500_B1-1	No				
500_EXITS	No				
500_FLOORS	No				
500_HALL_1	Yes				
500_HALL_2	Yes				
500_SB1	No				
506	Yes	Mayorga, Maria	Ra-226	sealed source -	LSC source
508_106	Yes				
508_108A	Yes				
511_132E	No				
513	Yes				
516	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M 6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
		Burton, David	Cs-137	Any	Medical
		Burton, David	H-3	Any	R & D
		Burton, David	I-125	any	Medical
		Burton, David	C-14	any	Medical
		Burton, David	Na-22	Any	Medical, R&D
		Burton, David	P-32	any	Medical
		Burton, David	S-35	any	Medical
		Burton, David	Ca-45	Any	Medical
		Burton, David	Mn-54	Any	Medical
		Burton, David	Tl-204	Any	Medical
		Burton, David	Cd-109	Any	Medical
		Burton, David	Ce-141	Any	Medical
		Burton, David	Cl-36	Any	Medical
		Burton, David	Cr-51	any	Medical
		Burton, David	Fe-59	Any	Medical
		Burton, David	Ga-67	Any	Medical, R&D
		Burton, David	Gd-153	sealed sources	Medical
		Burton, David	I-123	Any	Medical, R&D
		Burton, David	I-125	AECL or Amersha	Medical
		Burton, David	I-129	Any	Medical
		Burton, David	I-131	any	Medical
		Burton, David	In-111	Any	Medical, R&D
		Burton, David	Ir-192	any	Medical
		Burton, David	Mo-99	Any	Medical
		Burton, David	Nb-95	Any	Medical
		Burton, David	P-33	Any	Medical
		Burton, David	Rb-86	Any	Medical, R&D
		Burton, David	Ru-103	Any	Medical
		Burton, David	Sb-125	Any	Medical
		Burton, David	Sc-46	Any	Medical
		Burton, David	Se-75	Any	Medical
		Burton, David	Sr-85	Any	Medical
		Burton, David	Sr-89	Any	Medical
		Burton, David	Ta-182	Any	Medical
		Burton, David	Tl-201	Any	Medical, R&D
		Burton, David	Xe-127	Any	Medical, R&D
		Burton, David	Xe-133	any	Medical
		Burton, David	Yb-169	Any	Medical
		Burton, David	Zn-65	Any	Medical

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burton, David	U-NAT	Any	Research
		Burton, David	Tc-99m	any	Medical
516-LOWER	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
		Burton, David	Cs-137	Any	Medical
		Burton, David	H-3	Any	R & D
		Burton, David	I-125	any	Medical
		Burton, David	C-14	any	Medical
		Burton, David	Na-22	Any	Medical, R&D
		Burton, David	P-32	any	Medical
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	S-35	any	Medical
		Burton, David	Ca-45	Any	Medical
		Burton, David	Mn-54	Any	Medical
		Burton, David	Tl-204	Any	Medical
		Burton, David	Cd-109	Any	Medical
		Burton, David	Ce-141	Any	Medical
		Burton, David	Cl-36	Any	Medical
		Burton, David	Cr-51	any	Medical
		Burton, David	Fe-59	Any	Medical
		Burton, David	Ga-67	Any	Medical, R&D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Gd-153	sealed sources	Medical
		Burton, David	I-123	Any	Medical, R&D
		Burton, David	I-125	AECL or Amersha	Medical
		Burton, David	I-129	Any	Medical
		Burton, David	I-131	any	Medical
		Burton, David	In-111	Any	Medical, R&D
		Burton, David	Ir-192	any	Medical
		Burton, David	Mo-99	Any	Medical
		Burton, David	Nb-95	Any	Medical
		Burton, David	P-33	Any	Medical
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	Rb-86	Any	Medical, R&D
		Burton, David	Ru-103	Any	Medical
		Burton, David	Sb-125	Any	Medical
		Burton, David	Sc-46	Any	Medical
		Burton, David	Se-75	Any	Medical
		Burton, David	Sr-85	Any	Medical
		Burton, David	Sr-89	Any	Medical
		Burton, David	Ta-182	Any	Medical
		Burton, David	Tl-201	Any	Medical, R&D
		Burton, David	Xe-127	Any	Medical, R&D
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Xe-133	any	Medical
		Burton, David	Yb-169	Any	Medical

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burton, David	Zn-65	Any	Medical
		Burton, David	U-NAT	Any	Research
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M 6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
516-MAIN	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
		Burton, David	Cs-137	Any	Medical
		Burton, David	H-3	Any	R & D
		Burton, David	I-125	any	Medical
		Burton, David	C-14	any	Medical
		Burton, David	Na-22	Any	Medical, R&D
		Burton, David	P-32	any	Medical
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	S-35	any	Medical
		Burton, David	Ca-45	Any	Medical
		Burton, David	Mn-54	Any	Medical
		Burton, David	Tl-204	Any	Medical
		Burton, David	Cd-109	Any	Medical
		Burton, David	Ce-141	Any	Medical
		Burton, David	Cl-36	Any	Medical
		Burton, David	Cr-51	any	Medical
		Burton, David	Fe-59	Any	Medical
		Burton, David	Ga-67	Any	Medical, R&D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Gd-153	sealed sources	Medical
		Burton, David	I-123	Any	Medical, R&D
		Burton, David	I-125	AECL or Amersha	Medical
		Burton, David	I-129	Any	Medical
		Burton, David	I-131	any	Medical
		Burton, David	In-111	Any	Medical, R&D
		Burton, David	Ir-192	any	Medical
		Burton, David	Mo-99	Any	Medical
		Burton, David	Nb-95	Any	Medical
		Burton, David	P-33	Any	Medical
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	Rb-86	Any	Medical, R&D
		Burton, David	Ru-103	Any	Medical
		Burton, David	Sb-125	Any	Medical
		Burton, David	Sc-46	Any	Medical
		Burton, David	Se-75	Any	Medical
		Burton, David	Sr-85	Any	Medical
		Burton, David	Sr-89	Any	Medical
		Burton, David	Ta-182	Any	Medical
		Burton, David	Tl-201	Any	Medical, R&D

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burton, David	Xe-127	Any	Medical, R&D
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Xe-133	any	Medical
		Burton, David	Yb-169	Any	Medical
		Burton, David	Zn-65	Any	Medical
		Burton, David	U-NAT	Any	Research
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M 6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
516-MEZZAINE	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
		Burton, David	Cs-137	Any	Medical
		Burton, David	H-3	Any	R & D
		Burton, David	I-125	any	Medical
		Burton, David	C-14	any	Medical
		Burton, David	Na-22	Any	Medical, R&D
		Burton, David	P-32	any	Medical
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	S-35	any	Medical
		Burton, David	Ca-45	Any	Medical
		Burton, David	Mn-54	Any	Medical
		Burton, David	Tl-204	Any	Medical
		Burton, David	Cd-109	Any	Medical
		Burton, David	Ce-141	Any	Medical
		Burton, David	Cl-36	Any	Medical
		Burton, David	Cr-51	any	Medical
		Burton, David	Fe-59	Any	Medical
		Burton, David	Ga-67	Any	Medical, R&D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Gd-153	sealed sources	Medical
		Burton, David	I-123	Any	Medical, R&D
		Burton, David	I-125	AECL or Amersha	Medical
		Burton, David	I-129	Any	Medical
		Burton, David	I-131	any	Medical
		Burton, David	In-111	Any	Medical, R&D
		Burton, David	Ir-192	any	Medical
		Burton, David	Mo-99	Any	Medical
		Burton, David	Nb-95	Any	Medical
		Burton, David	P-33	Any	Medical
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	Rb-86	Any	Medical, R&D
		Burton, David	Ru-103	Any	Medical
		Burton, David	Sb-125	Any	Medical
		Burton, David	Sc-46	Any	Medical
		Burton, David	Se-75	Any	Medical

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burton, David	Sr-85	Any	Medical
		Burton, David	Sr-89	Any	Medical
		Burton, David	Ta-182	Any	Medical
		Burton, David	Tl-201	Any	Medical, R&D
		Burton, David	Xe-127	Any	Medical, R&D
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Xe-133	any	Medical
		Burton, David	Yb-169	Any	Medical
		Burton, David	Zn-65	Any	Medical
		Burton, David	U-NAT	Any	Research
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M 6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
516-TRUCK	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
		Burton, David	Cs-137	Any	Medical
		Burton, David	H-3	Any	R & D
		Burton, David	I-125	any	Medical
		Burton, David	C-14	any	Medical
		Burton, David	Na-22	Any	Medical, R&D
		Burton, David	P-32	any	Medical
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	S-35	any	Medical
		Burton, David	Ca-45	Any	Medical
		Burton, David	Mn-54	Any	Medical
		Burton, David	Tl-204	Any	Medical
		Burton, David	Cd-109	Any	Medical
		Burton, David	Ce-141	Any	Medical
		Burton, David	Cl-36	Any	Medical
		Burton, David	Cr-51	any	Medical
		Burton, David	Fe-59	Any	Medical
		Burton, David	Ga-67	Any	Medical, R&D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Gd-153	sealed sources	Medical
		Burton, David	I-123	Any	Medical, R&D
		Burton, David	I-125	AECL or Amersha	Medical
		Burton, David	I-129	Any	Medical
		Burton, David	I-131	any	Medical
		Burton, David	In-111	Any	Medical, R&D
		Burton, David	Ir-192	any	Medical
		Burton, David	Mo-99	Any	Medical
		Burton, David	Nb-95	Any	Medical
		Burton, David	P-33	Any	Medical
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	Rb-86	Any	Medical, R&D

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burton, David	Ru-103	Any	Medical
		Burton, David	Sb-125	Any	Medical
		Burton, David	Sc-46	Any	Medical
		Burton, David	Se-75	Any	Medical
		Burton, David	Sr-85	Any	Medical
		Burton, David	Sr-89	Any	Medical
		Burton, David	Ta-182	Any	Medical
		Burton, David	Tl-201	Any	Medical, R&D
		Burton, David	Xe-127	Any	Medical, R&D
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Xe-133	any	Medical
		Burton, David	Yb-169	Any	Medical
		Burton, David	Zn-65	Any	Medical
		Burton, David	U-NAT	Any	Research
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M 6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
516_LOWER	No				
516_MAIN	No				
516_TRUCK	No				
525_1	No				
525_2	No				
525_3	No				
528_7	No				
528_D3	No				
528_D3A	No				
528_D9	No				
53_B010	No				
54	No				
54_1030	No				
54_2008	Yes	Farb, Andrew	Mn-52	solid, stents	tissue mounting
		Farb, Andrew	Co-56	solid, stents	tissue mounting
54_2056	No				
54_2072	Yes	Taubenberger, Jeffer	P-32	liquid	in vitro labeli
		Taubenberger, Jeffer	C-14	Chloramphenicol	Regulation of H
		Taubenberger, Jeffer	S-35	liquid	in vitro labeli
		Taubenberger, Jeffer	P-33	unsealed, liqui	in vitro labeli
54_3002	Yes	Fishbein, William	C-14	unsealed	metabolic studi
		Fishbein, William	H-3	Unsealed (no th	metabolic studi
		Fishbein, William	S-35	unsealed	Metabolic studi
		Fishbein, William	P-32	unsealed, Cytid	Muscle Enzyme m
		Fishbein, William	Ba-133	sealed source	LSC source
54_3008HALL	Yes				
54_3012	Yes	Burke, Allen	S-35	unsealed uracil	RNA labeling
		Burke, Allen	H-3	unsealed, label	Atherosclerotic
		Burke, Allen	P-32	unsealed	In-situ Hybridi
		Farb, Andrew	H-3	unsealed, Liqui	endothelial tox
		Farb, Andrew	P-33	unsealed	in-situ hybridi
54_3014	Yes	Burke, Allen	S-35	unsealed uracil	RNA labeling

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Burke, Allen	H-3	unsealed, label	Atherosclerotic
		Burke, Allen	P-32	unsealed	In-situ Hybridi
54_3030	No				
54_3041	No				
54_3043	No				
54_3045	No				
54_3050	No				
54_3060	Yes	Taubenberger, Jeffer	P-32	liquid	in vitro labeli
		Taubenberger, Jeffer	C-14	Chloramphenicol	Regulation of H
		Taubenberger, Jeffer	S-35	liquid	in vitro labeli
		Taubenberger, Jeffer	P-33	unsealed, liqui	in vitro labeli
54_3061	No				
54_3063	No				
54_3066	No				
54_3067	No				
54_3099	Yes	Taubenberger, Jeffer	P-32	liquid	in vitro labeli
		Taubenberger, Jeffer	C-14	Chloramphenicol	Regulation of H
		Taubenberger, Jeffer	S-35	liquid	in vitro labeli
		Taubenberger, Jeffer	P-33	unsealed, liqui	in vitro labeli
54_3100	Yes	Taubenberger, Jeffer	P-32	liquid	in vitro labeli
		Taubenberger, Jeffer	C-14	Chloramphenicol	Regulation of H
		Taubenberger, Jeffer	S-35	liquid	in vitro labeli
		Taubenberger, Jeffer	P-33	unsealed, liqui	in vitro labeli
54_3102	Yes	Taubenberger, Jeffer	P-32	liquid	in vitro labeli
		Taubenberger, Jeffer	C-14	Chloramphenicol	Regulation of H
		Taubenberger, Jeffer	S-35	liquid	in vitro labeli
		Taubenberger, Jeffer	P-33	unsealed, liqui	in vitro labeli
54_3112	Yes	Taubenberger, Jeffer	P-32	liquid	in vitro labeli
		Taubenberger, Jeffer	C-14	Chloramphenicol	Regulation of H
		Taubenberger, Jeffer	S-35	liquid	in vitro labeli
		Taubenberger, Jeffer	P-33	unsealed, liqui	in vitro labeli
54_4002	Yes				
54_4004A	Yes	Lo, Shyh-Ching	S-35	unsealed - dATP	in vitro labeli
		Lo, Shyh-Ching	C-14	unsealed - amin	Antigen studies
		Lo, Shyh-Ching	P-32	unsealed - dATP	in vitro DNA la
		Lo, Shyh-Ching	Cr-51	unsealed - sodi	cell mediated c
		Lo, Shyh-Ching	I-125	I-125-Protein A	In vitro DNA la
		Lo, Shyh-Ching	H-3	unsealed - trit	lymphocyte tran
		Lo, Shyh-Ching	Ra-226	sealed sources	LSC source
54_4006	Yes	Lo, Shyh-Ching	S-35	unsealed - dATP	in vitro labeli
		Lo, Shyh-Ching	C-14	unsealed - amin	Antigen studies
		Lo, Shyh-Ching	P-32	unsealed - dATP	in vitro DNA la
		Lo, Shyh-Ching	Cr-51	unsealed - sodi	cell mediated c
		Lo, Shyh-Ching	I-125	I-125-Protein A	In vitro DNA la
		Lo, Shyh-Ching	H-3	unsealed - trit	lymphocyte tran
		Lo, Shyh-Ching	Ra-226	sealed sources	LSC source
54_4008_A_B	Yes	Busch, David	H-3	unsealed, Thymi	DNA labeling
		Busch, David	C-14	unsealed, Thymi	Cell labeling
54_4032	Yes				
54_4064	Yes	Lo, Shyh-Ching	S-35	unsealed - dATP	in vitro labeli

.ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
		Lo, Shyh-Ching	C-14	unsealed - amin	Antigen studies
		Lo, Shyh-Ching	P-32	unsealed - dATP	in vitro DNA la
		Lo, Shyh-Ching	Cr-51	unsealed - sodi	cell mediated c
		Lo, Shyh-Ching	I-125	I-125-Protein A	In vitro DNA la
		Lo, Shyh-Ching	H-3	unsealed - trit	lymphocyte tran
		Lo, Shyh-Ching	Ra-226	sealed sources	LSC source
54_4086	Yes	Lo, Shyh-Ching	S-35	unsealed - dATP	in vitro labeli
		Lo, Shyh-Ching	C-14	unsealed - amin	Antigen studies
		Lo, Shyh-Ching	P-32	unsealed - dATP	in vitro DNA la
		Lo, Shyh-Ching	Cr-51	unsealed - sodi	cell mediated c
		Lo, Shyh-Ching	I-125	I-125-Protein A	In vitro DNA la
		Lo, Shyh-Ching	H-3	unsealed - trit	lymphocyte tran
		Lo, Shyh-Ching	Ra-226	sealed sources	LSC source
54_4100	Yes	Lo, Shyh-Ching	P-32	unsealed - dATP	in vitro DNA la
		Lo, Shyh-Ching	S-35	unsealed - dATP	in vitro labeli
		Lo, Shyh-Ching	C-14	unsealed - amin	Antigen studies
		Lo, Shyh-Ching	Cr-51	unsealed - sodi	cell mediated c
		Lo, Shyh-Ching	I-125	I-125-Protein A	In vitro DNA la
		Lo, Shyh-Ching	H-3	unsealed - trit	lymphocyte tran
54_4106	Yes	Lo, Shyh-Ching	S-35	unsealed - dATP	in vitro labeli
		Lo, Shyh-Ching	C-14	unsealed - amin	Antigen studies
		Lo, Shyh-Ching	P-32	unsealed - dATP	in vitro DNA la
		Lo, Shyh-Ching	Cr-51	unsealed - sodi	cell mediated c
		Lo, Shyh-Ching	I-125	I-125-Protein A	In vitro DNA la
		Lo, Shyh-Ching	H-3	unsealed - trit	lymphocyte tran
		Lo, Shyh-Ching	Ra-226	sealed sources	LSC source
54_5003	Yes	Farb, Andrew	P-32	sealed stents	research
54_5005	Yes				
54_5007	Yes	Farb, Andrew	P-32	sealed stents	research
54_5047	Yes	Farb, Andrew	P-32	sealed stents	research
54_5050	Yes	Farb, Andrew	P-32	sealed stents	research
54_5051	No				
54_B045	No				
54_B063	No				
54_B065	No				
54_B067	No				
54_B088	Yes	Farb, Andrew	H-3	unsealed, Liqui	endothelial tox
		Farb, Andrew	I-125	unsealed, Ria l	lewkocyte label
		Farb, Andrew	P-33	unsealed	in-situ hybridi
54_EXITS	Yes				
54_FLOORS	No				
54_G014	Yes	Kulesh, David	Sr-85	Microspheres, u	Blood flow stud
		Kulesh, David	Sc-46	Microspheres, u	Blood flow stud
		Kulesh, David	Ce-141	Microspheres, u	Blood flow stud
54_G075	Yes	Kulesh, David	S-35	unsealed, methi	Labeling and Se
		Kulesh, David	P-32	unsealed, dNTP	Labeling
		Kulesh, David	P-33	unsealed, dNTP	Labeling
		Kulesh, David	H-3	unsealed, Thymi	Labeling
54_M093	Yes	Kalasinsky, Victor	Ni-63	sealed, solid (	Electron Captur
54_RESTROOMS	Yes				

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
54_STARIS	Yes				
56_5	No				
58_1XB	No				
610_XRAY	No				
660_4100	No				
75	No				
7_209	Yes				
7_211	Yes				
7_216	Yes				
7_218	Yes				
7_31	Yes	Abdelrahim, Maged	Eu-152	sealed sources	LSC source R &
7_35	Yes				
7_G19	Yes				
7_G34	Yes				
7_G35	Yes				
7_MOBILE	No				
808_03	No				
808_04	No				
808_05	No				
808_06	No				
808_07	No				
808_08	No				
808_09	No				
808_108	No				
808_MAMMO1	No				
808_MAMMO2	No				
808_MOBILE_"C"	No				
808_MOBL_0	No				
85_XRAY	No				
90	No				
91_22	Yes	Peguese, James	H-3	sealed source	Portable Gas Ch
A	No				
AFRRI_1	No				
ANDREWS_MAMMO1	No				
ANDREWS_MAMMO2	No				
ANDREWS_MAMMO3	No				
CDRH	No				
DORE_XRAY	No				
DUNHAM_404	No				
DUNHAM_409	No				
DUNHAM_507	No				
DUNHAM_512	No				
EPES_121	No				
EPES_122	No				
EPES_152	No				
FT._MEADE	No				
FTINDIANTOWN_01	No				
FTLEE_01	No				
FTLEE_02	No				
FTLEE_3RD_FLOOR	No				

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
FTLEE_M20	No				
FTLEE_M22	No				
FT_LEE	No				
GILLETTE	No				
GILLETTE_1097	No				
GILLETTE_14	No				
GILLETTE_2047	No				
GILT_1066	Yes	Hess, John	Cr-51	liquid	Medical/Researc
		Hess, John	Tc-99m	liquid	Medical/Researc
		Hess, John	I-129	sealed sources	Calibration
		Hess, John	Cs-137	sealed sources	Calibration
		Hess, John	Co-57	sealed sources	Calibration
		Hess, John	I-125	samples for cou	R&D
GILT_1082	Yes	Hess, John	Cr-51	liquid	Medical/Researc
		Hess, John	Tc-99m	liquid	Medical/Researc
		Hess, John	I-129	sealed sources	Calibration
		Hess, John	Cs-137	sealed sources	Calibration
		Hess, John	Co-57	sealed sources	Calibration
		Hess, John	I-125	samples for cou	R&D
GILT_2143	Yes	Bosy, Thomas	I-125	unsealed, Drugs	Drug screening
		Bosy, Thomas	I-129	sealed source,	Gamma counter r
GILT_EXITS	Yes				
GILT_FLOORS	Yes				
HOSP_B122	No				
HOSP_MN09	No				
HOSP_MN13	No				
KELLER_MAMMO	No				
LETTERKENNEY_44	No				
MEDDAC_EUSTIS_2	No				
MEDDAC_EUSTIS_M	No				
MEDDAC_FTMONMON	No				
MEDDAC_FT_BELVO	No				
MEPS_PITT_44	No				
PENT	No				
PENT_1	No				
PENT_1B929	No				
PENT_2	No				
PENT_3A948	No				
PENT_D15	No				
PENT_D18	No				
PENT_HELIPR	No				
PENT_MALL	No				
PENT_METRO	No				
PENT_NPARK	No				
PENT_PANO	No				
PENT_RIVER	No				
PENT_SPARK	No				
PENT_SUITE3	No				
PENT_SUITE4	No				
PENT_SUITE6	No				

ocation	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
ENT_TOURS	No				
ADER_2	No				
ADER_3	No				
OCK_10	Yes	Michael, Nelson	C-14	unsealed, ehlor	transferance as
		Michael, Nelson	P-32	unsealed, CTP,	DNA labeling, p
		Michael, Nelson	S-35	unsealed, methi	labeling of cel
OCK_11	Yes	Michael, Nelson	C-14	unsealed, ehlor	transferance as
		Michael, Nelson	S-35	unsealed, methi	labeling of cel
		Michael, Nelson	H-3	unsealed, any	Medical
OCK_14	Yes	Kim (Ratto), Silvia	Cr-51	Sodium Chromate	Cytotoxic assay
		Kim (Ratto), Silvia	H-3	Thymidine, aque	DNA incorporati
		Kim (Ratto), Silvia	P-32	unsealed, bound	R&D
OCK_15	Yes	Kim (Ratto), Silvia	Cr-51	Sodium Chromate	Cytotoxic assay
		Kim (Ratto), Silvia	H-3	Thymidine, aque	DNA incorporati
		Kim (Ratto), Silvia	Cs-137	sealed sources	LSC Standard
OCK_16	Yes	Kim (Ratto), Silvia	Cr-51	Sodium Chromate	Cytotoxic assay
		Kim (Ratto), Silvia	H-3	Thymidine, aque	DNA incorporati
		Kim (Ratto), Silvia	P-32	unsealed, bound	R&D
OCK_18	No				
OCK_24	Yes				
OCK_4	Yes				
OCK_5	Yes	Michael, Nelson	C-14	unsealed, ehlor	transferance as
		Michael, Nelson	P-32	unsealed, CTP,	DNA labeling, p
OCK_6	Yes				
OCK_7	Yes	Michael, Nelson	C-14	unsealed, ehlor	transferance as
		Michael, Nelson	P-32	unsealed, CTP,	DNA labeling, p
		Michael, Nelson	S-35	unsealed, methi	labeling of cel
OCK_9	Yes	Michael, Nelson	P-32	unsealed, CTP,	DNA labeling, p
		Michael, Nelson	S-35	unsealed, methi	labeling of cel
		Michael, Nelson	C-14	unsealed, ehlor	transferance as
		Michael, Nelson	H-3	unsealed, any	Medical
OCK_BREAK	Yes				
OCK_EXITS	Yes				
OCK_FLOORS	Yes				
T-2_11	Yes	Burton, David	Co-57	Any	Medical, R&D
		Burton, David	Ra-226	sealed sources	Medical, R&D, i
		Burton, David	Am-241	NRC-2704	R & D
		Burton, David	Am-241	Sealed Sources	Research
		Burton, David	Pu-239	CALIBRATION SOU	CALIBRATION
		Burton, David	Co-60	sealed sources	R & D
		Burton, David	Ni-63	sealed & foils	R & D
		Burton, David	Sr-90	sealed sources	Medical
		Burton, David	I-129	sealed sources	R & D
		Burton, David	Ba-133	Any	Medical
		Burton, David	Cs-137	Amer Nuc Corp M	Instr Cal
		Burton, David	Cs-137	3M 6D6C-CA	Instr Cal
		Burton, David	Cs-137	sealed sources	R & D
T-2_154A	Yes				
T-2_157	Yes	Abdelrahim, Maged	P-32	unsealed, dCTP	Protein Radiola
T-2_15A	Yes				

Location	Rad Area	Licensee	Nuclide	Chem/Phys Form	Purpose
T-2_225	Yes				
T-2_235	Yes	Abdelrahim, Maged	P-32	unsealed, dCTP	Protein Radiola
T-2_237A	Yes	Abdelrahim, Maged	P-33	unsealed	protein radiola
		Abdelrahim, Maged	I-125	unsealed	RADIOLABELED PR
		Abdelrahim, Maged	S-35	unsealed, UTP	DNA labeling
		Abdelrahim, Maged	H-3	THYMIDINE	DNA RADIOLABELI
		Abdelrahim, Maged	P-32	unsealed, dCTP	Protein Radiola
		Abdelrahim, Maged	Eu-152	sealed sources	LSC source R &
		Abdelrahim, Maged	Ra-226	sealed sources	LSC source, R&D
		Abdelrahim, Maged	Cr-51	unsealed	Medical R&D
T-2_37	Yes				
T-2_FLOORS	Yes				
T144_XRAY	No				
TAFT	No				
TAFT_10	No				
TAFT_129	No				
TAFT_14	No				
TAFT_15	No				
TAFT_7	No				
TOBYHANNA_01	No				
WALSON_MAMMO	No				

490 Records Processed

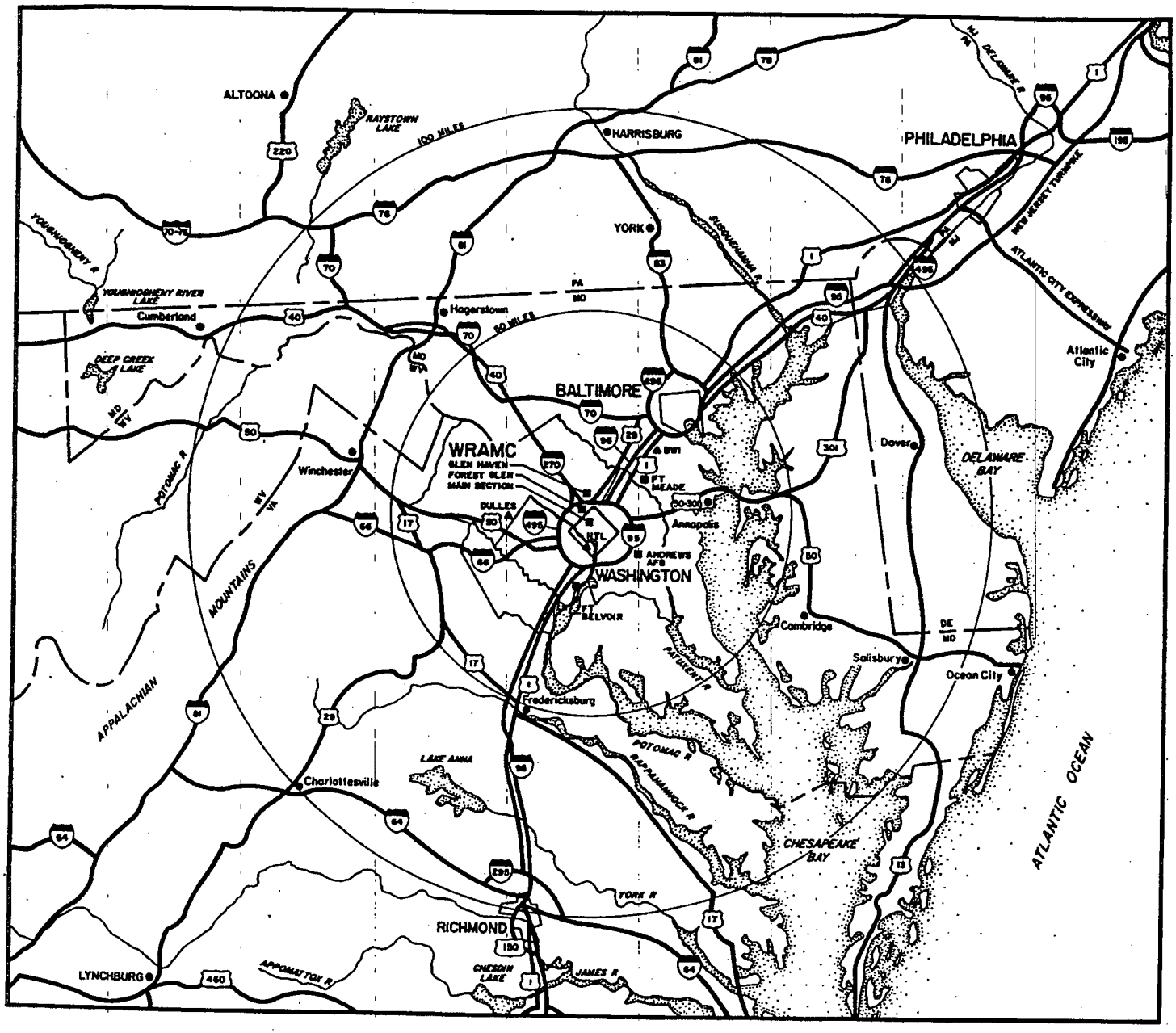
APPENDIX E

MAPS OF WASHINGTON DC,

WALTER REED ARMY MEDICAL CENTER,

AND FOREST GLEN ANNEX

□



LEGEND

STATE BOUNDARY

MAJOR HIGHWAYS

ROUTE MARKERS INTERSTATE-U.S.

COMMERCIAL AIRPORT

FEDERAL INSTALLATIONS

NATIONAL CAPITAL REGION
1 - DISTRICT OF COLUMBIA
2 - ARLINGTON CO., VA
3 - FAIRFAX CO., VA
4 - PRINCE WILLIAM CO., VA
5 - LOUDOUN CO., VA
6 - MONTGOMERY CO., MD
7 - PRINCE GEORGES CO., M

0 25 50
SCALE IN MILES

WRAMC

WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC

REGIONAL SETTING

PLATE
2

LEGEND

- INSTALLATION BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- MAJOR HIGHWAYS
- ROUTE MARKERS INTERSTATE-U.S.-STATE
- PARKS
- METRORAIL STATION
  - M1 - TAKOMA PARK
  - M2 - SILVER SPRING
  - M3 - FOREST GLEN

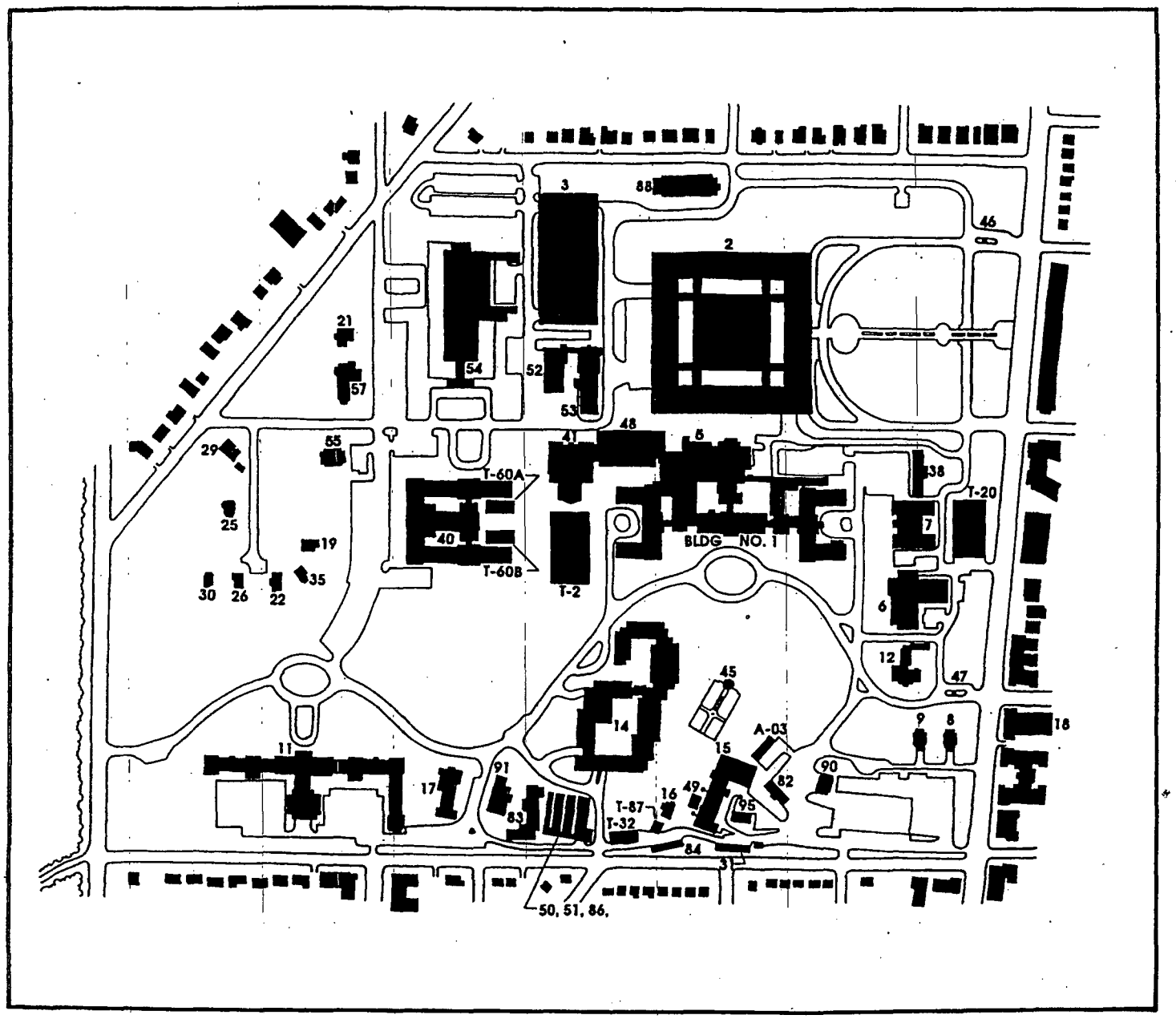
0 3000 6000
SCALE IN FEET

WRAMC

WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC

VICINITY MAP

PLATE
3



LEGEND

BUILDINGS & STRUCTURES

ROADS & PARKING

0 300 600

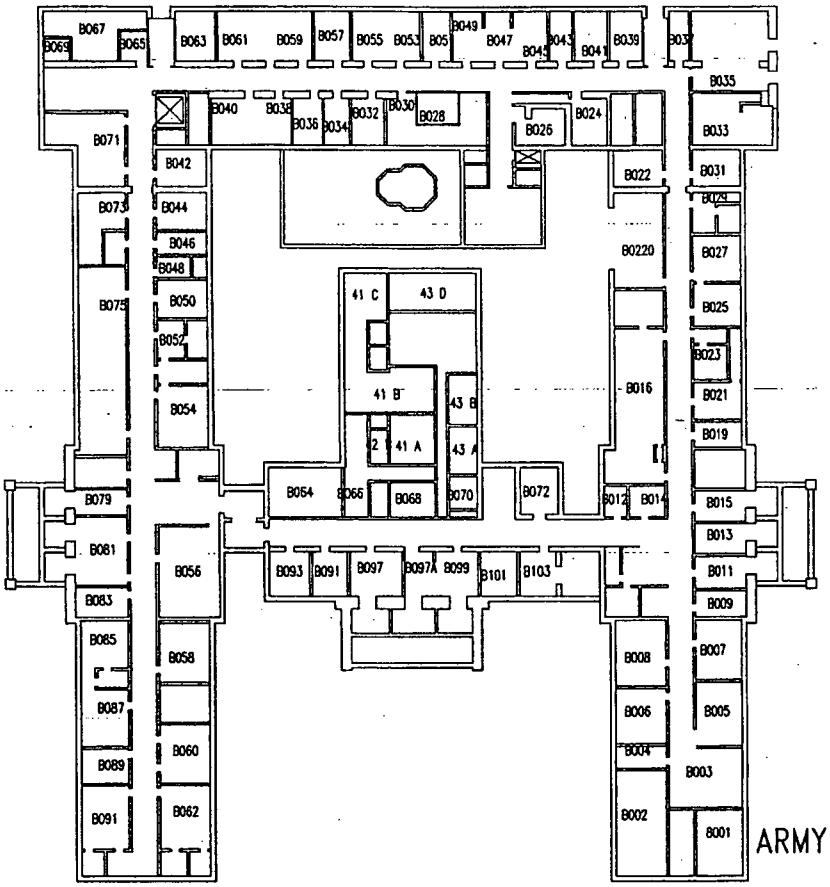
SCALE IN FEET

MAIN SECTION

WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC

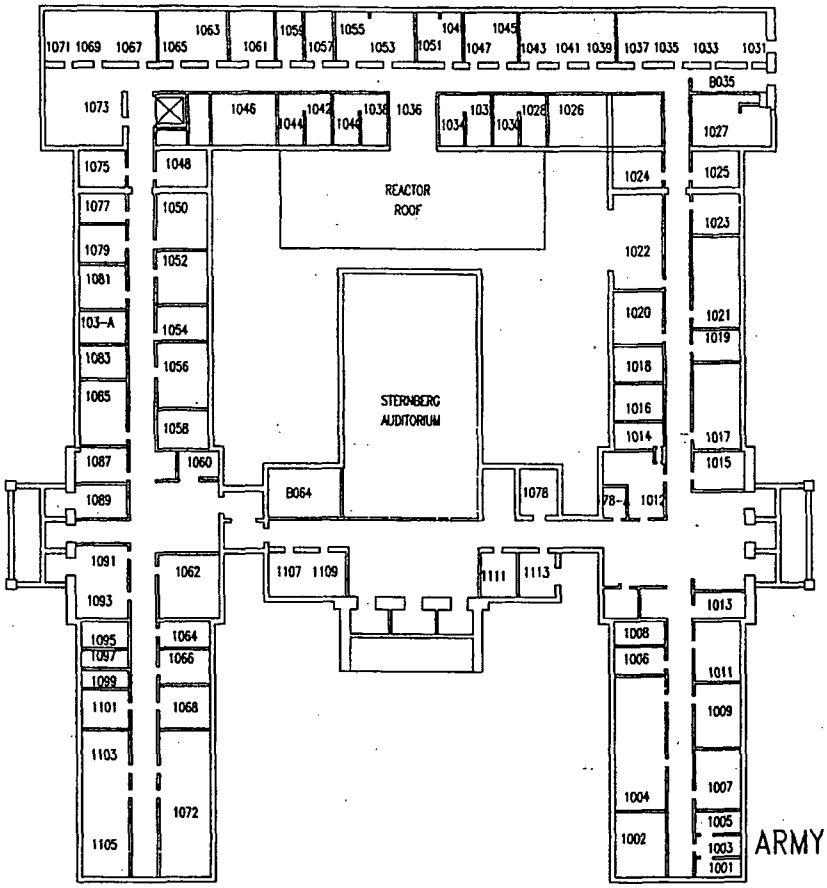
EXISTING SITE MAP

PLATE
6



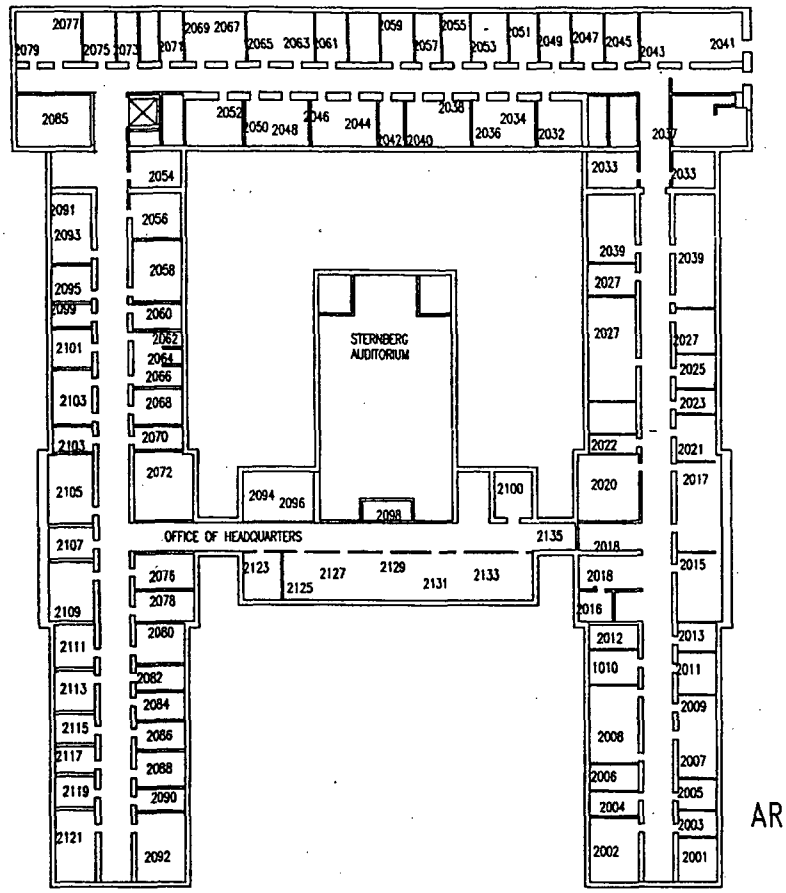
WALTER REED
ARMY INSTITUTE OF RESEARCH
BUILDING 40

BASEMENT FLOOR PLAN



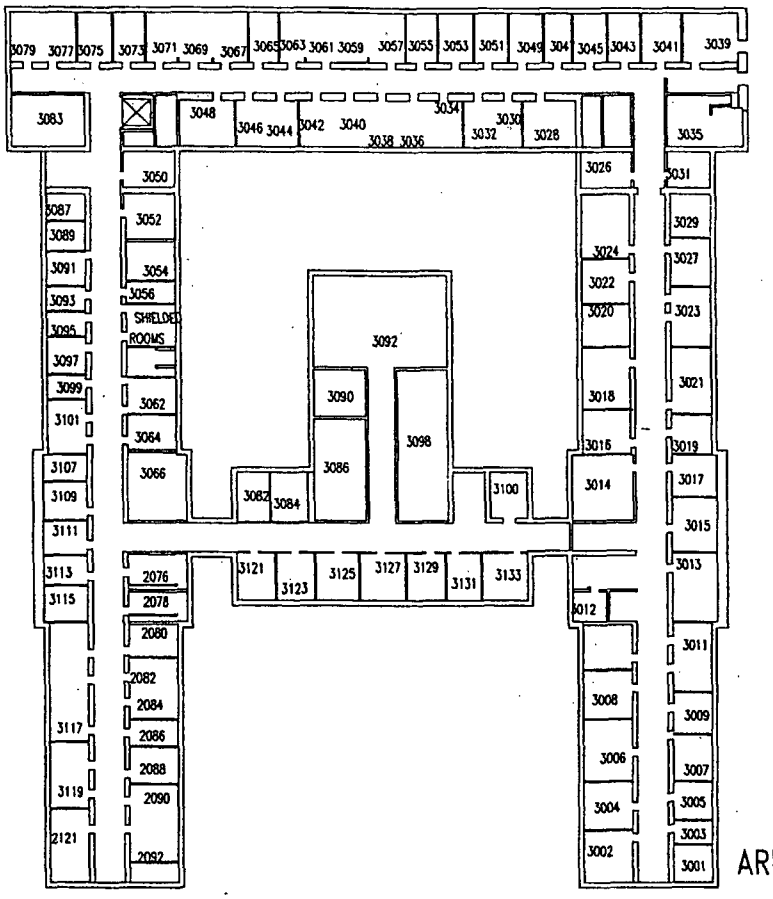
WALTER REED
ARMY INSTITUTE OF RESEARCH
BUILDING 40

FIRST FLOOR PLAN



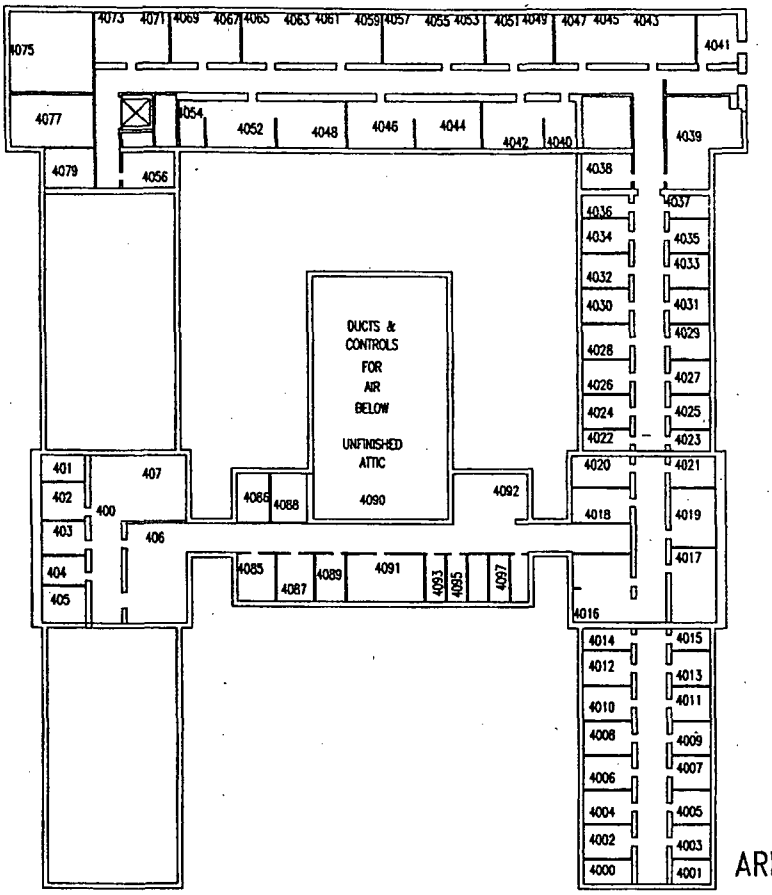
WALTER REED
ARMY INSTITUTE OF RESEARCH
BUILDING 40

SECOND FLOOR PLAN



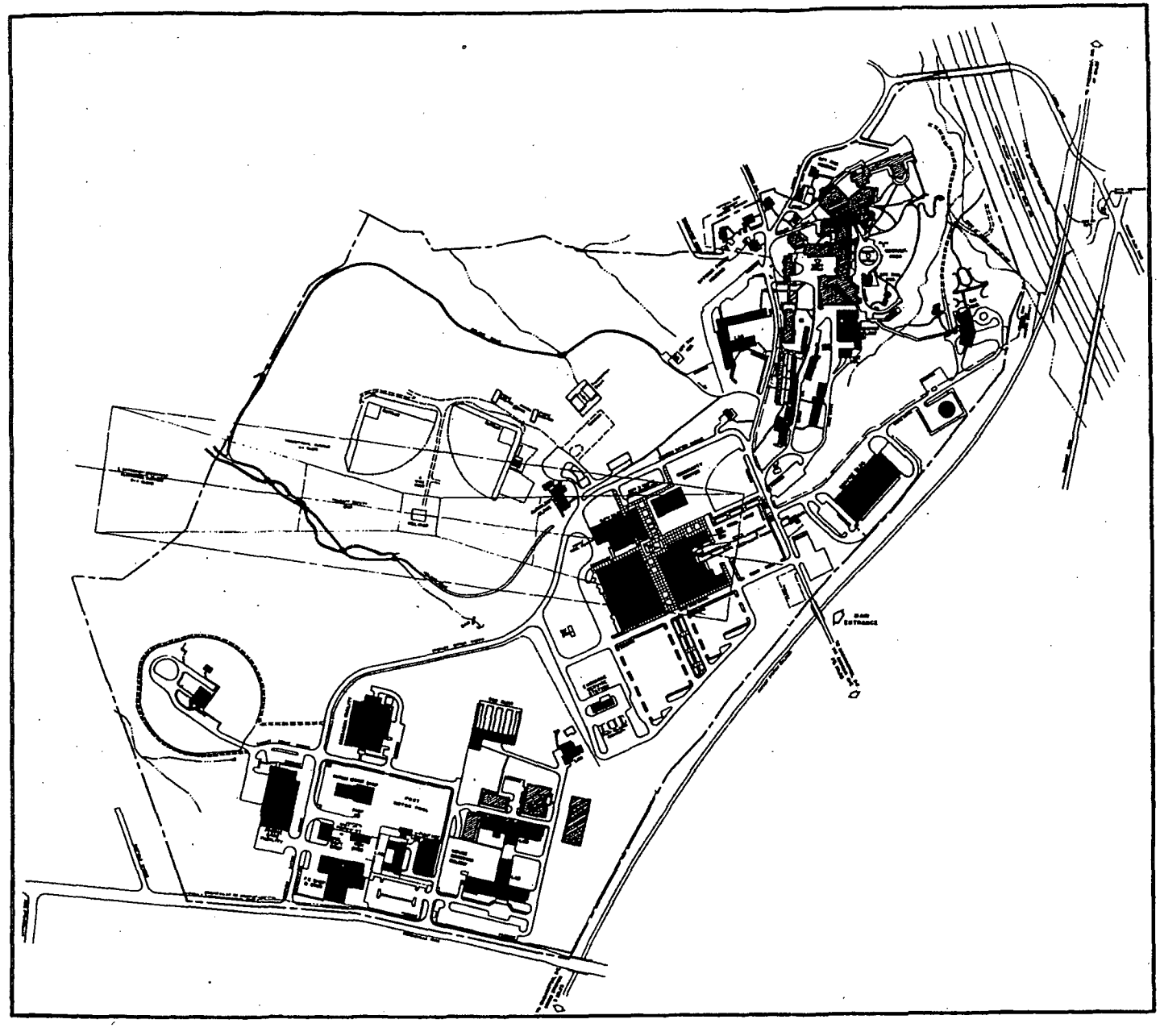
THIRD FLOOR PLAN

WALTER REED
ARMY INSTITUTE OF RESEARCH
BUILDING 40



FOURTH FLOOR PLAN

WALTER REED
ARMY INSTITUTE OF RESEARCH
BUILDING 40



LEGEND

- BUILDING, PERMANENT
- BUILDING, SEMIPERMANENT
- BUILDING, TEMPORARY
- ROADS & PARKING

0 400 800

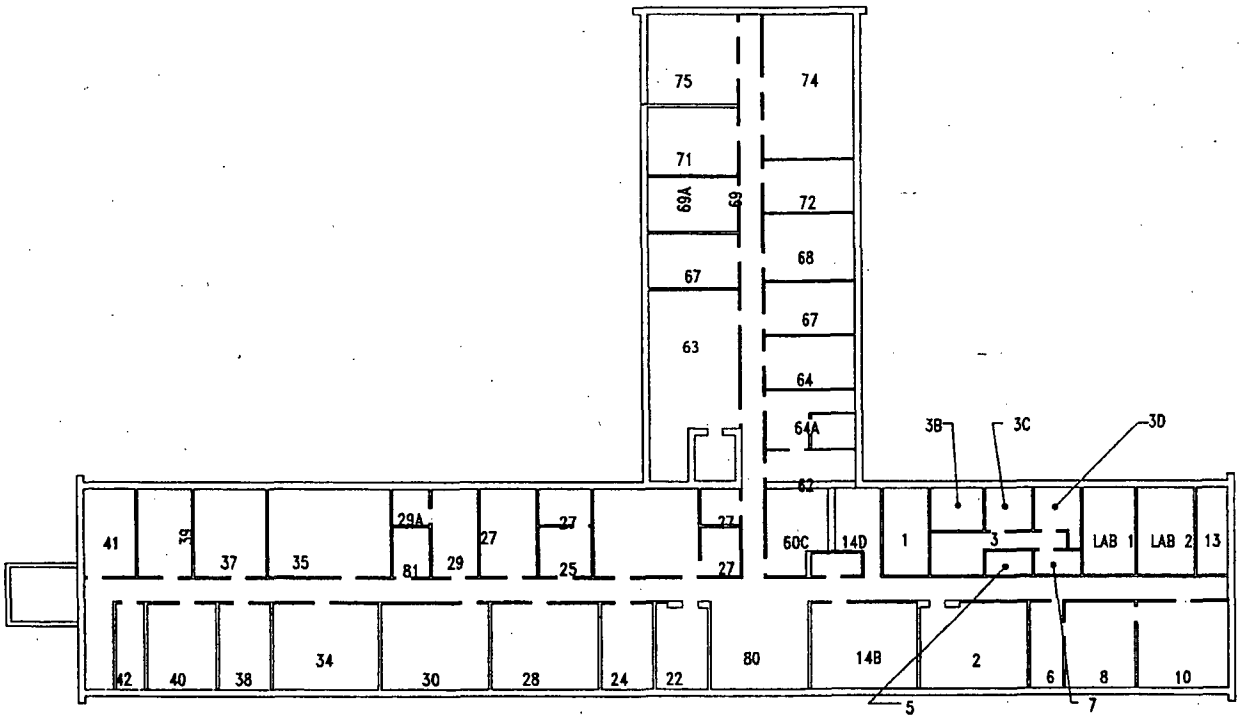
SCALE IN FEET

FOREST GLEN

WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC

EXISTING SITE MAP

PLATE
6



UPPER LEVEL

WALTER REED ARMY INSTITUTE OF RESEARCH
BUILDING 500
FOREST GLEN ANNEX.

APPENDIX F

CLASSIFICATION OF AREAS

1. Affected Area(s): Area(s) that have the potential for radioactive contamination (based on facility operating history) or known radioactive contamination (based on past or preliminary radiological survey/surveillance). This would normally include areas where radioactive materials were used and stored, where records indicate spills or other unusual occurrences that could have resulted in the spread of radioactive contamination, and where radioactive materials were buried. Areas immediately surrounding or adjacent to locations where radioactive materials were used or stored, spilled, or buried are included in this classification because of the potential for the inadvertent spread of radioactive contamination. Affected areas are further divided into those areas that are considered to have a potential for containing small areas of elevated residual radioactivity (hot spots) in excess of the regulatory guideline levels and those in which such areas of elevated radioactivity would not be anticipated. (If there is any doubt, the area should be designated as an affected area.)

(a) Affected/Non-Uniform Area: An area that has the potential for a non-uniform or spotty residual radioactivity pattern. Indoor survey units that are classified as affected/non-uniform will generally consist of a single room. **NOTE**: Any area that has been remediated or decontaminated shall be designated as affected/non-uniform. In general, all areas shall be treated as affected/non-uniform until substantial bases are provided to reclassify them to either affected/uniform, unaffected, or non-impacted area.

(b) Affected/Uniform Area: An area with little or no potential for non-uniform or spotty residual radioactivity.

2. Unaffected Area: Any area that is not expected to contain any residual radioactivity, based on a knowledge of site history and previous radiological survey information. The unaffected areas of a facility may consist of a single survey unit of unlimited size.

3. Non-Impacted Area: Any area that has no potential for residual radioactive contamination.

□

APPENDIX G

TABLE OF ISOTOPES UTILIZED AT WRAIR

Isotope	Half life	Comments
H-3	12.33y	
C-14	5730y	
Na-22	2.60y	
Na-24	14.96h	
Mg-28	20.91h	
P-32	14.26d	
P-33	25.34d	
S-35	87.51d	
Cl-36	301000y	
K-42	12.36h	
Ca-45	162.61d	
Sc-46	87.79d	
Cr-51	27.70d	
Co-56	77.20d	
Co-57	271.79y	
Fe-59	44.50d	
Co-60	1925.1d	
Ni-63	100.1y	
Zn-65	244.26d	
Ga-67	3.26d	
Se-75	119.78d	
Br-82	35.30h	
Sr-85	64.84d	
Rb-86	18.63d	
Sr-89	50.53d	
Sr-90	28.78y	
Nb-95	34.97d	

Isotope	Half life	Comments
Mo-99	65.94h	
Tc-99m	90.1d	
Ru-103	39.26d	
In-111	2.80d	
I-123	13.27h	
Sb-125	2.76y	
I-125	59.40d	
I-129	1.57×10^7	
I-131	8.02h	
Xe-127	36.34d	
Ba-133	3854d	
Xe-133	5.24d	
Cs-137	30.07y	
Ce-141	32.50d	
Gd-153	241.60d	
Sm-153	46.27h	
Eu-155	4.76y	
Yb-169	32.02d	
Ta-182	114.43d	
Ir-192	73.83d	
Au-198	2.70d	
Tl-201	72.91h	
Hg-203	46.6d	
Rn-222	3.82d	
Ra-226	1600y	
Am-241	432.2y	
U-238	4.47×10^9	

APPENDIX H

REACTOR STUDIES

AND

INFORMATION

Mallory File

THE WALTER REED MEDICAL RESEARCH REACTOR

Robert van Hoek, Captain, USAF (MC)

and

James B. Smathers, 1st Lt, USA

Department of Biophysics
Division of Nuclear Medicine
Walter Reed Army Institute of Research
Walter Reed Army Medical Center
Washington 12, D. C.

THE WALTER REED MEDICAL RESEARCH REACTOR

INTRODUCTION

The United States Army Medical Service was founded one hundred and seventy nine years ago with the mission of maintaining the health of the Army's personnel. As an integral part of this mission, the service has supported research programs in the pathogenesis, prevention, and treatment of disease and the mechanisms and treatment of trauma. The development of nuclear energy for weapon systems and power sources has presented new health hazards to the military as well as civilian population and new problems for the medical service.

The detonation of a nuclear weapon releases an enormous amount of energy which can be placed in three broad categories: (1) pressure, (2) heat and (3) ionizing radiation. This energy has characteristics, both quantitative and qualitative, which are distinct from those of energy produced by conventional sources (1). Following the first nuclear detonation in 1945, world-wide research programs were initiated to determine the biological effects of these energies and methods for their prophylaxis and treatment.

The study of ionizing radiation has received by far the greatest support and occupied the talents of many investigators in the physical and biological sciences. The great majority of radiobiological investigations have of necessity employed conventional X-ray sources. These sources cannot produce the high energy or intensity of radiation which is characteristic of nuclear fission. The gamma radiations from radioactive isotopes such as Cobalt-60 or the X-rays from high energy X-ray

generators and electron accelerators permit biological exposures which approach the desired levels. However, the study of biological responses to neutron irradiation, a major component of the fission yield, has been limited by the lack of neutron sources for biological experiments. Prior to the moratorium on weapon testing in 1958, nuclear detonations were the primary neutron sources. Biological experiments were restricted, however, by problems in logistics and experimental priorities. Nuclear reactors and particle accelerators were used for radiobiological investigations, but they were not designed for biological experimentation and their usefulness was limited.

Based on these considerations, the United States Army Medical Service purchased and installed a nuclear reactor at the Walter Reed Army Institute of Research. This is the second reactor in the United States to be installed primarily for biological and medical radiation research. It is the first reactor for this purpose to be located in a general medical center.

REACTOR FACILITY

The reactor facility occupies a new wing of the Walter Reed Army Institute of Research. It consists of a reactor floor area of 3900 sq ft and 6800 sq ft of laboratory and office space.

The reactor is of the homogeneous solution configuration. It is designed to operate at 50 kilowatts of thermal power and to produce a maximum thermal neutron flux of about 10^{12} neutrons/cm^2-sec at the center of the core. It utilizes an aqueous solution of uranyl sulfate (UO_2SO_4), enriched to 93% in the isotope U^{235}, as the fuel, deionized water as the moderator, and graphite as the reflector. Control is

achieved by use of four Boron Carbide control rods, of which two can control the reactor. A five foot thick magnitite-colmanite (Iron and Boron) concrete shield provides sufficient shielding to allow personnel to occupy the reactor floor during operation at full power.

The exposure facilities are located on two levels (Figure 1). Neutron irradiation is obtained by means of exposure ports which are accessible on the reactor floor proper; this permits positioning of the samples close to the reactor core. Radioactive fission gases are produced in the core and flow into a gas recombiner system, located on the floor level below the reactor. The recombiner system serves as a distinct gamma radiation source.

Figure 2 illustrates the position and Table 1 lists the dimensions of the exposure ports.

The access port opposite the thermal column, (Table 1, Number 8), will be modified to contain a fission plate assembly. This will provide a sizable fast neutron irradiation facility which will complement the thermal neutron irradiation capability the reactor presently possesses.

The thermal column (Table 1, Number 9) has selective shielding material between it and the reactor core to reduce the contamination by gamma radiation as much as possible.

The gamma field (Table 1, Numbers 14, 15, and 16), furnished by the inert radioactive fission gases in the recombiner system, will have a maximum dose rate of one million Rads per hour.

As designed, the reactor provides a versatile and challenging research instrument for use in radiation biology.

REACTOR RESEARCH PROGRAM

The reactor facility is a part of the Division of Nuclear Medicine in the Walter Reed Army Institute of Research. The reactor operations and the research program are the responsibility of the Department of Biophysics of the Division. Military and civilian consultants in the physical and biological sciences are available for advice and impartial evaluation.

The research program of the reactor facility can be divided into four categories: (1) radiation dosimetry, (2) radiation chemistry, (3) biological research, and (4) medical research. There are individual projects in each category, but the major effort is directed toward elucidating the biological effects of radiation.

Radiation Dosimetry: The significance of radiation effects on biological systems cannot be fully evaluated without a knowledge of the physical parameters of the radiation. This is particularly important when the source is nuclear fission. The parameters to be measured are: (1) specific types of ionizing radiation, (2) amount of contamination by other ionizing radiation, (3) energy spectrum and, (4) intensity. The measurement of neutron energy and neutron flux, particularly of the epithermal and fast components of the fission spectrum, is the most difficult. Methods employed at present must be improved and new techniques and instrumentation developed.

Another problem to be investigated is that of measuring the amount of radiation actually absorbed by the biological sample or tissue

of interest. Neutron radiation is again the center of attention although gamma radiation is not excluded. Answers to this problem will provide a firmer foundation for the term, Relative Biological Effectiveness.

Radiation Chemistry: Neutron activation has become an invaluable technique in research. Fundamentally, it consists of exposing an element to a neutron flux. If the element, neutron flux, and duration of exposure are properly selected, the interaction of the element's nuclei and the neutrons results in a radioactive isotope. This process is the basis for the mass production of radioactive isotopes in large nuclear reactors.

Neutron activation also offers a method for microchemical analysis and radiation dosimetry. This is known as activation analysis. In general terms, the amount of radioactive isotope produced is directly proportional to the amount of element irradiated and the neutron flux. A variety of trace elements can be detected and quantified by this technique and without other chemical procedures. Conversely, the irradiation of standardized elements can be employed to measure neutron flux, and the activation of trace elements in vivo provides a method of biological neutron dosimetry.

Biological Research: The Walter Reed Reactor provides a variety of exposure facilities. There is a large thermal neutron column in which large groups of rodents can be irradiated; dogs or monkeys can be exposed in pairs. A second thermal column will be converted to a fast neutron facility by the insertion of a movable uranium fission plate (2). A mixed neutron flux can be obtained for rodent experiments by removing graphite stringers from each of the thermal columns. Cytological studies

can be performed by inserting cell systems such as bacteria, viruses and tissue cultures into the smaller exposure tubes. High intensity, wide-field or collimated gamma-radiation can be given to animals in two radiation areas below the reactor.

The biological research program is aimed at determining the relative biological effectiveness of acute thermal and fast neutron irradiation, the acute biological effects of mixed radiation, and the mechanisms of radiation injury. The consequences of acute high energy, high dose rate gamma radiation can be elaborated. The reactor facility is also employed as a neutron source for evaluating chemoprophylaxis and treatment of acute radiation injury.

Medical Research: The diagnostic and therapeutic applications of radiation in medicine are well known. The existence of a nuclear reactor in a medical center provides new techniques in clinical research and new potentials in radiation therapy.

As discussed previously, the reactor is capable of producing radioactive isotopes. This is most valuable when isotopes of short half-life and high specific activity are required.

Presently, the most significant medical application of the reactor resides in the technique of activation analysis. All forms of biological material can be rapidly and non-destructively analyzed for trace elements. The value of this method to the study of metabolic diseases is obvious.

Nuclear reactors are employed in the experimental radiation therapy of tumors (3). The thermal neutrons produced by nuclear fission are collimated and focused on the tumor area. Prior to

irradiation, an element is administered intravenously to the patient. The properties of this element are: (1) it will absorb thermal neutrons and become radioactive, or the interaction of the neutron and the nucleus will result in two nuclei, one of which is an ionizing particle; (2) at a predetermined time, the element's concentration will be greater in the tumor than in surrounding normal tissue. The radiation produced by neutron bombardment of the element is thereby localized to the tumor tissue. A reactor has been designed and constructed specifically for this purpose (4).

The Walter Reed Reactor is capable of producing the desired neutron flux for this type of therapy. However, investigations will first be directed to finding compounds which are more selectively localized in tumor tissue, and neutron irradiation will be limited to animal experiments.

When calibration has been completed, the gamma radiation exposure room may prove to be suitable for human radiation therapy.

CONCLUSION

The existence of a nuclear reactor for biological and medical research provides the United States Army Medical Service with the opportunity to extend its knowledge in the radiological sciences. The information gained from its use will be useful for civilian as well as military applications.

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3. Farr, L. E., et ala: "Neutron Capture Therapy with Boron in the Treatment of Glioblastome Multiforme". The Am. J. of Roent., Rad. Ther. & Nuc. Med., 1954: 71, 279.

4. Farr, L. E.: "The Brookhaven Medical Research Reactor". Science, 1959: 130, 1067.

TABLE 1

RADIATION EXPOSURE FACILITIES

1. Two horizontal beam tubes:
   4 inch diameter.

2. Four vertical beam tubes:
   4 inch diameter.

3. Two horizontal beam tubes:
   3 inch diameter.

4. One straight pneumatic tube:
   2 inch diameter.

5. One curved pneumatic tube:
   1.5 inch diameter.

6. One central exposure tube:
   1.5 inch diameter.

7. Thermal column access ports:
   Two 6 inch square and two 6 inch round.

8. One access port opposite the thermal column:
   24 inches high x 28 inches wide x 12 inches deep.

9. One horizontal thermal column:
   Approximately 5 feet x 5 feet x 5 feet.

10. One thermal column access port:
    1 foot square x 5 feet deep.

11. One thermal column access port:
    2.8 inches high x 36 inches wide x 20 inches deep.

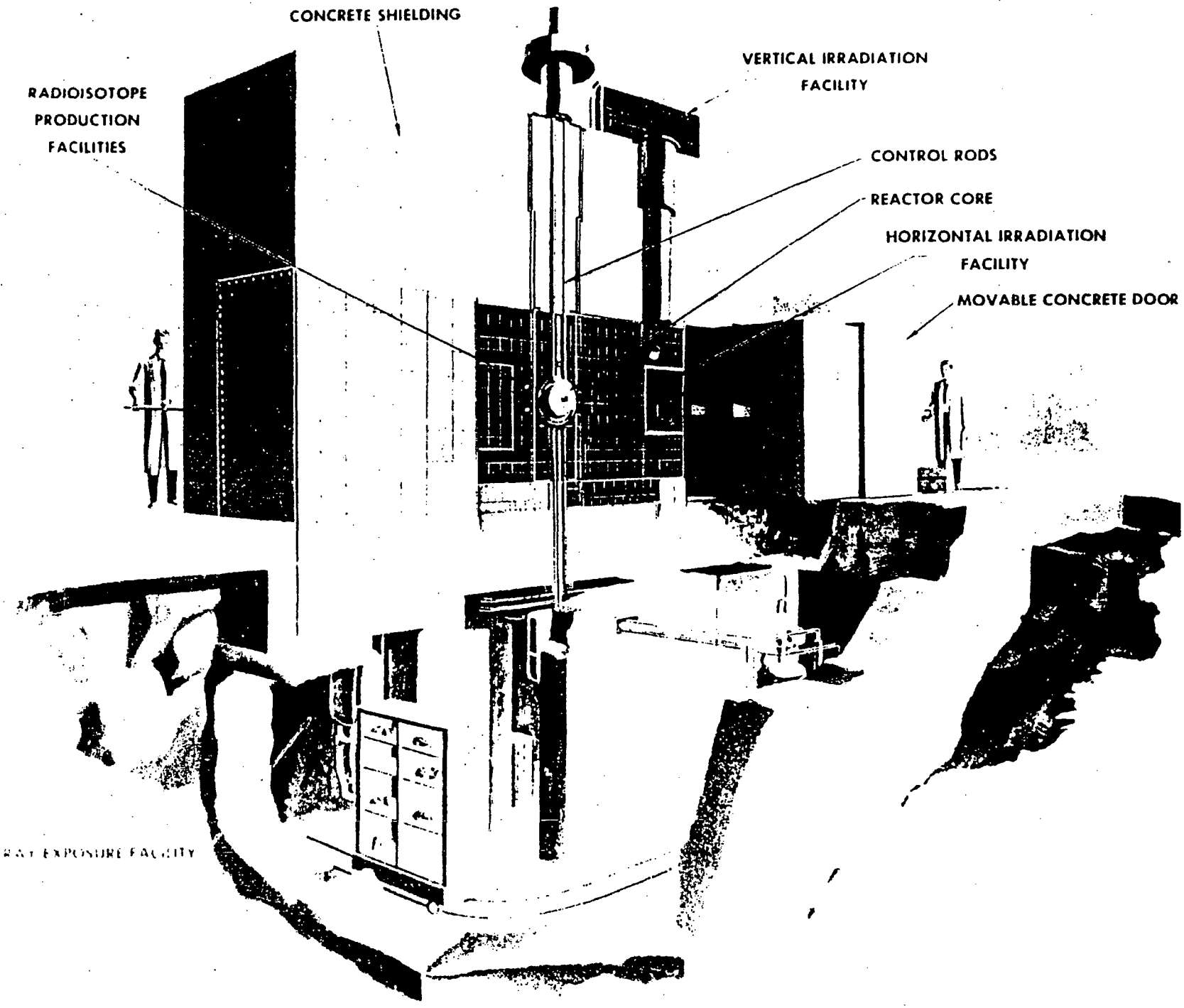
12. One thermal column access port:
    60 inches square x 20 inches deep.

13. One vertical thermal column (Exponential Facility):
    54 inches diameter at its upper surface and 24 inches thick.

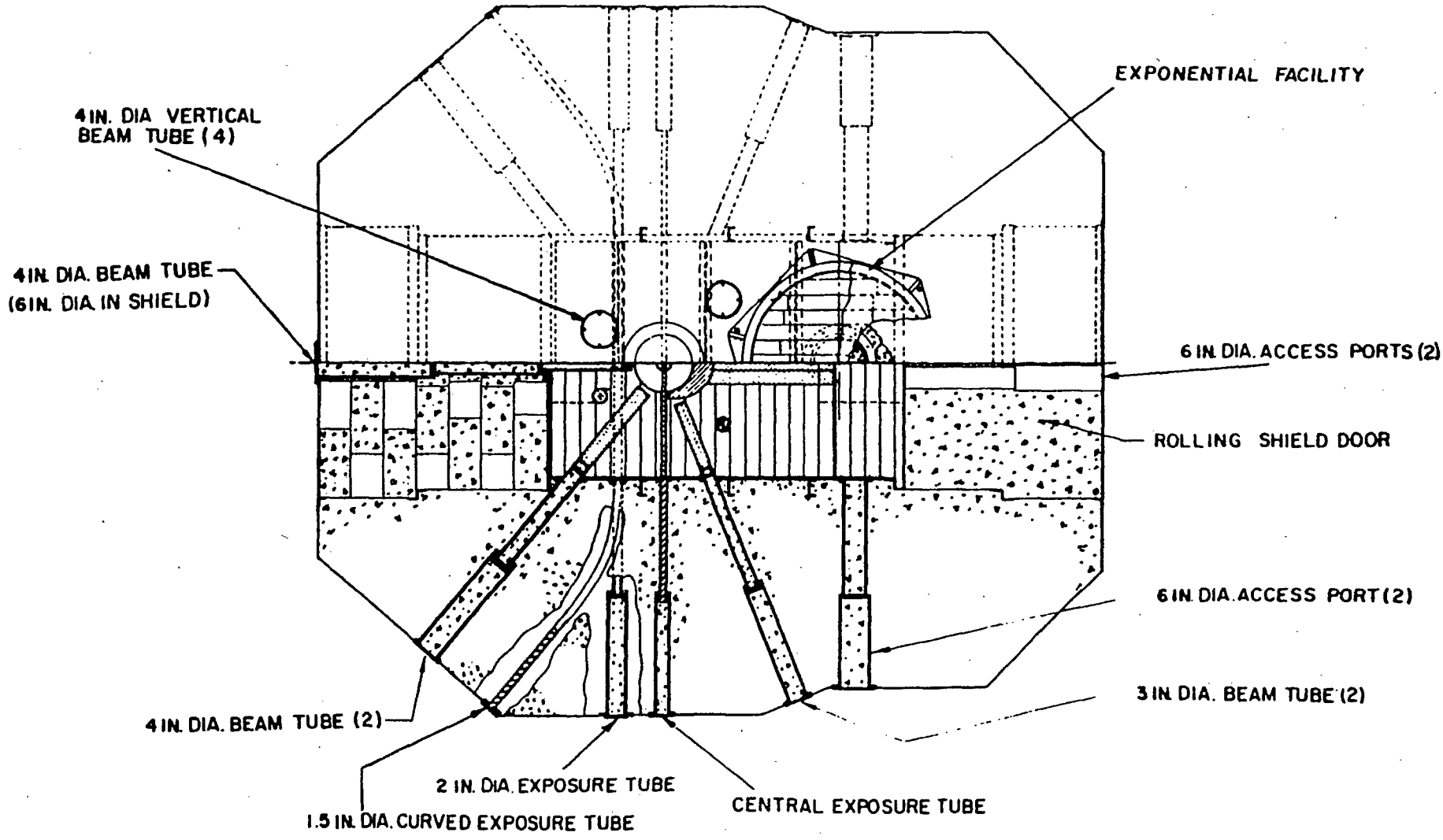
14. Three ports to recombiner gamma field:
    4 inch diameter.

15. One port to high level recombiner gamma field:
    1 1/2 inch diameter.

16. Two gamma radiation exposure rooms:
    One for large field and one for collimated beam exposure.



GAMMA RAY EXPOSURE FACILITY


EXPONENTIAL FACILITY
4 IN. DIA VERTICAL BEAM TUBE (4)
4 IN. DIA. BEAM TUBE (6 IN. DIA. IN SHIELD)
6 IN. DIA. ACCESS PORTS (2)
ROLLING SHIELD DOOR
6 IN. DIA. ACCESS PORT (2)
3 IN. DIA. BEAM TUBE (2)
4 IN. DIA. BEAM TUBE (2)
2 IN. DIA. EXPOSURE TUBE
1.5 IN. DIA. CURVED EXPOSURE TUBE
CENTRAL EXPOSURE TUBE

The following information is submitted as Supplement No. 2# to the Hazards Summary Report for the Walter Reed Army Medical Center Nuclear Research Reactor, A.I. 3739.

CONTROL

The radiation detection equipment previously described will be supplemented by a Stack Monitor, Air Particulate Monitor, and a series of Area Monitors.

Recording of instrument readings will be expanded to include the Stack Monitor, Air Particulate Monitor, Secondary Water Monitor and Reactor Operation Parameters. Examples of Reactor Operation Parameters that might be recorded are as follows:

1. Core liquid level temperature.
2. Core gas phase temperature.
3. Core sweep gas out temperature.
4. Lower core temperature.
5. Overflow chamber coolant out temperature.
6. Recombiner water phase temperature.
7. Recombiner sweep gas out temperature.
8. Recombiner gas phase temperature.
9. Recombiner heat exchanger out temperature.
10. Recombiner heat exchanger in temperature.
11. Secondary coolant out temperature.
12. Secondary coolant in temperature.
13. Upper catalyst bed temperature.
14. Lower catalyst bed temperature.
15. Catalyst bed heater temperature.
16. Catalyst bed gas out temperature.
17. Recombiner pump pressure.
18. Recombiner system pressure.
19. Sweep gas flow.
20. Recombiner coolant flow.
21. Core coolant flow.

#Note: Included are several changes to procedures previously submitted in the Hazards Summary Report, A.I. 3739.

22. Surge Tank liquid level.

23. Secondary enclosure radiation level.

24. Area monitors (10).

The butterfly valves in the reactor room ventilation supply and exhaust ducts will automatically be closed if any of the following occur:

1. High stack monitor radiation alarm.
2. High recombiner pressure alarm.
3. High subpile room radiation level alarm. (Secondary containment).

The following alarms are monitored continuously:

1. Stack monitor radiation level.
2. Recombiner pressure.
3. Subpile room radiation level (secondary containment).
4. Area monitors radiation level.
5. Secondary coolant radiation level.

During duty hours, the existence of alarm conditions will be indicated in the Control Room. On off-duty hours, the alarm conditions will be indicated at the Charge of Quarters desk in the building. He, in turn, will contact the reactor personnel as indicated in his instructions.

REACTOR AUXILIARY SYSTEMS

Flow in the primary system is controlled by the valves located on the valve room wall. When not in use, the recessed connections to the primary system are capped and protected from accidental damage by a cover plate. Each connection is routinely monitored for radiation to check for any leakage through the valve that might have occurred.

Before any penetration of the primary system is made, a detailed step-by-step procedure is written. These procedures will incorporate all the safeguards necessary to insure that there will be no escape of radioactive material. Suggested reactor servicing procedures are given in the Reactor Operations Manual, A.I. 1857, Revision 3.

Auxiliary equipment is not connected to the reactor primary system during normal operation. However, the following components are readily available.

a. 6 - 34 liter small waste tanks:

Type 316 Stainless Steel.
Designed pressure 30" Hg vacuum.

b. 4 - 200 liter large waste tanks:

Type 316 Stainless Steel.
Designed pressure 30" Hg vacuum.

c. 4 - 55 gallon drums, ICC-5C:

Type 304 Stainless Steel.
Designed pressure 26" Hg vacuum.

d. 2 - 1 ton 150 gallon Chemical Corps tanks:

ICC approved for hazardous material.
ICC approved for NaOH and Na_2O_2.

As stated in the Hazards Summary Report, A. I. 3739, the volume of radioactive waste to be expected during critical assembly and fuel sampling procedures is 29 to 290 liters of gas and/or liquid. The tanks listed in a and b above will be used for the normal operational handling of radioactive waste. They should be more than adequate as their total volume is three times the volume of the largest amount expected.

The tanks listed in section c and d will be used if any emergency arises or extensive decontamination of the primary system is required.

DISPOSAL OF RADIOACTIVE GAS

The disposal of radioactive gas will be in accord with the A. E. C. regulations as stated in Title 10, Code of Federal Regulations, Chapter 1, Part 20, Paragraph 20, 106 (b) and AR 755-380. The release of radioactive gas will be limited to airborne radioactivity from the subpile room (A 41) and to small amounts of decayed fission gases. The small amounts of fission gases, withdrawn when a fuel sample is obtained, fuel added, or a recombiner water sample obtained, will be held until the activity is negligible and then discharged to the stack under controlled conditions. As in the case of the subpile room radioactivity levels, any discharge will be authorized by the Supervisor of Reactor Operations and approved by the Health Physics Supervisor.

REACTOR EXPERIMENTAL LOADINGS

Explosives will not be irradiated in the Reactor.

Liquids, inflammables included, will be irradiated providing their boiling point is a minimum of 10°F above the highest temperature of the exposure area in which they are placed. An example of a possible inflammable would be an alcohol solution.

All liquid specimens must be contained in a minimum of three sealed containers. Each of the three containments must be able to independently contain the liquid. In almost all cases the outer two containments will be heat sealed plastic. If for some reason, a breakable container must be used as the primary containment, it will be enclosed by an outer protective container. Thus the outer protective container will act as a safeguard against the accidental breakage of the inner one. Should breakage occur, the outer container will retain the broken pieces, thus protecting the two remaining containments from puncture.

Except for foils used in flux measurements, solid samples will be sealed in two plastic enclosures.

Reactivity changes due to animal movement should not be significant because all animals to be irradiated will be enclosed in suitable cages that will restrict their motion to a minimum and contain any excrement.

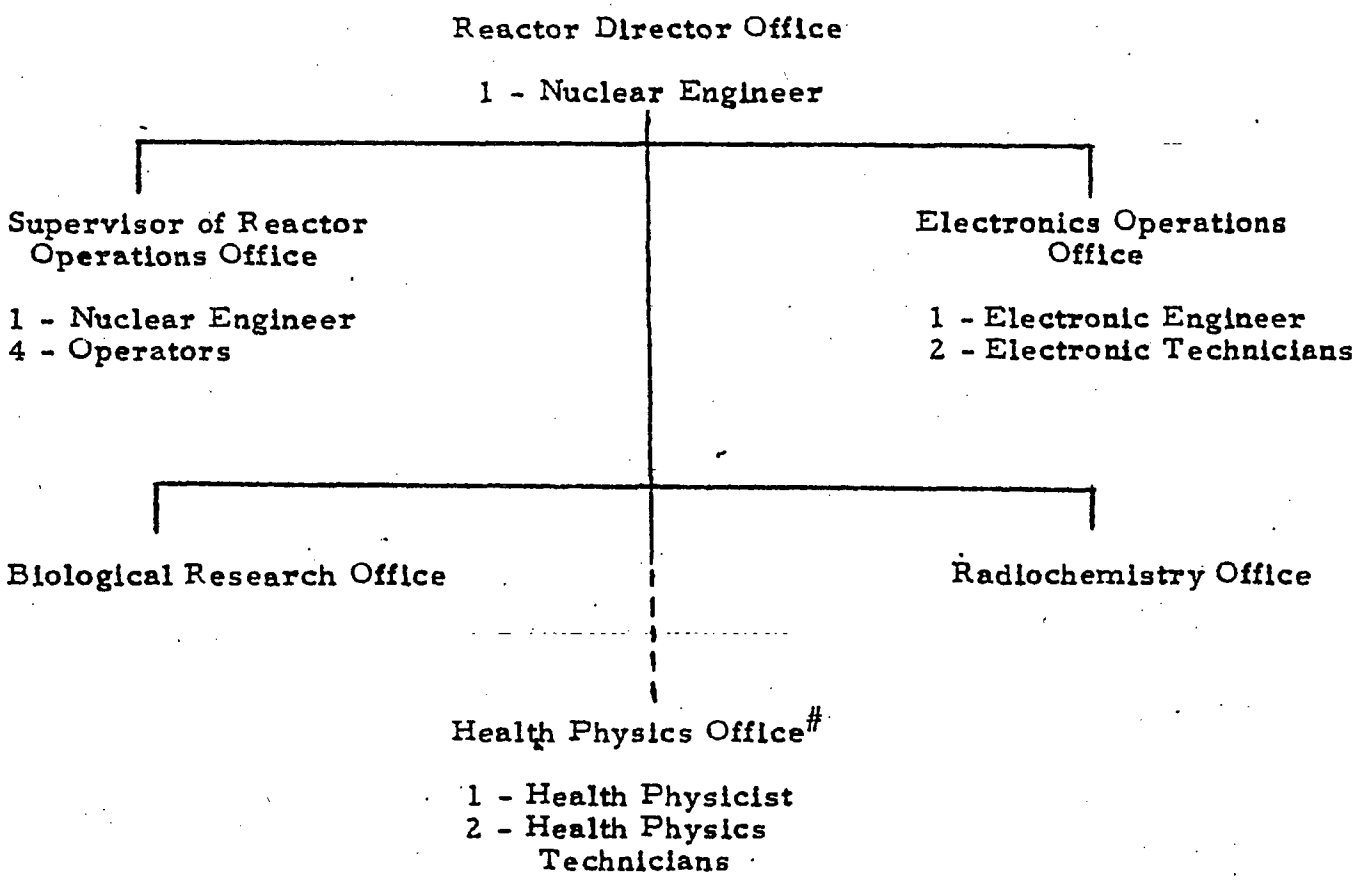
Thermal neutron irradiation of large samples will be obtained by removing only 20" from the end of the thermal column. Thus leaving a minimum of 29" of graphite between the sample and the bismuth shield around the core. Atomics International has stated that the removal of this graphite has a negligible effect on the reactivity.

Fast neutron irradiation for large samples will be obtained by removing a 12" square volume along the center of the thermal column; the exposure volume extends from the face of the thermal column to the bismuth shield. Armour Research Foundation has determined the reactivity of the graphite in this area to be 0.7%. The addition of a 1 ft^2 cadmium box next to the bismuth shield results in an additional 0.3% loss in reactivity.

The general design characteristics of the reactor, as given in the Hazards Summary Report, A.I. 3739, are such that the experimental loadings are not subject to damage or movement during irradiation, nor are the experimental loadings apt to damage the reactor. In all cases, central core exposure tube and central recombiner exposure tube included, the primary and secondary enclosures are protected from damage by exposure port liners.

It is conceivable that the negative reactivity of the experimental loadings could approach 2 to 3 per cent. An example of such a loading would be a bacterial sample in a thick cadmium shield inserted in the central exposure tube.

REACTOR STAFF OUTLINE*



*Note: This staff is based on eight hour day - 5 day week work schedule

#Note: Health Physics supervision is controlled directly from WRAMC rather than WRAIR.

TECHNICAL QUALIFICATIONS

REACTOR DIRECTOR'S OFFICE

Working out of this office will be the senior nuclear engineer in charge of the reactor. Acceptable qualifications for the position will be an M.S. and two years of experience, or a B.S. and three and a half to four years of experience.

SUPERVISOR OF REACTOR OPERATIONS OFFICE

Acceptable qualifications for the nuclear engineer assigned to this office will be an M.S. and one year of experience, or a B.S. and two and one half to three years of experience.

The reactor operators will be graduates of the Fort Belvoir Power Reactor Operators School and will receive the additional training necessary to qualify them as WRAIR reactor operators.

ELECTRONICS OFFICE

The electronic engineer will have an M.S. or a B.S. and two years of experience.

The electronic technicians will have a minimum of two years of experience, excluding home radio and television repair work.

HEALTH PHYSICS OFFICE

The health physics office has the responsibility of monitoring the hospital radiation therapy section, hospital radioisotope clinic, radioisotope research conducted at WRAIR, and reactor operations. That part of the staff which will be primarily concerned with reactor operations has been included in the outline. In case of an emergency, the staff can be increased threefold by the reassignment of all WRAMC health physics personnel to the reactor staff.

The reactor health physicist will be a commissioned officer who has had appropriate training and experience in health physics.

The health physics technicians will be graduates of the Fort Belvoir Power Reactor Operators School who received primary training in the health physics specialty.

RADIOCHEMISTRY AND BIOLOGICAL RESEARCH OFFICE

These offices will be staffed as the research projects necessitate. Present planning indicates that the staff will be small but highly skilled.

REACTOR STARTUP

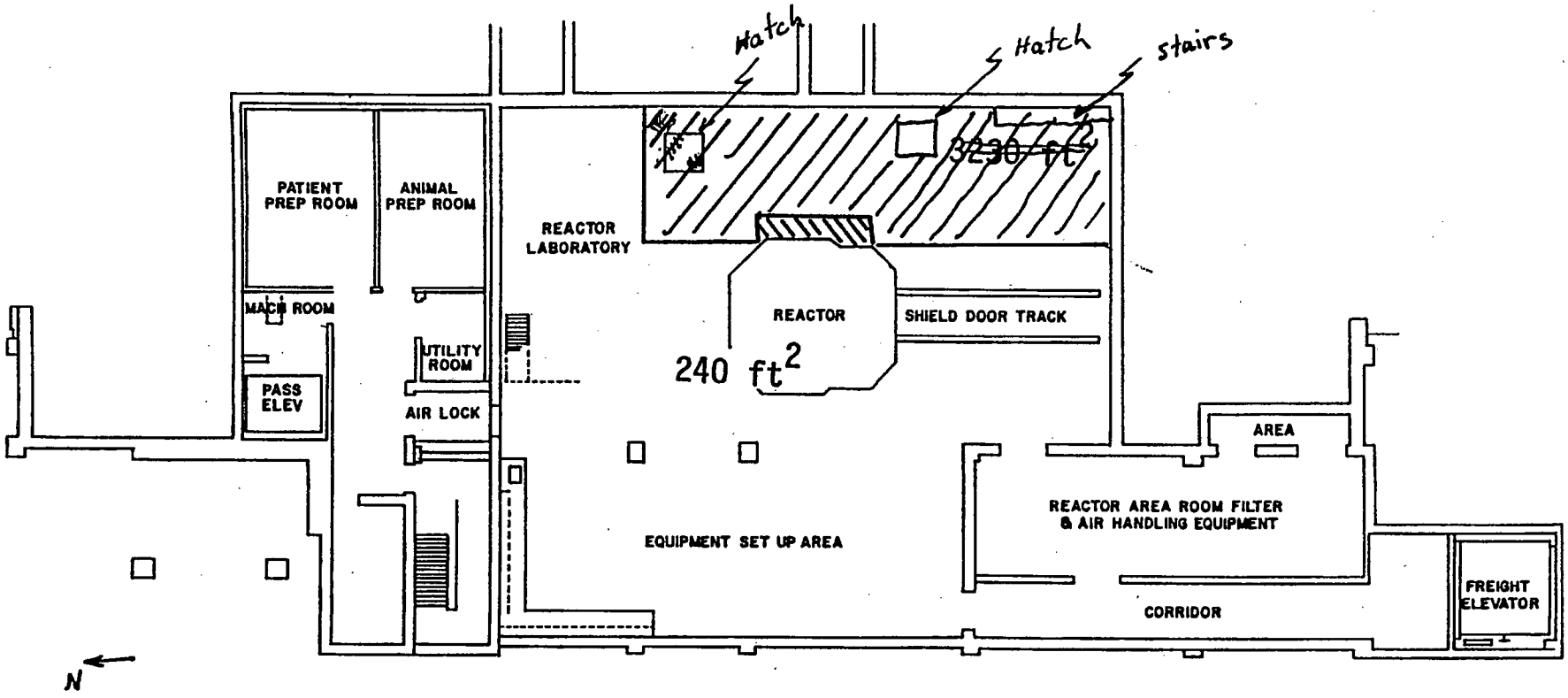
With regard to the Reactor Startup Procedures previously submitted to the A. E. C. on 20 May 1959, Walter Reed has received confirmation from Atomics International that "... at least one Atomics International representative to be present during the performance of all of the initial operation tests listed in the startup procedure." This time period is tentatively scheduled for one month.

In addition to the A. I. technical support, the reactor consultant to WRAIR, Mr. Robert Carter of the Los Alamos Scientific Laboratory, will be present for the initial period of operation.

R. P. MASON
Colonel, MC
Director

Subscribed and sworn to before me this day of April 1961.

WILLIAM H. HERRICK
Captain, MSC
Adjutant



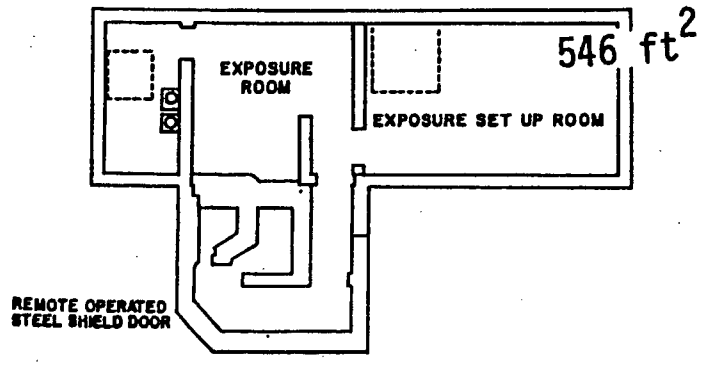
Floor Loading

//// 350 PSF

\\\\ 1600 PSF

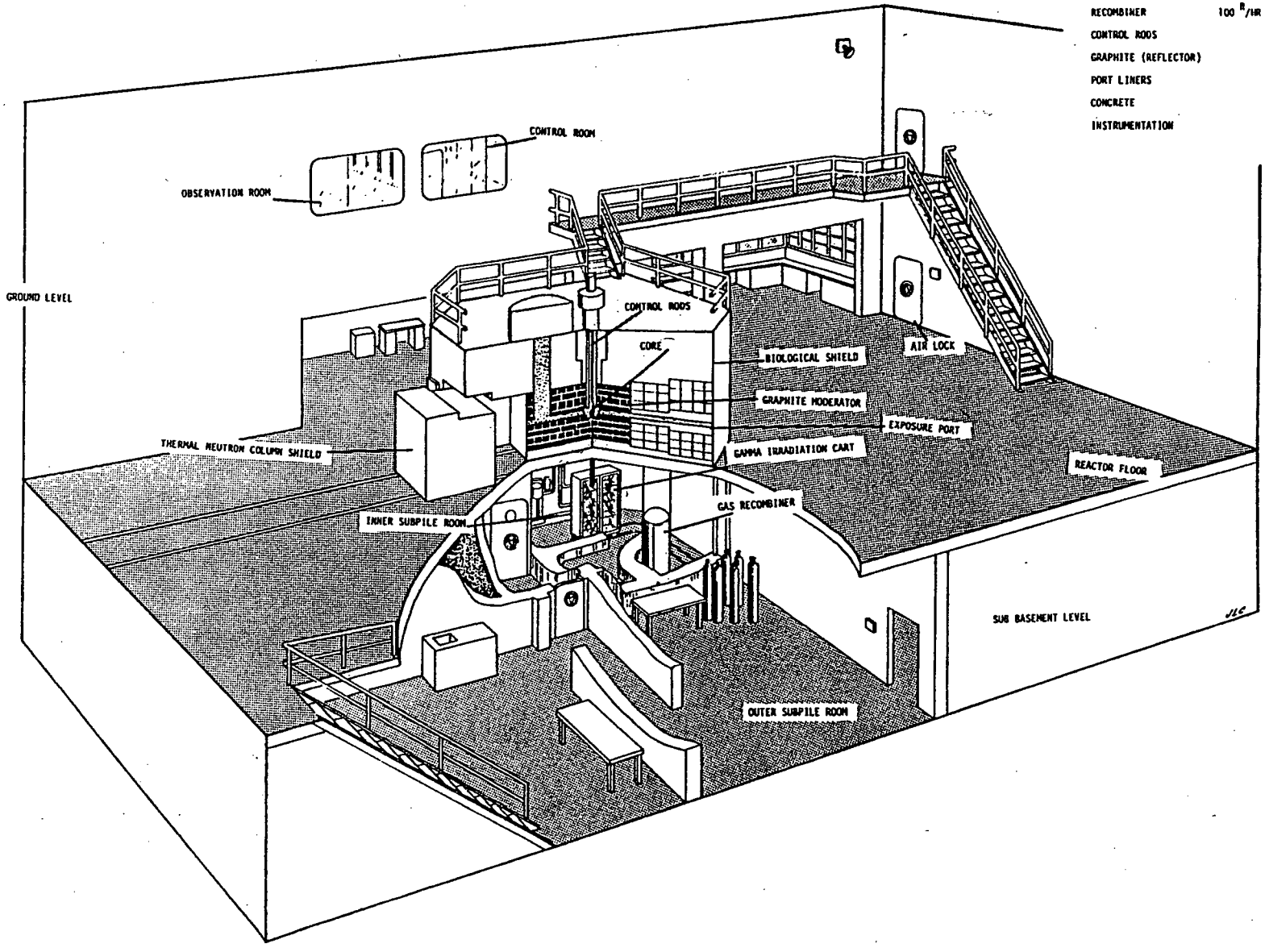
▭ 4000 PSF

(Uniform Distribution)



RADIOACTIVITY LEVELS

	Before Defueling	After Defueling	After Rinse
CORE (GLORY HOLE)	740 R/HR	250	230
SEC. CONTAINER	350 R/HR	25	20
RECOMBINER	100 R/HR	22	15
CONTROL RODS		9	
GRAPHITE (REFLECTOR)		3 to 150 MR/HR	
PORT LINERS		2 to 50 MR/HR	
CONCRETE		50 MR/HR	
INSTRUMENTATION		30 MR to T R	



THE WALTER REED RESEARCH REACTOR DISMANTLING PROJECT

The Walter Reed Research Reactor located at the Walter Reed Army Medical Center in Washington, D. C., has been defueled and dismantled. The objective of this paper is a review of the problems experienced in the procedures and equipment used.

The reactor was built in 1961 as an integral part of a new wing of the Walter Reed Army Institute of Research and was dismantled during the period August through December 1971. The facility was an Atomics International Model L-54 homogeneous fueled research reactor with a maximum operating power of 50,000 watts. The reactor had been operated for a total integrated power of 186 Megawatt hours.

The reactor facility was located about 20 feet below ground level and was completely surrounded by the four-story research institute. Access to the reactor room was through a 3-ton freight elevator and a 2-ton passenger elevator. Both elevators were controlled access type. The weight limits restricted the type shipping containers that could be deployed in removing the fuel and radioactive materials. The height of the structures surrounding the facility discouraged the use of cranes or other heavy duty equipment.

The principal problems encountered were the fuel removal and shipment, recombiner removal, core removal, and biological shield demolition. The fuel consisted of 26.5 liters of aqueous UO_2SO_4 with 1215 grams of uranium highly enriched in ^{235}U. Two specially designed containers were used to ship the fuel and rinse solution. These containers were approved by DOT for transporting the fuel. The recombiner water and decon solutions were solidified in vermiculite and shipped in shielded stainless steel drums.

The core assembly was removed with the built-in overhead crane and heavy duty dollies. A U-shaped lead brick shadow shield was constructed to allow technicians to separate the core container from its concrete shield plug.

The heavy dense concrete biological shield was demolished by use of a hydraulic device called the "Darda" rock splitter. This device consists of a 2-foot snout constructed of two irregular hemi-cylinders separated by an inclined plunger which is actuated by a hydraulic mechanism. The snout is placed in a 3-foot hole drilled in the rock or concrete, and the two hemi-cylinders are separated as the incline blade is forced outward. The expansion of the snout produces uniform lateral pressures in excess of 400 tons. Early attempts to break the concrete shield by conventional devices were frustrating and even comical. Dynamite was undesirable because of the reactor's structural intimacy with the rest

of the research institute. The shield was demolished by establishing fracture planes in the structure with the splitter and then using conventional pavement breakers to separate the concrete.

The reactor dismantlement and decontamination was accomplished with virtually no disruption to normal institute operations. All defueling operations were performed within a temporary hot cell constructed in the reactor room. All radioactive materials were removed from the facility during off duty hours - at night and on weekends.

TABLE VI

WALTER REED REACTOR

MAJOR FISSION PRODUCT ACTIVITY AT 8 MONTHS

CHAIN	ISOTOPE	ACTIVITY (Curies)	HALF LIFE	RADIOACTIVITY (Type, Energy (MeV), %)
144	CE	79.46	285 d	B, 0.31 (76%) 0.175 (25%) g, 0.08 - 1.13
144	PR	79.46		B, 2.98 g, 2.18 (2%)
137	CS	23.13	26.6y	B, 0.51 (92%) 1.17 (8%)
137	BAm	21.28		g, 0.662
90	SR	23.13	28 y	B, 0.54
90	Y	23.13		B, 2.26 g, 1.74 (0.02%)
95	ZR	12.04	65 d	B, 0.36 (49%) 0.25 (49%) g, 0.76 (98%)
147	PM	43.18	2.6 y	B, 0.227
85	KR	2.70	10.3 y	B, 0.67
89	SR	4.37	59 d	B, 0.55
91	Y	8.00	58 d	B, 1.56 g, 0.004

TOTAL ACTIVITY = ~~496.54~~ 337.34 Ci

GAMMA ACTIVITY = 122.33 Ci

TABLE V

FISSION PRODUCT ACTIVITIES AFTER SHUTDOWN

WALTER REED RESEARCH REACTOR

CHAIN	ISOTOPE	8 MOS	10 MOS	12 MOS	14 MOS	16 MOS	18 MOS
137	Cs	23.13	23.04	22.96	22.87	22.78	22.69
	BA	21.28	21.20	21.12	21.04	20.96	20.88
141	CE	0.99	0.27	0.08	0.02	0.01	0.00
144	CE	79.46	68.35	58.80	50.58	43.51	37.42
	PR	79.46	68.35	58.80	50.58	43.51	37.42
147	PM	43.18	41.31	39.50	37.80	36.61	34.59
151	PM	0.00	0.00	0.00	0.00	0.00	0.00
	SM	0.66	0.66	0.66	0.66	0.66	0.66
155	EU	0.61	0.57	0.54	0.51	0.48	0.45
TOTAL		337.34	296.82	267.31	244.31	225.98	209.82

TABLE V

FISSION PRODUCT ACTIVITIES AFTER SHUTDOWN

WALTER REED RESEARCH REACTOR

CHAIN	ISOTOPE	8 MOS	10 MOS	12 MOS	14 MOS	16 MOS	18 MOS
85	BR	0.00	0.00	0.00	0.00	0.00	0.00
	KRm	0.00	0.00	0.00	0.00	0.00	0.00
	KR	2.70	2.67	2.64	2.61	2.58	2.55
89	SR	4.37	1.89	0.82	0.36	0.15	0.07
	Ym	0.00	0.00	0.00	0.00	0.00	0.00
90	SR	23.13	23.03	22.94	22.84	22.75	22.70
	Y	23.13	23.03	22.94	22.84	22.75	22.70
91	Ym	0.00	0.00	0.00	0.00	0.00	0.00
	Y	8.00	3.97	1.92	0.93	0.45	0.22
93	FR	0.00	0.00	0.00	0.00	0.00	0.00
95	ZR	12.04	6.30	3.29	1.72	0.90	0.47
	NBm	0.24	0.13	0.07	0.03	0.02	0.01
	NB	0.24	0.13	0.07	0.04	0.02	0.01
103	TC	0.00	0.00	0.00	0.00	0.00	0.00
	RU	1.10	0.38	0.13	0.04	0.02	0.01
	RH	1.10	0.38	0.13	0.04	0.02	0.01
106	RU	6.12	5.46	4.87	4.34	3.87	3.46
	RH	6.12	5.46	4.87	4.34	3.87	3.46
125	SN	0.00	0.00	0.00	0.00	0.00	0.00
	SB	0.04	0.02	0.01	0.01	0.00	0.00
	TEM	0.03	0.02	0.01	0.01	0.00	0.00
127	SB	0.00	0.00	0.00	0.00	0.00	0.00
	TEm	0.16	0.10	0.07	0.05	0.03	0.02
	TE	0.15	0.10	0.07	0.05	0.03	0.02

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

REFERENCE OR OFFICE SYMBOL	SUBJECT
MEDEC-HPO	Special Survey of WRRR Area

TO Billy G. Bass, DAC
Ch, Dept Auto Instr Analysis
WRAIR

FROM Ch, Reactor & Survey Br
WRAMC

DATE 17 March 1972 CMT 1

1. General. A survey of the reactor area was completed on 10 Feb 72 by SFC Huber. The purpose of this survey was to determine if the reactor area can be cleared for use as an unrestricted area.

2. Instrumentation.

a. Survey. The instrument used was a Victoreen Mdl 440 ion chamber type survey meter. S.N. 1289

b. Wipes. All wipes were counted on the R/A Lab, NL&TS Br Beckman WIDEBETA II. Isotope identification was performed on the R/A Lab 4"x4" NaI analyzer system.

3. Methods and Results.

a. Exposure rates were measured on all floor and wall areas in the WRRR facility. All readings were taken within 2 inches of the surface. The maximum observed exposure rate readings were obtained at the point labeled A in Inclosure 1 (Walter Reed Research Reactor Area Floor Plan) and were 0.5 mR/hr. All other surface readings were less than or equal to 0.4 mR/hr.

b. Wipes were taken on all floor and wall surfaces in the WRRR facility. The maximum removable activity of 269 dpm/100 cm^2 was observed at the location labeled B in Incl 1, with all other wipes being less than or equal to 215 dpm/100 cm^2.

c. Additional Findings.

(1) The absolute filter in the lower level was reading 1 mR/hr and was showing a pressure drop of 2 inches of H_2O across the filter.

(2) All radioactively contaminated tools and waste have been collected for disposal.

4. Recommendations.

a. It is suggested that the inner sub pile room be cleaned down once more and the surface be painted with an epoxy type paint. This would fix any remaining contamination and protect the metal surface now exposed in this naturally humid area.

b. The absolute filters should be changed and disposed of as they contain fission products and activated materials released during dismantling. Notify Health Physics prior to filter removal so that shipment can be coordinated.

MEDEC-HPO
SUBJECT: Special Survey of WRRR Area 17 March 1972

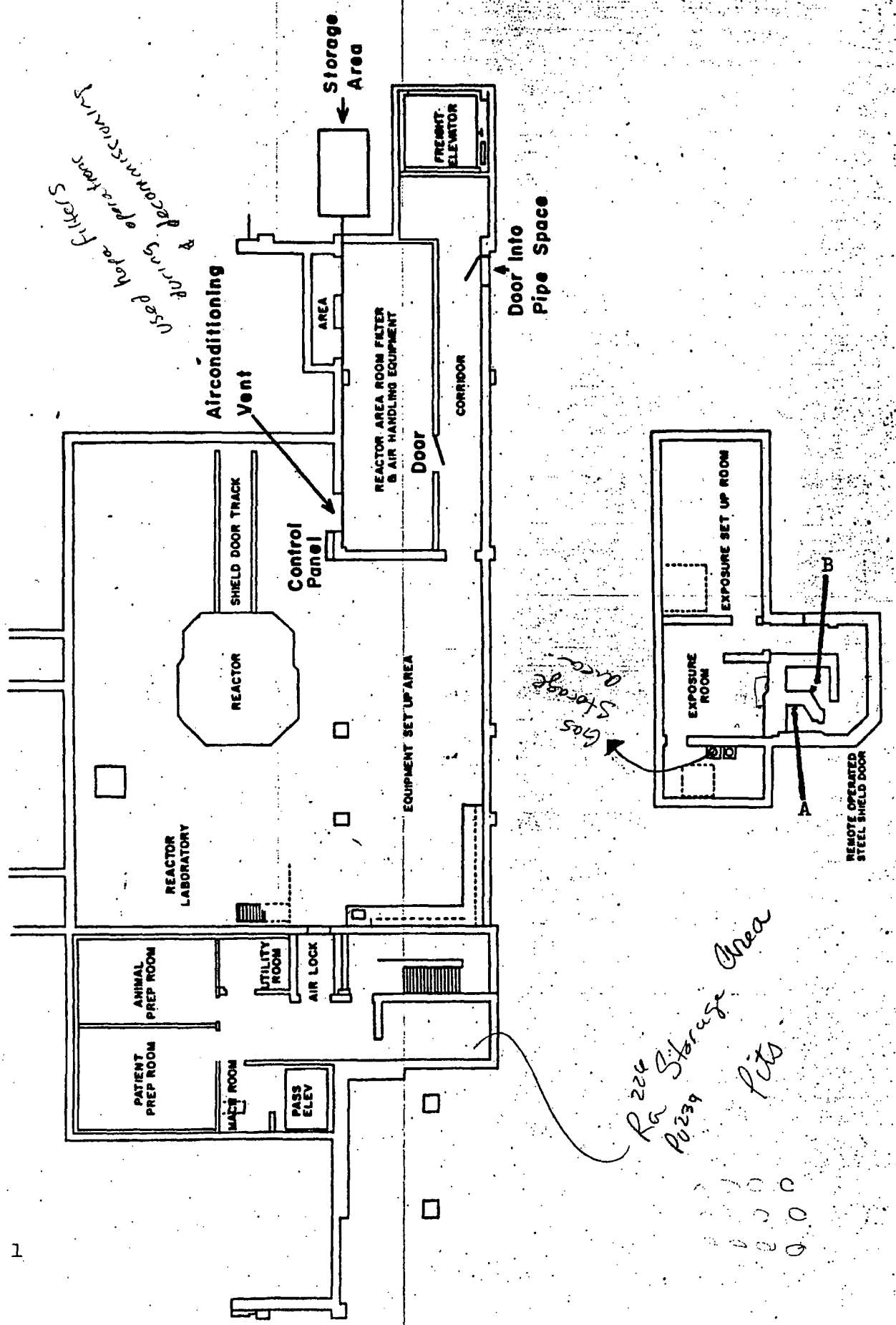
5. Conclusions. The area meets the requirements for clearance as set forth by the AEC. It is felt that after the above recommendations are implemented it would also meet the more stringent limits in WR 40-10.

Anthony R Benedetto
ANTHONY R. BENEDETTO
1LT, MSC
Chief, Reactor & Survey Branch

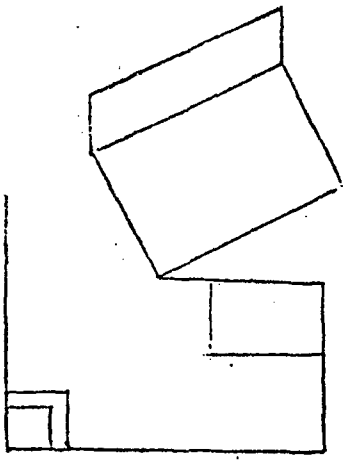
APPROVED:

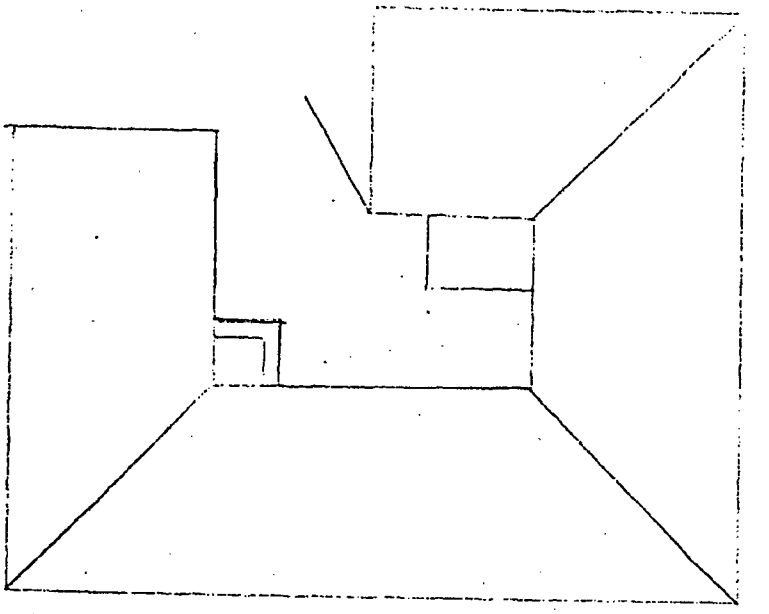
Vandy D. Miller
VANDY D. MILLER
LTC, MSC
Health Physics Officer

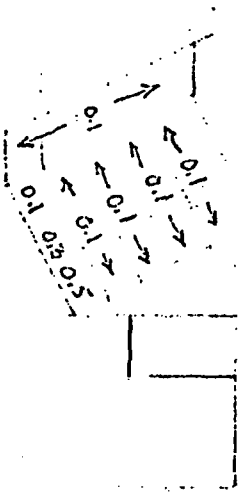
WALTER REED RESEARCH REACTOR FLOOR PLAN



Incl 1



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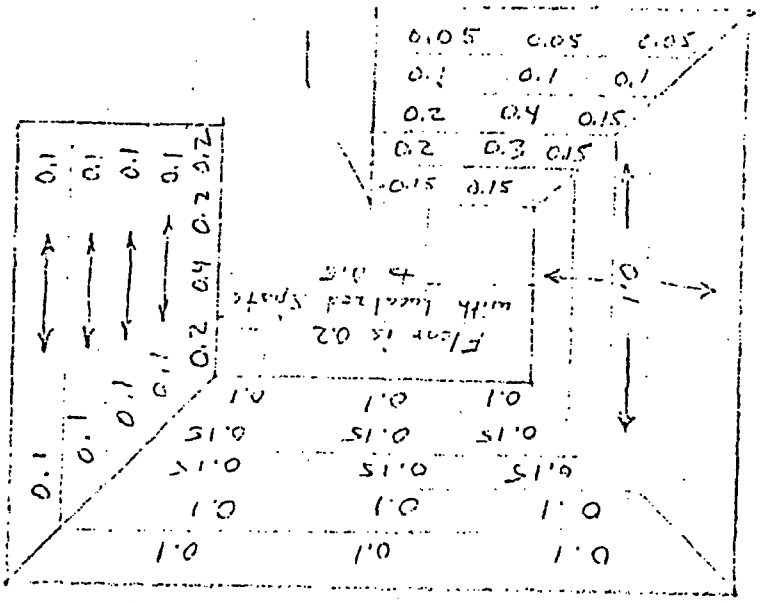
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0.1
0.1
0.1
0.2
0.4
0.15
0.2
0.3
0.15
0.15
0.15
Floor is 0.2
with local spots
+ 0.2
1.0
0.1
0.1
0.1
0.1
0.2
0.2
0.4
0.2
0.1
0.1
0.1
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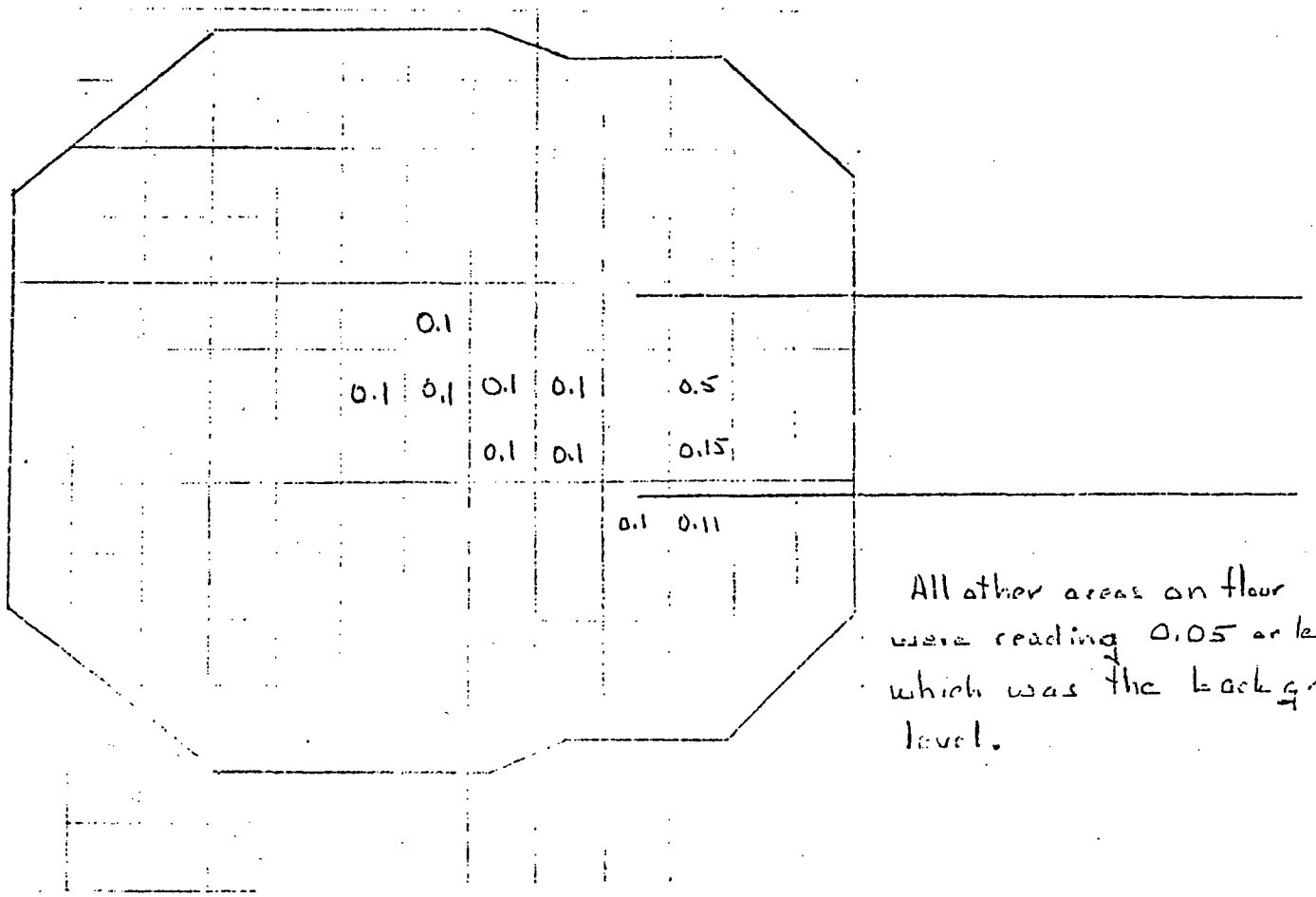
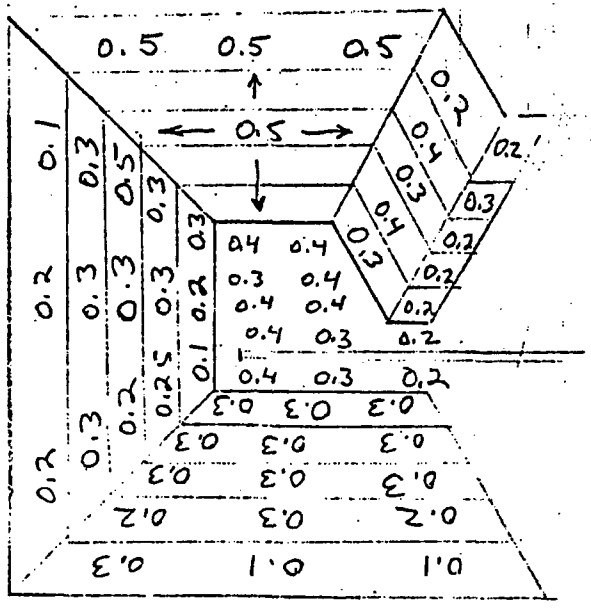


All other areas on floor were reading 0.05 or less which was the background level.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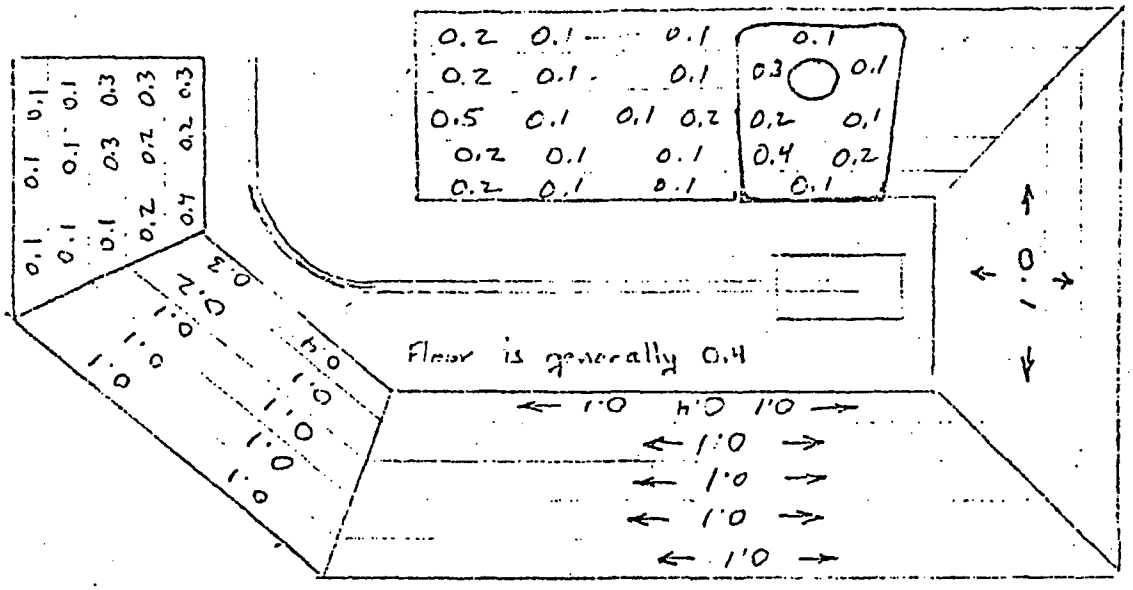
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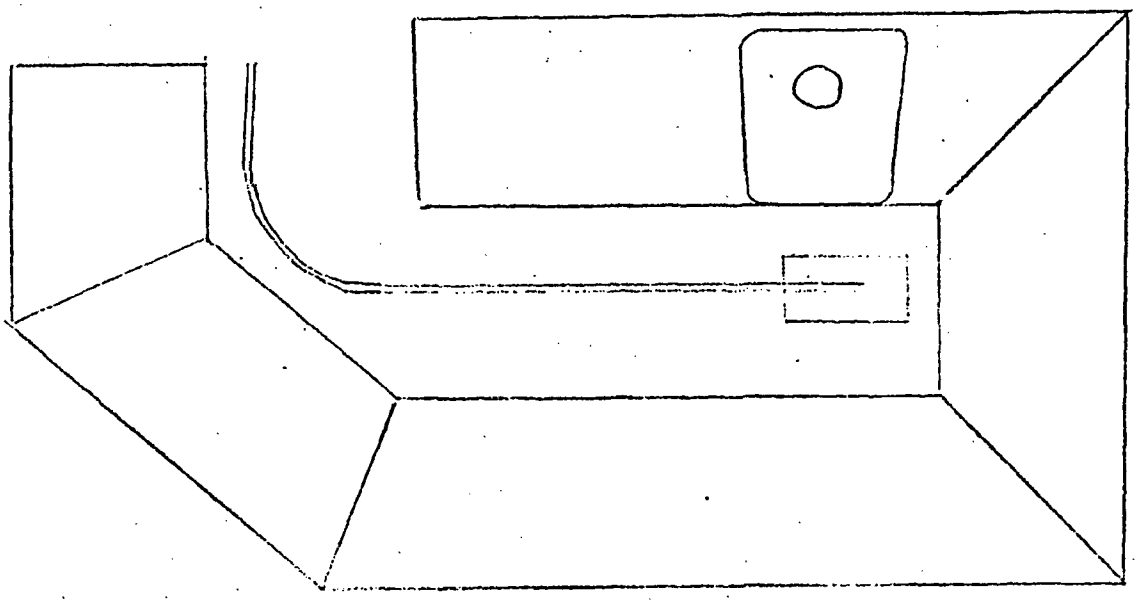
0.2 0.1 0.1 0.1
0.1 0.1 0.1 0.3 0.3 0.3
0.1 0.1 0.3 0.2 0.2
0.1 0.1 0.1 0.2 0.4
Floor is generally 0.4
1.0 1.0 1.0
1.0
1.0
1.0
1.0



DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

REFERENCE OR OFFICE SYMBOL	SUBJECT
HSWP-QHP	Radiation Survey

TO Ch, Div Instr
WRAIR

FROM NCOIC, R&S Br
HPO, WRAMC

DATE 21 July 1977 CMT 1
SFC Harmon/cdh/63481

In accordance with your request, this office conducted a radiation survey of the lower reactor level in Building #40, WRAMC. The results of that survey are attached at Inclosure 1.

Charles D. Harmon
CHARLES D. HARMON
SFC (E7)
NCOIC, R&S Br, HPO

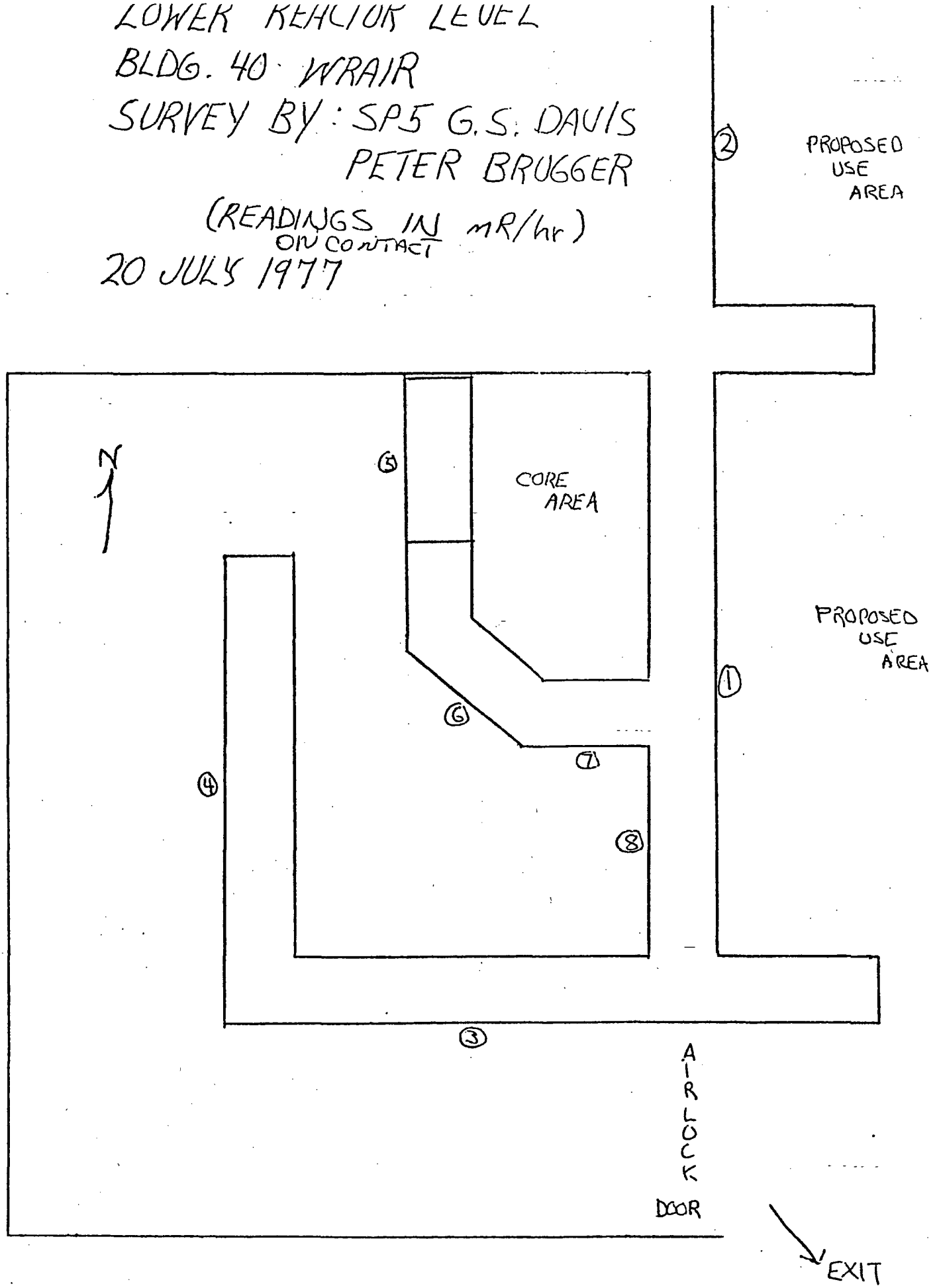
1 Incl
as

Cf: HPO, WRAMC

DA FORM 1 FEB 62 2496 REPLACES DD FORM 96, EXISTING SUPPLIES OF WHICH WILL BE ISSUED AND USED UNTIL 1 FEB 63 UNLESS SOONER EXHAUSTED.

GPO : 1968 O - 322-400

LOWER REACTOR LEVEL
BLDG. 40 WRAIR
SURVEY BY: SP5 G.S. DAVIS
PETER BRUGGER
(READINGS IN mR/hr ON CONTACT)
20 JULY 1977



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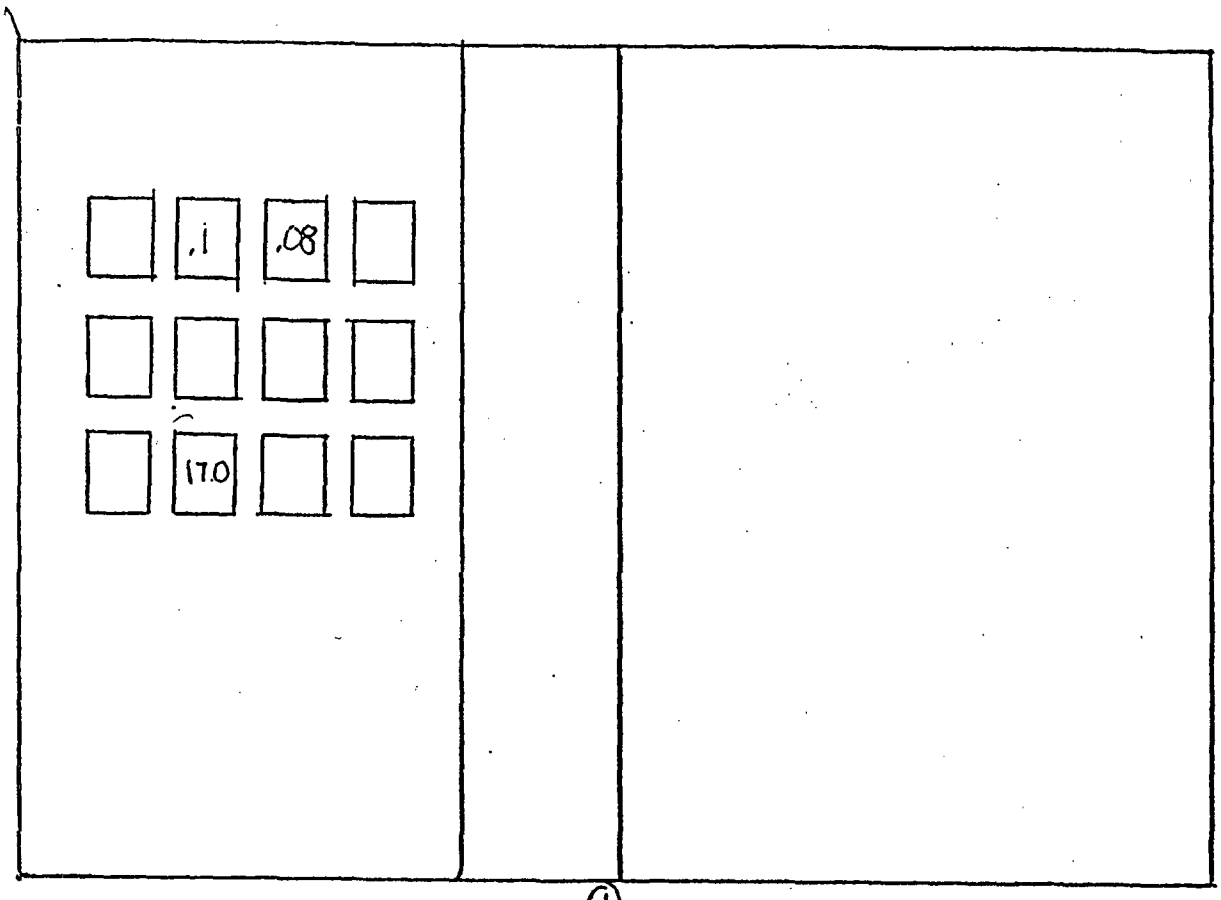
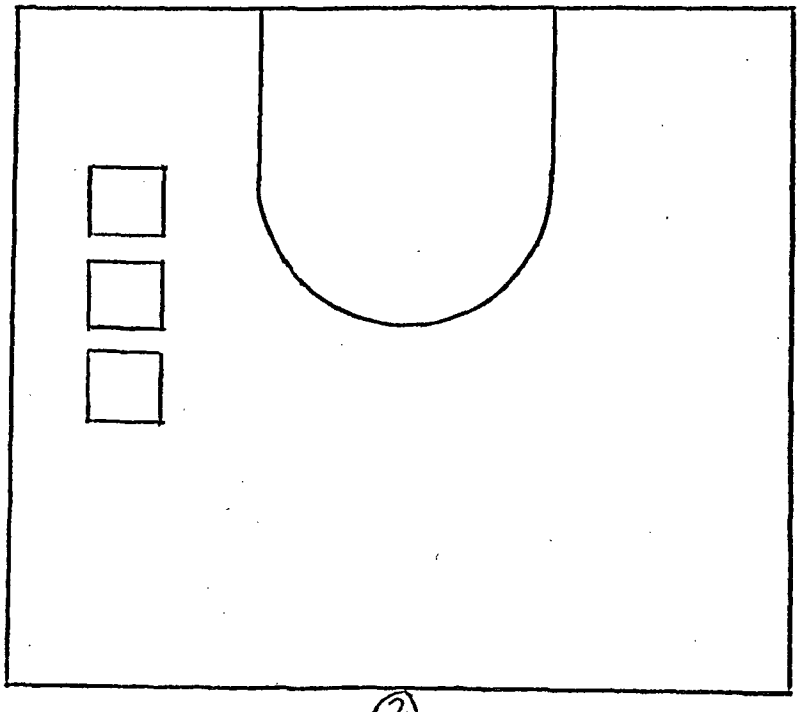


① BKG ≤ 0,08

gud.



② BKG ≤ 0,08

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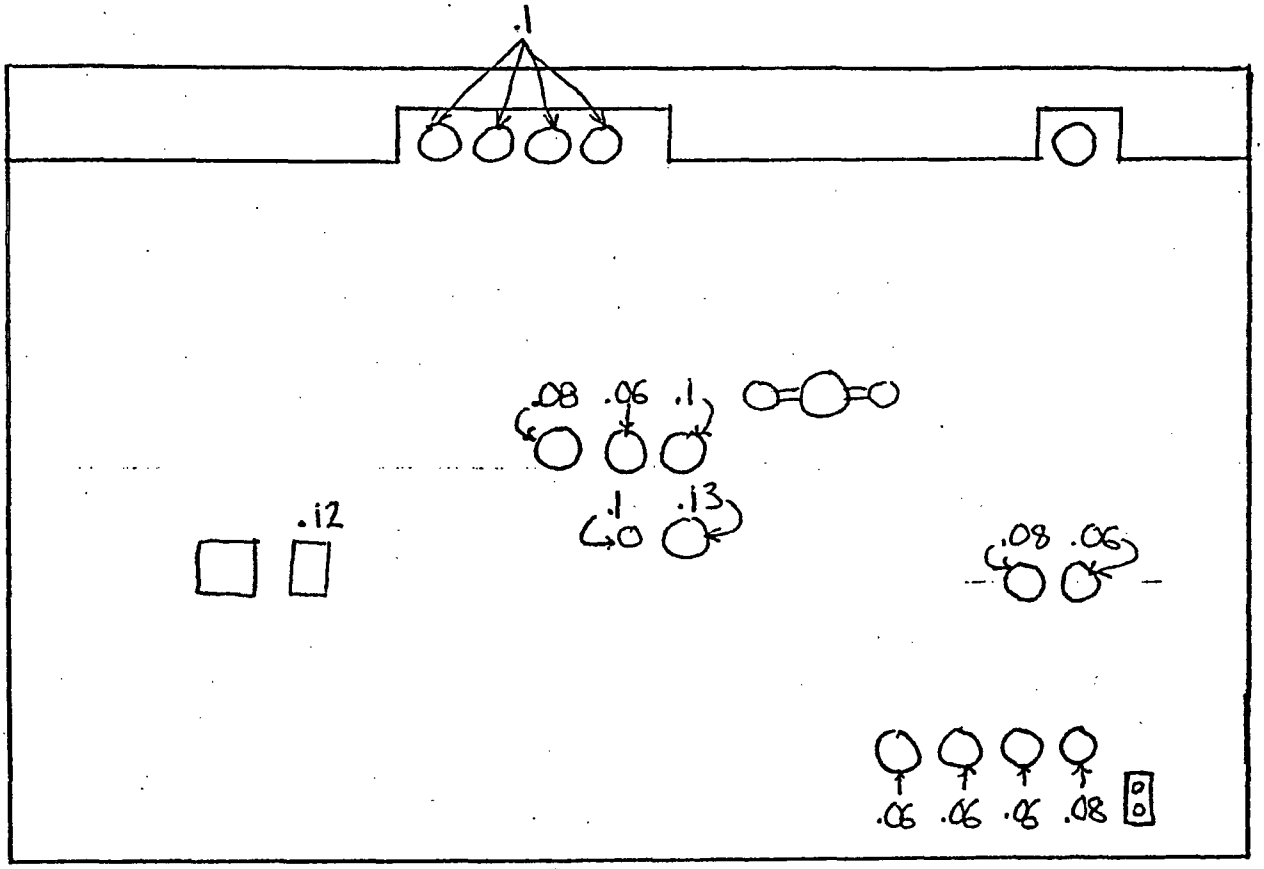

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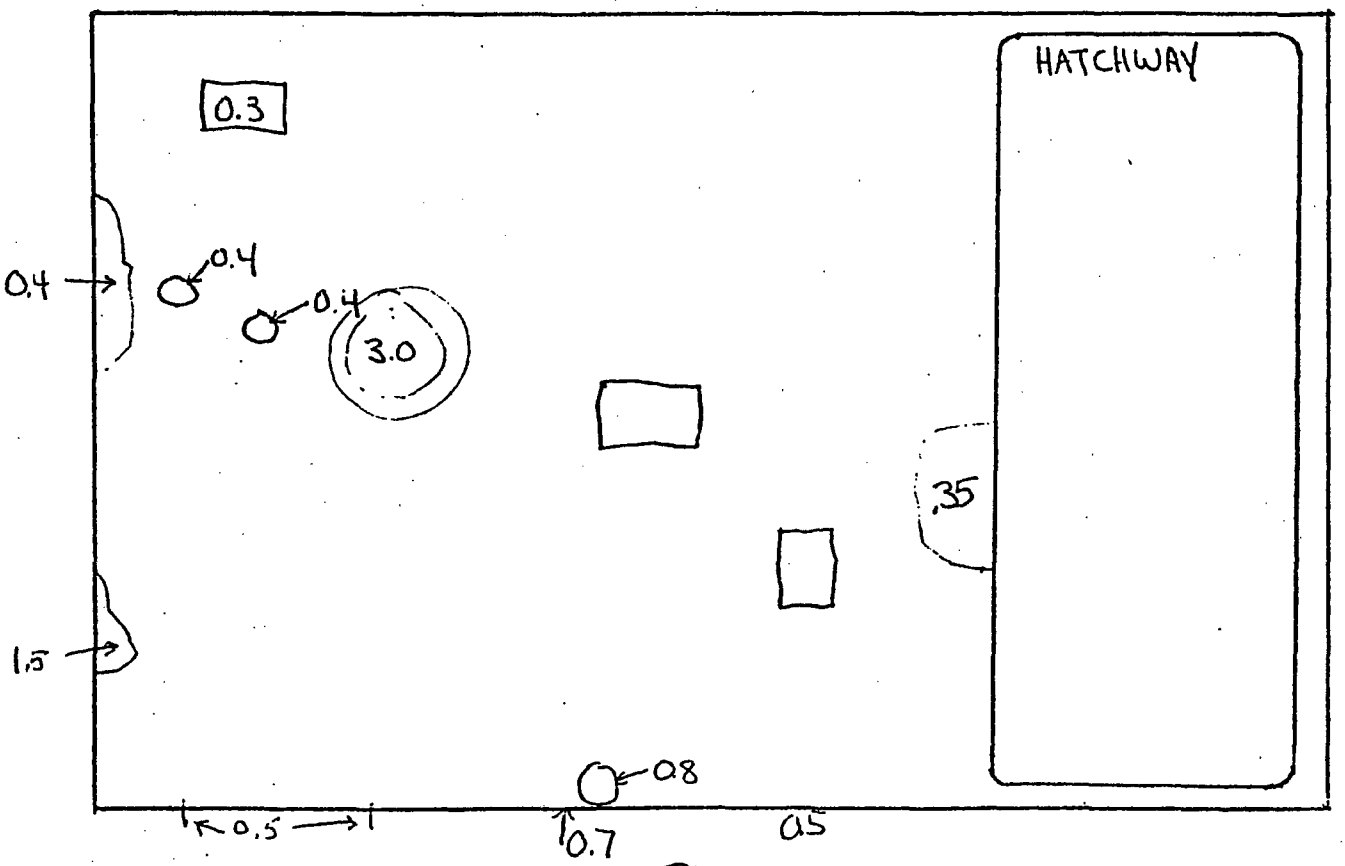
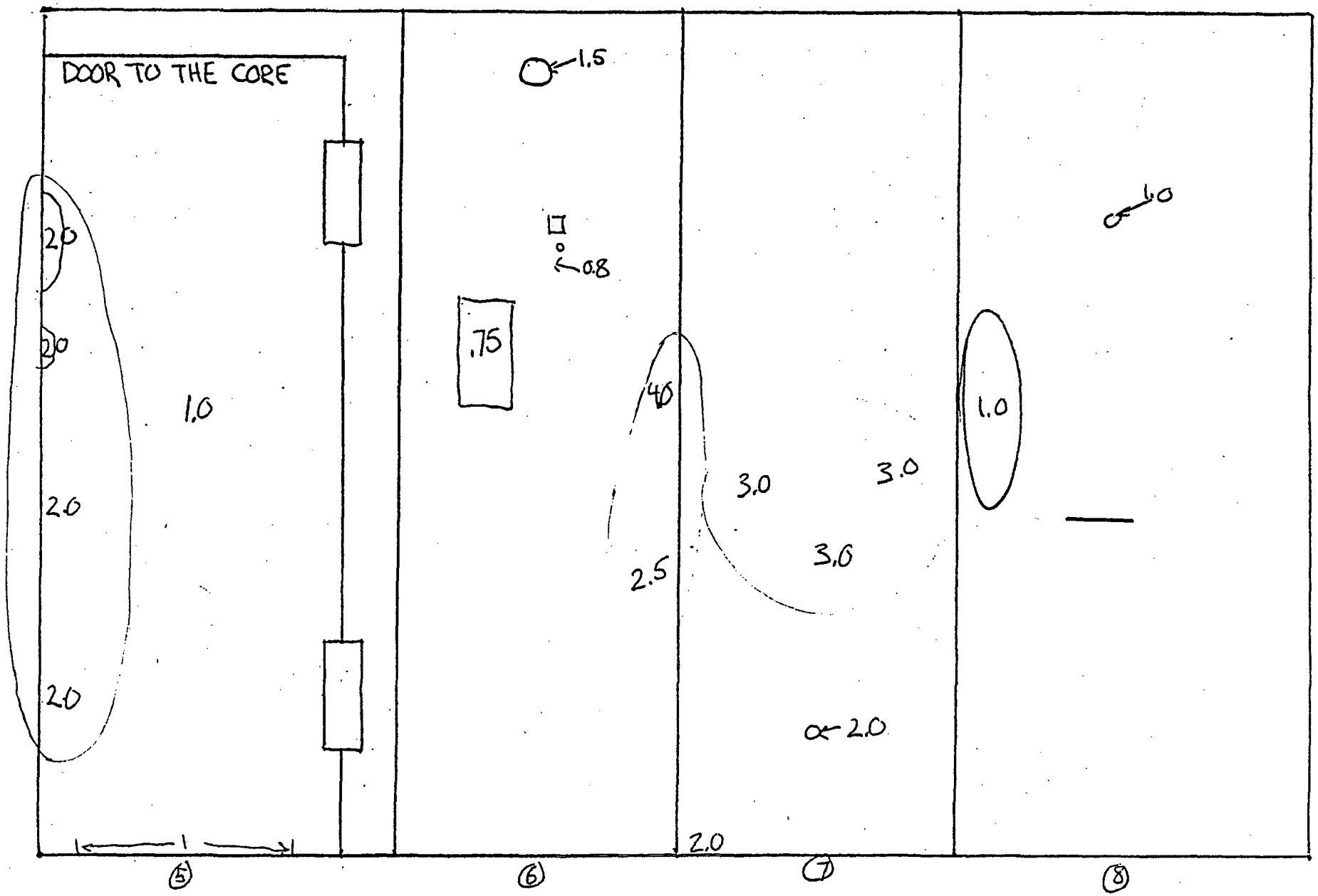


Incl 3

④

gsc


DOOR TO THE CORE
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gsd

APPENDIX I

WRAMC HPO SOP'S

AND

LICENSES

??
??

(7-94)

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Amendment No. 69

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Department of the Army Walter Reed Army Medical Center (WRAMC)	In accordance with the letter dated December 6, 1996,
2. Washington, D.C. 20307-5001	3. License Number 08-01738-02 is amended in its entirety to read as follows:
	4. Expiration Date June 30, 2004
	5. Docket or Reference No. 030-01317

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount that Licensee May Possess at Any One Time Under This License
A. Any byproduct material with atomic numbers 1-83	A. Any	A. 400 millicuries of each radionuclide with a total possession limit of 26 curies
B. Iodine 131	B. Any	B. 2 curies
Xenon 133	C. Any	C. 2 curies
Krypton 85	D. Any	D. 1 curie
E. Phosphorus 32	E. Any	E. 2 curies
F. Carbon 14	F. Any	F. 2 curies
G. Iodine 125	G. Any	G. 1 curie
H. Iridium 192	H. Any	H.
I. Chromium 51	I. Any	I. 750 millicuries
J. Sulfur 35	J. Any	J. 1 curie
K. Hydrogen 3	K. Any	K. 5 curies
L. Molybdenum 99	L. Molybdenum 99/ Technetium 99m Generators	L. 23 curies
M. Technetium 99m	M. Any	M. 23 curies
N. Strontium 90	N. Sealed sources	N.
O. Cesium 137	O. Sealed sources	O.
P. Gadolinium 153	P. Sealed sources	P.
Q. Iodine 125	Q. Sealed sources (3M Company seeds)	Q. 1 curie
R. Iodine 125	R. Sealed sources ((Norland Inst. Co., Model 178A591A or AECL Models C235 or C324, or Amersham Corp. Model IMC.P2)	R. 4 sources, not to exceed 300 millicuries each

Ex 2

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MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
08-01738-02
Docket or Reference Number
030-01317
Amendment No. 69

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
S. Cesium 137	S. Sealed sources	S.
T. Cobalt 60	T. Sealed sources	T.
U. Americium 241	U. Any	U. 100 microcuries
V. Americium 241	V. Sealed sources	V.
W. Nickel 63	W. Sealed sources and foils	W. 1 curie
X. Iodine 129	X. Sealed sources	X. 1 curie
Y. Thorium	Y. Any	Y. 5 kilograms
Z. Uranium	Z. Any	Z. 50 kilograms
AA. Cesium 137	AA. Sealed sources	AA.
BB. Americium 241	BB. Sealed sources	BB.
CC. Cesium 137	CC. Sealed source	CC.
DD. Paladium 103	DD. Sealed sources	DD. 3 curies
EE. Uranium depleted in Uranium 235	EE. Plated Metal	EE. 400 Kilograms

9. Authorized use

A. through DD. Medical diagnosis, therapy and research in humans in accordance with any applicable Food and Drug Administration (FDA) requirements. Research and development as defined in 10 CFR 30.4, including animal studies; instrument calibration; student instruction.

EE. Shielding in linear accelerators.

CONDITIONS

10. Location of use: Walter Reed Army Medical Center, Washington, D. C.; WRAMC Forest Glen Section and Annex, Silver Spring, Maryland; Walter Reed Army Institute of Research Animal Holding Facility, Fort Meade, Maryland; U.S. Army Medical Laboratory, WRAMC Department of Pathology, Fort Meade, Maryland; and U.S. Army Institute of Dental Research Facility, Fort Meade, Maryland; Rickman Building, 13 Taft Court, Rockville, Maryland and Gillette Building, 270 Research Center, 1413 Research Boulevard, Rockville, Maryland.

11. A. Licensed material shall be used by, or under the supervision of, individuals designated in writing by the Radiation Safety Committee, Colonel John R. Pierce, Chairperson.

B. The use of licensed material in or on humans shall be by a physician, dentist, or podiatrist as defined in 10 CFR 35.2.

Ex 2

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C. Physicians, dentists, or podiatrists designated to use licensed material in or on humans shall meet the training criteria established in 10 CFR 35, Subpart J and shall be designated in writing by the licensee's Radiation Safety Committee.

D. The Radiation Safety Officer for this license is Colonel William B. Johnson.

12. In addition to the possession limits in Item 8, the licensee shall further restrict the possession of licensed material at a single location to quantities below the limits specified in 10 CFR 30.72 which require consideration of the need for an emergency plan for responding to a release of licensed material.

13. Notwithstanding the requirements of 10 CFR 35.49(a) and (b), 35.100, 35.200, 35.300, 35.400 and 35.500 the licensee may use for any medical use any byproduct material or reagent kit. The licensee shall possess and use byproduct material for medical use in accordance with the prescriptive and performance criteria in the other sections of 10 CFR 35. This does not relieve the licensee from complying with applicable U.S. Food and Drug Administration (FDA) and other Federal and State requirements.

14. A. Detector cells containing a titanium tritide foil or a scandium tritide foil shall only be used in conjunction with a properly operating temperature control mechanism which prevents the foil temperatures from exceeding that specified in the certificate of registration referred to in 10 CFR 32.210.

B. When in use, detector cells containing a titanium tritide foil or a scandium tritide foil shall be vented to the outside.

15. The licensee shall conduct a physical inventory every three months to account for all sealed sources and devices containing licensed material received and possessed pursuant to 10 CFR 35.59, 35.400 and 35.500 and every six months for all other sealed sources and devices.

16. A. Sealed sources and detector cells containing licensed material shall be tested for leakage and/or contamination at intervals not to exceed six months or at such other intervals as are specified by the certificate of registration referred to in 10 CFR 32.210, not to exceed three years.

B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed three months.

C. In the absence of a certificate from a transferor indicating that a leak test has been made within six months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.

D. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to any use or transfer as a sealed source.

License Number
08-01738-02

Docket or Reference Number
030-01317

Amendment No. 69

MATERIALS LICENSE
SUPPLEMENTARY SHEET

E. Sealed sources and detector cells need not be leak tested if:

(i) they contain only hydrogen-3; or

(ii) they contain only a radioactive gas; or

(iii) the half-life of the isotope is 30 days or less; or

(iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or

(v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transfer to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

F. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission and the source or detector cell shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within five days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region I, ATTN: Chief, Nuclear Materials Safety Branch, 475 Allendale Road, King of Prussia, Pennsylvania 19406. The report shall specify the source or detector cell involved, the test results, and corrective action taken.

G. The licensee is authorized to collect leak test samples for analysis by the licensee. Alternatively, tests for leakage and/or contamination may be performed by persons specifically licensed by the Commission or an Agreement State to perform such services.

17. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.

18. The licensee is authorized to hold radioactive material with a physical half-life of less than 65 days and Sulfur 35, Cobalt 58, Iridium 192, Scandium 46, for decay-in-storage before disposal in ordinary trash, provided:

A. Waste to be disposed of in this manner shall be held for decay a minimum of ten half-lives.

B. Before disposal as ordinary trash, the waste shall be surveyed at the container surface with the appropriate survey instrument set on its most sensitive scale and with no interposed shielding to determine that its radioactivity cannot be distinguished from background. All radiation labels shall be removed or obliterated.

C. A record of each such disposal permitted under this License Condition shall be retained for three years. The record must include the date of disposal, the date on which the byproduct material was placed in storage, the radionuclides disposed, the survey instrument used, the background dose rate, the dose rate measured at the surface of each waste container, and the name of the individual who performed the disposal.

19. Experimental animals, or the products from experimental animals, that have been administered licensed materials shall not be used for human consumption.

20. The licensee shall possess and use byproduct material for human research in accordance with the prescriptive and performance criteria in all sections of 10 CFR Part 35 except sections 35.49(a) and (b), 35.100, 35.200, and 35.300.

21. The licensee is authorized to transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

22. The licensee shall not acquire licensed material in a sealed source or device unless the source or device has been registered with the U.S. Nuclear Regulatory Commission pursuant to 10 CFR 32.210 or equivalent regulations of an Agreement State.

Radioactive waste generated shall be stored in accordance with the statements, representations, and procedures included with the waste storage plan described in the licensee's letter/application dated September 9, 1993 and October 29, 1993.

24. Notwithstanding the requirements of 10 CFR 35.315(a)(7), the licensee may control contamination in rooms used to house radiopharmaceutical therapy patients in accordance with the commitments and procedures contained in the letters dated April 8, 1992 and November 24, 1992.

License Number
08-01738-02

Docket or Reference Number
030-01317

Amendment No. 69

MATERIALS LICENSE
SUPPLEMENTARY SHEET

25. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below, except for minor changes in the medical use radiation safety procedures as provided in 10 CFR 35.31. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated January 21, 1993
B. Letter dated September 9, 1993
C. Letter dated October 29, 1993
D. Letter dated December 9, 1993
E. Letter dated February 15, 1994
F. Letter dated June 2, 1994
G. Letter daetd December 6, 1996

For the U.S. Nuclear Regulatory Commission

Date MAR 26 1997

By _____
Nuclear Materials Safety Branch
Region I
King of Prussia, Pennsylvania 19406

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special ear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Department of the Army Walter Reed Army Medical Center 2. Washington, D.C. 20307-5001	In accordance with the letter dated May 13, 1994, 3. License number 08-01738-03 is amended in its entirety to read as follows: 4. Expiration date November 30, 1996 5. Docket or Reference No. 030-06895

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Cobalt 60	A. Sealed sources	A.
B. Cesium 137	B. Sealed sources	B.
Cesium 137	C. Sealed sources	C.

9. Authorized use

A. In [illegible] for the irradiation of material except explosives, flammables, or corrosives.

B. In [illegible] for the irradiation of material except exp[illegible]

C. [illegible] for the irradiation of material except explosives, flammables, or corrosives.

CONDITIONS

10. Licensed material may be used only at the licensee's facilities located at Walter Reed Army Medical Center, Washington, D.C.

11. A. Licensed material shall only be used by, or under the supervision of, individuals who have received the training described in application dated March 18, 1991 and have been designated in writing by the Radiation Safety Officer.

B. The Radiation Safety Officer for this license is LTC William B. Johnson.

Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.

Ex 2

13. A. Sealed sources and detector cells containing licensed material shall be tested for leakage and/or contamination at intervals not to exceed six months or at such other intervals as are specified by the certificate of registration referred to in 10 CFR 32.210, not to exceed three years.

B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed three months.

C. In the absence of a certificate from a transferor indicating that a leak test has been made within six months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.

D. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to any use or transfer as a sealed source.

E. Sealed sources and detector cells need not be leak tested if:

(i) they contain only hydrogen-3; or

(ii) they contain only a radioactive gas; or

(iii) the half-life of the isotope is 30 days or less; or

(iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or

(v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transfer to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

F. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission and the source or detector cell shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within five days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region I, ATTN: Chief, Nuclear Materials Safety Branch, 475 Allendale Road, King of Prussia, Pennsylvania 19406. The report shall specify the source or detector cell involved, the test results, and corrective action taken.

G. The licensee is authorized to collect leak test samples for analysis by licensee. Alternatively, tests for leakage and/or contamination may be performed by persons specifically licensed by the Commission or an Agreement State to perform such services.

14. The licensee shall not perform repairs or alterations of the irradiator involving removal of shielding or access to the licensed material. Removal, replacement, and disposal of sealed sources in the irradiator shall be performed by persons specifically licensed by the Commission or an Agreement State to perform such services.

15. The licensee shall conduct a physical inventory every six months to account for all sealed sources and devices containing licensed material received and possessed under the license.

16. The procedures contained in the manufacturer's instruction manual for the irradiator authorized by this license shall be followed and a copy of this manual shall be made available to each person using or having responsibility for the use of the device.

17. The licensee is authorized to transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

18. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

    A. Application dated March 18, 1991
    B. Letter dated July 11, 1991

For the U.S. Nuclear Regulatory Commission

Date JUN 30 1995

By Original Signed By:
Duncan White
Nuclear Materials Safety Branch
Region I
King of Prussia, Pennsylvania 19406

AUTHORITY FOR SELECTED RADIOACTIVE MATERIALS NOT CONTROLLED BY NUCLEAR REGULATORY COMMISSION (NRC)

reliance on statements and representations made by the applicant, authority is hereby granted to receive, s, use and store the material(s) designated in Item 4. This authority is subject to conditions specified n 8 below.

1. ACTIVITY GRANTED AUTHORITY (Give name and address)	2. AUTHORIZATION NUMBER
Walter Reed Army Medical Center Washington, DC 20307-5001	08-01-94
	3. EXPIRATION DATE 30 June 1994

4. MATERIAL AND MASS NUMBER	5. CHEMICAL AND/OR PHYSICAL FORM	6. QUANTITY LIMITATION
a. Atomic numbers 1 thru 84 inclusive	a. Any accelerator produced or naturally occuring radioactive material.	a. 2.0 Curies totaL with no more than 400 mCi of any element on hand at any one time.
b. Radium-226 daughters	b. Sealed sources	b. 50 millicuries

7. AUTHORIZED USE

Medical purposes, research and development, instrument check and calibration.

CONDITIONS

8. UNLESS OTHERWISE SPECIFIED, THE AUTHORIZED PLACE OF USE IS THE ADDRESS STATED IN ITEM 1 ABOVE.

a. The use of radioactive materials shall be in accordance with provisions of AR 40-5, TB MED 525 and Title 10, Chapter 1, Code of Federal Regulations.

b. Radiation protection will accomplished on a full-time basis in accordance with AR 40-5. Your approved RPO is LTC Peter Myers.

c. Use of radioactive material shall be by, or under the supervision of, individuals designated by the Walter Reed Army Medical Center Radiation Control Committee.

d. The use of radioactive materials in or on humans shall be by, or under the supervision of a physician with training and experience as described in Appendix A, US Nuclear Regulatory Commission Regulatory Guide 10.8 (Rev 2, Aug 1987).

(See Continuation Sheet)

SIGNATURE (Director, HCO and Chairman AMEDD Radioisotope Committee)	DATE
for COL, MC RONALD R. BLANCK, BG, MC, Dir, Professional Svcs	APR 12 1991

ITEM 8 (cont)

e. Each sealed source, other than tritium, with a physical half-life of greater than 30 days and in a form other than a gas shall be tested for leakage and contamination:

(1) After acquisition but prior to use unless tested within 6 months.

(2) At intervals not to exceed 6 months except that sources designed to emit alpha particles shall be tested every 3 months.

(3) Does not apply to sources containing 100 microcuries or less of beta or gamma emitters or 10 microcuries or less of alpha emitters or sources, other than alpha, that are in storage and not being used.

f. The test shall be capable of detecting the presence of 0.005 microcuries of radioactive material on the test sample. Samples shall be taken from surfaces where contamination is likely to occur. Records of leak tests shall be kept in units of microcuries and maintained for inspection.

g. Except as specifically provided otherwise by this authorization, dioactive materials described in items 4, 5 and 6 of this horization will be possessed and used in accordance with statements, epresentations and procedures contained in the application dated 24 May 1990.

h. This supersedes DARA No. 08-01-90.

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application. If application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 15. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail three copies to: U. S. Atomic Energy Commission, Washington 25, D. C. Attention: Isotopes Branch, Division of Licensing and Regulation. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30 and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. *(Institution, firm, hospital, person, etc.)*

Department of the Army
Walter Reed Army Medical Center (WRAMC)
Washington, D. C. 20012

(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. *(If different from 1 (a).)*

Walter Reed Army Institute of Research
Washington D. C. 20012 (WRAIR)
Bldg 500, Forest Glen Section (FGS)
Montgomery County, Maryland 20910

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

a. WRAIR, Bldg 40, WRAMC
b. Forest Glen Section, Bldg 500, WRAMC

3. PREVIOUS LICENSE NUMBER(S). *(If this is an application for renewal of a license, please indicate and give number.)*

Renewal of 08-01738-03 with Ammendments 05-09. Expiration date 31 Aug 70

4. INDIVIDUAL USER(S). *(Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)*

Individual(s) approved by the Radioisotope Committee, Commanding General WRAMC, Chairman

5. RADIATION PROTECTION OFFICER *(Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.)*

Ref: AR 40-14, 40-37, 700-WR 40-10 & Organization, Mission and Function Statement for WRAMC, HPO. The HPO will be appointed by the CG, WRAMC

6. (a) BYPRODUCT MATERIAL. *(Elements and mass number of each.)*

A. Cobalt 60
B. Cobalt 60
C. Cobalt 60

(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. *(If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)*

A.
B.
C.

A.
B.
C.

7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. *(If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)*

A. Used in located in Room Bldg. 40, WRAIR, Wash D. C. 20012, for medical research and development and radiation dosimetry.
B. Used in a small animal irradiator (Source Dwgs on file at USAEC) located in Room Bldg 40, WRAIR, Wash, DC 20012. For medical research and development and radiation dosimetry.
C. Used in located in Bldg 500, Forest Glen Section, WRAMC, Montgomery County, Maryland 20910 for medical research and development and radiation dosimetry.

Ex 2

(Continued on reverse side)

★ U.S. GOVERNMENT PRINTING OFFICE : 1966 O—238-669

	WHERE TRAINED	TRAINING	(Circle answer)	(Circle answer)
a. Principles and practices of radiation protection	(Ref: WR 40-10 (Annex A&B) ~~Health Physics Regulations as~~ changed and current listing of WRAMC Radioisotope Committee ~~Membership with Training &~~ Experience of Members; both ~~forwarded herewith)~~		Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments			Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
d. Biological effects of radiation			Yes No	Yes No

9. EXPERIENCE WITH RADIATION. *(Actual use of radioisotopes or equivalent experience.)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
		(Ref: WR 40-10 (Annex A&B) Health Physics Regulations, as changed, and current listing of WRAMC Radioisotope Committee Membership with Training & Experience of Members; forwarded herewith)		

10. RADIATION DETECTION INSTRUMENTS. *(Use supplemental sheets if necessary.)*

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm²)	USE (Monitoring, surveying, measuring)
(Reference: WRAMC Health Physics MEMO No. 10, Radiation Detection Instruments, 29 Jul 69 on file at USAEC)					

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.

See attached continuation sheet

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. *(For film badges, specify method of calibrating and processing, or name of supplier.)*

Film badges are furnished by Lexington Blue-Grass Army Depot in accordance with SB 11-206; Pocket Chambers and Self Reading Pocket Dosimeters are furnished at the discretion of the HPO. Ref AR 40-14 & WR 40-10. Bioassay: See HP MEMO 2 and WR 40-10.

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No

Ref: HP MEMO 9, Lab Facilities, 29 Jul 69, on file at USAEC

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source. Ref WR 40-10, USAMU MEMO 40, HP SOP 1-6, HP SOP 3-H-1, HP MEMOS No. 3 and 4 on file at USAEC

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. DA TM 3-261, AR 755-15, and WR 40-10 (Annex N) and HP SOP 1-5 on file at USAEC

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

FOR THE COMMANDER:
Applicant named in item 1

Date JUL 1 3 1970

By: JAMES A. PHILLIPS, LTC, MSC
Adjutant
Title of certifying official

WARNING.—18 U. S. C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U.S. GOVERNMENT PRINTING OFFICE: 1960 O - 568572

DEPARTMENT OF THE ARMY
HEADQUARTERS, WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

WRAMC Regulation
No. 40-10

4 September 1996

Medical Services
HEALTH PHYSICS

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CHAPTER 1
General

1-1. PURPOSE. The purpose of this regulation is to supplement applicable Federal, State and Army regulations governing the methods for control of potential health hazards resulting from the procurement, possession, storage, transportation, use and disposal of radioactive materials and equipment capable of producing potentially hazardous radiation.

1-2. APPLICABILITY. This regulation is applicable to all activities assigned or attached to Walter Reed Army Medical Center (WRAMC) for Health Physics support.

1-3. REFERENCES. Applicable publications are listed in the appendix A.

1-4. DEFINITIONS AND TERMS. The definitions, terms, and abbreviations that are used in this regulation are listed in the Glossary.

1-5. ALARA.

a. Management Commitment.

(1) The management of this medical facility is committed to the program described herein for keeping individual and collective doses as low as reasonable achievable (ALARA). In accordance with this commitment, we hereby describe an administrative organization for radiation safety and will develop the necessary written policy, procedures, and instructions to foster the ALARA concept within our institution. The organization will include a Radiation Control Committee (RCC) and a Radiation Protection Officer (RPO).

(2) We will perform a formal annual review of the radiation safety program, including ALARA considerations. This will include reviews of operating procedures and dose records, inspections, etc., and consultations with the radiation safety staff or outside consultants.

(3) Modifications to operating and maintenance procedures and to equipment and facilities will be made if they will reduce exposures unless the cost, in our judgment, is considered to be unjustified. We will be able to demonstrate, if necessary, that improvements have been made, that modifications have been considered, and that they have been implemented when

reasonable. If modifications have been recommended but not implemented, we will be prepared to describe the reasons for not implementing them.

(4) In addition to maintaining doses to individuals as far below the limits as is reasonable achievable, the sum of the doses received by all exposed individuals will also be maintained at the lowest practicable level. It would not be desirable, for example, to hold the highest doses to individuals to some fraction of the applicable limit if this involved exposing additional people and significantly increasing the sum of radiation doses received by all involved individuals.

TABLE 1-1 DOSE LIMITS FOR OCCUPATIONAL EXPOSURE	
Stochastic Limit (TEDE)[1]	5 rem in 1 year
Nonstochastic Limit H_d and CEDE other than eye	50 rem in 1 year
Shallow Dose Equivalent H_s Skin or Extremity	50 rem in 1 year
Lens of the Eye	15 rem in 1 year
Dose to Embryo or Fetus[2]	0.5 rem in gestation period
Planned Special Exposures	Not Allowed Without Waiver
Emergency Exposure Limits (Life Saving)	100 rem
Emergency Exposure Limits (Not Life Saving)	10 rem

[1] Total Effective Dose Equivalent (TEDE) = External Exposure at a depth of 1 cm in tissue (H_d), and committed effective dose equivalent (CEDE) from internal exposure

[2] H_d to pregnant woman and dose to the embryo or fetus (after notifying the RPO in writing)

TABLE 1-2 FOR MEMBERS OF THE GENERAL PUBLIC, OCCUPATIONALLY EXPOSED INDIVIDUALS, AND MINORS	
Members of the Public	0.1 rem in any one year
Occupationally Exposed Individuals[1]	0.5 rem in any one year
Occupationally Exposed Minors (Under 18 years of age)	10% of the annual dose limits for occupationally exposed adults

[1] Individuals who occasionally enter restricted areas must not receive a radiation exposure in excess of that permitted for any member of the public, however, transient operations may exist which require exposure of individuals not normally occupationally exposed to be exposed to

levels in excess of 0.1 rem limit. Approval for this practice must be obtained in advance from OTSG and the NRC as per 10 CFR 20 for licensees.

TABLE 1-3
INVESTIGATION LEVELS

(mrems per calendar quarter)	Level I	Level II
Whole Body[1]	125	375
Lens of the Eye	375	1,125
Other[2]	1,250	3,750

[1] TEDE

[2] Other includes: Shallow-dose equivalent (H_s) to the skin or to any extremity, or the sum of the deep-dose equivalents (H_d) and the committed dose equivalents (H_T) to any individual organ or tissue other than the lens of the eye.

b. Radiation Control Committee.

(1) Review of Proposed Users and Uses

(a) The RCC will thoroughly review the qualifications of each applicant concerning the types and quantities of materials and methods of use for which application has been made to ensure that the applicant will be able to take appropriate measures to maintain exposure ALARA.

(b) When considering a new use of byproduct material, the RCC will review the efforts of the applicant to maintain exposure ALARA.

(c) The RCC will ensure that the users justify their procedures and that individual and collective doses will be ALARA.

(2) Delegation of Authority.

(d) The RCC will delegate authority to the RPO for enforcement of the ALARA concept.

(e) The RCC will support the RPO when it is necessary for the RPO to assert authority. If the RCC has overruled the RPO, it will record the basis for its action in the minutes of the quarterly meeting.

(3) Review of the ALARA Program.

(a) The RCC will encourage all users to review current procedures and develop new procedures as appropriate to implement the ALARA concept.

(b) The RCC will perform a quarterly review of occupational radiation exposure with particular attention to instances in which the investigational levels in Table 1-3 are exceeded. The principal purpose of this review is to access trends in occupational exposure as an index of the ALARA program quality and to decide if action is warranted when investigational levels are exceeded (see paragraph 1-5.f. below for a discussion of investigational levels).

(c) The RCC will evaluate our institution's overall efforts for maintaining doses ALARA on an annual basis. This review will include the efforts of the RPO, authorized users, and workers as well as those of management.

c. Radiation Protection Officer.

(1) Annual and Quarterly Review.

(a) Annual Review of the Radiation Safety Program. The RPO will perform an annual review of the radiation safety program for adherence to ALARA concepts. Reviews of specific methods of use may be conducted on a more frequent basis.

(b) Quarterly review of occupational exposures. The RPO will review at least quarterly the external radiation doses of authorized users and workers to determine that their doses are ALARA in accordance with the provisions of Section 6 of this program and will prepare a summary report for the RCC.

(c) Quarterly review of records of radiation surveys. The RPO will ensure radiation surveys in unrestricted and restricted areas are reviewed to determine that dose rates and amounts of contamination were at ALARA levels during the previous quarter.

(2) Education Responsibilities for ALARA Program.

(a) The RPO will schedule briefings and educational sessions to inform workers of ALARA program efforts.

(b) The RPO will ensure that authorized users, workers, and ancillary personnel who may be exposed to radiation will be instructed in the ALARA philosophy and informed that management,

the RCC, and the RPO are committed to implementing the ALARA concept.

(3) Cooperative Efforts for Development of ALARA Procedures.

(a) Radiation workers will be given opportunities to participate in formulating the procedures that they will be required to follow.

(b) The RPO will be in close contact with all users and workers to develop ALARA procedures for working with radioactive materials.

(c) The RPO will establish procedures for receiving and evaluating suggestions of individual workers for improving health physics practices and will encourage the use of those procedures.

(4) Reviewing Instances of Deviation from Good ALARA Practices. The RPO will investigate all known instances of deviations from good ALARA practices and, if possible, will determine the causes. When the cause is known, the RPO will implement changes in the program to maintain doses ALARA.

d. Authorized Users.

(1) New Methods of Use Involving Potential Radiation Doses.

(a) The authorized user will consult with the RPO during the planning stage before new use of radioactive materials.

(b) The authorized user will review each planned use of radioactive materials to ensure that doses will be kept ALARA.

(2) Authorized User's Responsibility to Supervised Individuals.

(a) The authorized user will explain the ALARA concept and the need to maintain exposures to all supervised individuals.

(b) The authorized user will ensure that supervised individuals who are subject to occupational radiation exposure are trained and educated in good health physics practices and in maintaining exposures ALARA.

e. Individuals Who Receive Occupational Radiation Doses.

(1) Workers will be instructed in the ALARA concept and its relationship to work procedures and work conditions.

(2) Workers will be instructed to recourses available if they feel that ALARA is not being promoted on the job.

f. Establishment of Investigational Levels in Order to Monitor Individual Occupational External Radiation Doses.

(1) This institution hereby establishes investigational levels for occupational external radiation doses that, when exceeded, will initiate review or investigation by the RCC and/or the RPO. The investigational levels that we have adopted are listed in Table 1-3. These levels apply to the exposure of individual workers.

(2) The RPO will review and record on the Automated Dosimetry Report (ADR) results of personnel monitoring not less than once in any calendar quarter as required by 10 CFR Part 20, Section 20.1502. The following actions will be taken if the investigational levels as stated in Table 1-3 are exceeded.

(a) Personnel dose less than investigational level I. Except when deemed appropriate by the RPO, no further action will be taken in those cases where an individual's dose is less than Table 1-3 values for the Investigational Level I.

(b) Personnel dose equal to or greater than Investigational Level I but less than Investigational Level II. The RPO will review the dose of each individual whose quarterly dose equals or exceeds Investigational Level I and will report the results of the reviews at the first RCC meeting following the quarter when the dose was recorded. If the dose does not equal or exceed Investigational Level II, no action related specifically to the exposure is required unless deemed appropriate by the Committee. The Committee will, however, review each such dose in comparison with those of others performing similar tasks as an index of ALARA program quality and will record the review in the Committee minutes.

(c) Personnel dose equal to or greater than Investigational Level II. The RPO will investigate in a timely manner the causes of all personnel doses equaling or exceeding Investigational Level II and, if warranted, will take action. A report of the investigation, any actions taken, and a copy of the individual's ADR will be presented to the RCC at its first

meeting following completion of the investigation. The details of these reports will be included in the RCC minutes.

(d) Re-establishment of investigational levels to levels above those listed in Table 1-3. In cases where a worker's or a group of workers' doses needs to exceed an investigational level, a new, higher investigational level may be established for that individual or group on the basis that it is consistent with good ALARA practices. Justification for new investigational levels will be documented.

(e) The RCC will review the justification for and must approve or disapprove all revisions of investigational levels.

CHAPTER 2
Training

2-1. PURPOSE. The NRC requires that training be given to any employee who works in or frequents the vicinity of any restricted area. The Commander, WRAMC, has implemented training programs pertaining to the hazards of radiation and the methods for minimizing those hazards for radiation workers and other personnel.

2-2. TRAINING PROGRAMS.

a. Initial Briefing.

(1) The Principal User is responsible for the safe use of Radioisotopes and is required to give initial and annual briefings to all personnel working in areas designated on his/her authorization. The briefings will cover as a minimum, the following:

(a) WRAMC Notice to Employees (Provides basic "Right to Know" information).

(b) NRC Form - 3, Notice to Employees.

(c) Title 10, Code of Federal Regulations, Parts 19 (Notices, Instructions, and Reports to Workers; Inspections), 20 (Standards for Protection Against Radiation), and 21 (Reporting of Defects and Noncompliance).

(d) Information concerning the storage, transfer and use of radioisotopes allowed under his authorization.

(e) Authorization to Use Radioisotopes, WRAMC Form 1661 (Application for Authorization to Use Radioactive Material - Human Use) and/or WRAMC Form 1662 (Application for Authorization to Use Radioactive Material-Non-Human Use).

(f) Hazards and protective measures associated with isotope usage or other sources of radiation.

(g) Procedures for requesting a report of exposure to ionizing radiation.

(h) Precautions and procedures to minimize radiation exposure and control radioactive contamination.

(2) All personnel will acknowledge receiving and understanding the above information by signing and dating WRAMC Form 538 (Radiation Worker Briefing).

b. Introductory Principles of Radiation Protection Course: This one day course, given by the staff of the HPO, is designed to complete and reinforce training given by the Principal User. It provides supplementary training, in an academic setting, required for the safe handling of radioisotopes and protection of individuals from external and internal radiation hazards. All radiation workers should attend this course (presented at least twice a year), as soon as possible after beginning work at WRAMC. Failure to attend the course by a worker's second opportunity will result in consideration being given to suspending that worker's authorization to work with radioactive materials. An examination is given at the end of this course. If the student fails the exam it may be retaken after additional preparation, or the student may elect to retake the course.

c. Principal User Classes. The senior staff of the HPO conducts periodic classes on selected topics. These topics are based on the need to disseminate current information on license and regulation changes, to correct deficiencies that have been noted and to enhance the professional competency of individuals working in radiation environments. This is mandatory for Principal Users. Coworkers are encouraged to attend.

d. Nursing In-service: Annual radiation safety training for nursing staff who encounter patients undergoing therapy with radioisotopes. Specific details on the types of therapy or other procedures are covered.

e. Support Personnel Briefing: Presented annually to personnel whose duties occasionally take them into restricted areas. It will familiarize them with the signs, placards, and color-codes associated with radioactive material use. It also gives a general outline of radiation hazards and contamination procedures and reinforces the ALARA principle.

f. Fire Fighters Briefing: Presented annually and covers methods of designating where radioactive materials are used, use of radiation detection instruments, notification procedures and procedures for ensuring protection from contamination and internal deposition.

g. Military Police and Security Personnel Briefing: Presented annually and teaches the proper method for receiving, inspecting, and storing incoming packages containing radioisotopes and addresses the procedures for dealing with problems such as damaged containers or leaking packages.

h. On-The-Job Training. Supervisors will conduct on-the-job training of sufficient content and duration to ensure that all personnel under their supervision know how to safely perform their work. As a minimum, the immediate supervisor will:

(1) Explain the hazards associated with the job the employee is to perform, the corresponding safe practices to be followed, and the standing operating and emergency procedures for the operations.

(2) Explain the steps required to perform the job and the equipment to be used (including safety equipment).

(3) Where possible, demonstrate how the operations are performed and allow the employee to practice the steps and constructively critique the employee's performance.

(4) Periodically spot check the employee's safety practices.

CHAPTER 3
Authorization to Use Radioactive Material

3-1. GENERAL.

a. NRC Licenses. The NRC has issued two Byproduct Material licenses to WRAMC allowing the use of specific types and quantities of radioactive material. In addition, the Department of the Army controls all radioactive material in excess of one microcurie.

b. The RCC issues Radioactive Material Authorizations to Principal Users as a means of controlling the use of radioactive material. All users of radioactive material must receive their authorization prior to receiving and using the material.

c. Nonhuman Use Radioactive Material Authorizations are issued for 3 years. Human Use Authorizations are issued for 1 year. Both types of authorizations may be renewed upon request.

d. Individuals possessing more than ½ pound of natural uranium compounds (i.e., uranyl acetate) are required to obtain an authorization.

e. Contractors or non-government agencies wishing to use radioactive sources on U.S. Army installations must obtain the appropriate Department of the Army Radiation Permit (DARP) or Department of the Army Radiation Authorization (DARA), or local Command approval in accordance with the guidelines in AR 385-11. The use will submit a written request to the HPO, and include at least the following information:

(1) Use and storage information and use location.

(2) Copy of the applicable license(s).

(3) Operating procedures.

(4) Radioactive source(s), element, atomic number, and activity.

(5) Estimated length of operation.

(6) A statement of understanding that the HPO will be notified before bringing radioactive materials on the installation.

(7) In the unlikely event that the sealed source leaks and contaminates Federal property, the contractor or agency will restore the property to Nuclear Regulatory Commission's unrestricted use criteria.

f. The NRC requirements stipulate that a Radiation Control Committee be established to exercise administrative control over the safe use of these radioactive materials. The WRAMC RCC has been charted to meet these requirements.

3-2. APPLICATION PROCEDURE.

a. To obtain, amend, renew, or terminate an authorization for use of radioactive material, individuals must submit WRAMC Form 2046R (Application for Authorization to Use Radioactive Material-Human Use) 1 June 1996 or WRAMC Form 1662 (Application for Authorization to Use Radioactive Material-Nonhuman Use). Each Principal User and coworker must submit WRAMC Form 1643 (Training and Experience of Authorized Radioisotope Users) with the application. Each physician listed on a Human Use Authorization is required to submit NRC Form 313-M Supplement B (Preceptor Statement) or a certificate of board certification with the application. Protocols describing the use and accountability of radioactive material from the time of receipt until the time of disposal will be submitted with the application on WRAMC Form 1644 (Health Physics Radioactive Protocol). Applications will be submitted to the HPO for review and approval. All applications for human use of radioisotopes will be submitted to the Human Use Subcommittee of the RCC by the HPO for review of physician training and experience.

b. All requested information on the application must be provided. Incomplete applications will be returned, causing a delay in approval.

c. Application for use of gamma cell irradiators must include a copy of the proposed Standing Operating Procedures (SOP) addressing personnel safety, routine operation and emergency provisions.

3-3. REVIEW PROCEDURES. All applications will be reviewed by the RCC and HPO to ensure that; individuals meet the training and

experience requirements, proposed procedures do not violate existing regulations, and facilities and equipment are adequate for proposed usage. If human use or nonhuman use applications meet the approval of the appropriate subcommittee of the RCC, they will be signed by the Chairman of the Human Use Subcommittee and granted interim approval. All interim approvals will be reviewed by the next convening RCC for final approval.

3-4. TERMINATION OF AUTHORIZATION. An authorization may be terminated by the Principal User, the RCC, or the HPO at any time. When an authorization is terminated, the Principal User will ensure that all work areas are cleared by the HPO prior to releasing them for alternate use and coordinate final disposition of unused radionuclides with the Radioactive Materials Control Branch, HPO.

CHAPTER 4
General Rules for the Safe Use of Radioactive Material

4-1. RESPONSIBILITIES.

a. Principal Users of radioactive materials are responsible for applying precautions listed in this chapter and ensuring their implementation by personnel listed on their Radioactive Material Authorization.

b. Principal Users of radioactive materials are responsible for maintaining a current inventory of all radioactive material on DA FORM 3862 (Controlled Substances Stock Record) or on a computer format that records the equivalent information.

4-2. LABORATORY PRECAUTIONS. General rules for the safe use of radioactive materials include:

a. Wear laboratory coats or other removable protective clothing at all times when actively involved in the use of unsealed radioactive material. To preclude the possible spread of contamination, only wear the laboratory coats or other protective clothing in the designated work areas.

b. Wearing of disposable gloves at all times while handling radioactive materials except:

(1) Those quantities less than those specified by WRAMC general license for use of byproduct material for certain in-vitro clinical or laboratory testing (less than 10 μCi of ^{125}I, ^{131}I, ^{14}C and ^{75}Se; 20 μCi of ^{59}Fe; and less than 50 μCi of ^{3}H).

(2) When handling totally encapsulated sealed sources of beta or gamma types that are exempt from leak testing requirements (see paragraph 9-5.a.).

(3) During the injection of a radiopharmaceutical when the loss of tactile sensation would hinder venipuncture technique potentially resulting in infiltrations, thereby requiring repeat studies and increasing patient exposure.

c. Monitor hands, clothing, and work areas for contamination after each procedure and before leaving the controlled area.

d. Do not eat, drink, smoke, or apply cosmetics in any area where radioactive materials are used or stored.

e. Do not store food, drink, or personal effects in areas where radioactive materials are used or stored.

f. Always wear assigned personnel dosimetry while in radioactive materials use or storage areas. Whole body dosimeters should be worn at chest or waist level. Finger or extremity dosimeters should be worn close to and facing sources handled. When not being worn, store dosimeters in the approved low-background storage location.

g. Dispose of radioactive waste only in specially designated receptacles, labeled, and if necessary shielded receptacles

h. Never pipette by mouth.

i. Confine radioactive solutions in containers plainly identified and labeled with the name of the compound, radionuclide, date, activity, and radiation level, if applicable.

j. Transport radioactive materials in appropriately shielded containers.

k. When transporting radioactive materials and waste, use items such as carts or wheelchairs to avoid contact with the surface of the container.

4-3. NUCLEAR MEDICINE PRECAUTIONS. Additional general rules specifically applicable to preparations and use of radioactive materials for human use include:

a. Use syringe shields for preparation of patient doses and administration to patients except in circumstances such as pediatric cases when their use would compromise the patient's well-being. Consider other protective methods such as remote handling if the syringe shields cannot be used.

b. Assay each patient dose in the dose calibrator before administration. Do not administer any doses that differ from the prescribed dose by more than 10%. Check the patient's name, identification, and prescribed radionuclide, chemical form, and dosage before administering the radionuclide.

c. Wear a finger dosimeter during elution of the generator, preparation, assay, and injection of the radiopharmaceuticals.

d. Survey the generator, kit preparation and injection areas for contamination after each procedure or at the end of the day. Decontaminate when necessary.

4-4. VENTILATION IN RADIATION CONTROLLED AREAS. Procedures potentially resulting in the generation of radioactive aerosols, dusts, or gaseous products will be conducted in a hood, iodine box, dry box or other suitable closed system.

a. Radioactive gases or materials with gaseous radioactive daughters will be stored in gas-tight containers and kept in areas having approved ventilation.

b. Use an average velocity through openings of 100 fpm when handling low to moderate levels of volatile radioactive materials. For highly toxic or high-level volatile radioactive material, raise the velocity through the openings to an average of 125 to 150 fpm.

4-5. DETERMINATION OF MAJOR VERSUS MINOR SPILLS.

a. A spill is considered major if there is an accidental or uncontrolled release of 1 mCi or more of any radionuclide.

b. The exception to this rule is Tc-99m and Tl-201 used in the Nuclear Medicine pharmacy where a spill is considered major if 100 mCi or more is released.

c. The decision to implement a major spill procedure instead of a minor spill procedure depends on several incident specific variables. Variables to consider include;

(1) Number of individuals affected.

(2) Other hazards present.

(3) Likelihood of the spread of contamination.

(4) Types of surfaces contaminated.

(5) Radiotoxicity of the spilled material.

d. For some short-lived radionuclides, the best spill procedure may be restricted access to the area pending complete decay.

4-6. MAJOR SPILLS OF LIQUIDS AND SOLIDS.

a. Clear the Area. Notify all persons not involved in the spill to vacate the room.

b. Prevent the spread of contamination by covering the spill with absorbent pads, but do not attempt to clean it up. Confine the movement of all personnel potentially contaminated to prevent the spread of contamination.

c. Shield the source if possible. This should be done without further contamination or a significant increase in radiation exposure.

d. Notify the Health Physics Officer immediately.

e. Conduct limited decontamination by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with mild soap. Do not use brushes or any other abrasive substances. Limit the spread of contamination by consolidating and keeping contaminated personnel in one location. Wait for Health Physics personnel to arrive and evaluate personnel before attempting further decontamination. Retain contaminated clothing and materials used in decontamination for further analysis by the Health Physics Office.

f. Initiate a radioactive spill report. A sample radioactive spill report is included at the end of this chapter.

4-7. MINOR SPILLS OF LIQUIDS AND SOLIDS.

a. Notify persons in the area that a spill has occurred.

b. Prevent the spread of contamination by covering the spill with absorbent paper.

c. Clean up the spill wearing disposable gloves, remote handling tongs, and absorbent paper. Carefully fold the absorbent paper with clean side out and insert it into a plastic bag. Transfer the plastic bag to a radioactive waste container. Place other contaminated materials, such as disposable gloves, and any other contaminated disposable material into the plastic bag.

d. Survey the area with a low-range radiation detector survey meter. Check the area around the spill, hands, shoes, and clothing for contamination.

e. Report the incident to the Health Physics Officer.

f. Initiate a radioactive spill report. A sample radioactive spill report is included at the end of this chapter.

Radioactive Spill Report

The spill occurred at ____:____ *am* *pm* on ____/____/____ Room _____

Instrument used to check for decontamination:_____

Meter Model:_____ SN:_____ Probe Model:_____ SN:_____

Personnel Present Personnel Contamination Results

_____

_____

_____

On the back of this sheet, indicate and personnel decontamination, additional monitoring, or care instituted.

Survey the spill area to identify hot spots and begin decontamination. Conduct a post-decontamination wipe test.

Radioisotopes present or suspected in the spill:

_____ mCi of _____ as _____

_____ mCi of _____ as _____

_____ mCi of _____ as _____

Give a brief description of the accident:

Give a brief description of the follow-up actions taken to prevent reoccurrence:

WRAMC Health Physics Office
(202) 356-0058

Name:_____
Date:_____

Radioactive Spill Report

CHAPTER 5
Personnel Monitoring

5-1. GENERAL.

a. This chapter prescribes procedures and responsibilities for monitoring and recording occupational exposures to ionizing radiation from radiation producing devices and radioactive materials.

b. Each activity receiving personnel dosimetry service from the HPO will designate a personnel dosimetry coordinator and alternate to assist the HPO in the issue, exchange, and collection of dosimetry devices.

c. Appropriate personnel monitoring devices will be assigned to each individual as required by the Health Physics Office. In addition, other personnel monitoring techniques (i.e., whole body counting or bioassay) will be utilized to evaluate personnel dosimetry as deemed necessary by the Health Physics Officer.

d. Personnel monitoring devices will be assigned when individuals could potentially receive an occupational exposure in excess of 10% of the levels in Tables 5-1 and 5-2 for occupational exposure in a calendar year.

TABLE 5-1 OCCUPATIONAL EXPOSURE	
Stochastic Limit (TEDE)[1]	5 rem in 1 year
Nonstochastic Limit H_d and CEDE other than eye	50 rem in 1 year
Shallow Dose Equivalent H_s Skin or Extremity	50 rem in 1 year
Lens of the Eye	15 rem in 1 year

[1] Total Effective Dose Equivalent (TEDE) = External Exposure at a depth of 1 cm in tissue (H_d), and committed effective dose equivalent (CEDE) from internal exposure

TABLE 5-2 MEMBERS OF THE GENERAL PUBLIC, DECLARED PREGNANT WORKERS, AND MINORS	
Members of the Public	0.1 rem in any one year
Dose to Embryo or Fetus[1]	0.5 rem in gestation period
Minors (Under 18 years of age)	10% of the annual dose limits for occupationally exposed adults

[1] H_d to pregnant woman and dose to the embryo or fetus (after notifying the RPO in writing)

e. Application for personnel dosimetry service must be completed by the individual and submitted on DD Form 1952 (Dosimeter Application and Record of Occupational Radiation Exposure) to the HPO. The HPO will evaluate the information on the application and issue appropriate dosimetry or provide written notification that dosimetry is not needed.

f. Assignment of a personnel dosimetry device to an individual does not automatically make one a radiation worker. Occasionally exposed individuals may be monitored to determine need for permanent issue of dosimetry devices.

g. The procedures and responsibilities for processing the application are:

(1) The applicant has the responsibility to furnish:

(a) Individual identification data.

(b) Previous occupational radiation exposure history.

(2) The supervisor has the responsibility to furnish:

(a) A statement of the type of exposures in the worker's environment (i.e., x-ray, neutron, or radioactive isotopes).

(b) Complete WRAMC Form 538 indicating that the applicant has been instructed concerning the safe handling and usage of the radioactive materials listed in the authorization permit.

(c) The responsibilities and rights of an occupational radiation worker.

5-2. WHOLE BODY DOSIMETRY.

a. The thermoluminescent dosimeter (TLD) badge is the primary dosimetry device used at WRAMC.

b. A whole body badge will be worn only by the individual to whom it is issued.

c. WRAMC issued dosimeters shall not be worn by any personnel when occupationally exposed at other facilities away from their designated Government job site. However, if an individual wears a different dosimeter while working at other

facility, the individual will inform the authorization holder and the Health Physics Office of the off-duty (moonlighting) dose records no later than 2 months after such records are received by the individual or 4 months following termination of such moonlighting employment, whichever is earlier.

d. Whole body dosimetry will be worn:

(1) Below the shoulders.

(2) Above the hips.

(3) Outside the clothing.

(4) On the portion or area of the body nearest the radiation source.

(5) With the dosimeter window facing out (away) from the body, and towards the radiation source.

(6) In the event a protective garment such as a lead apron is worn while working with material specifically licensed by the NRC, the dosimeter shall be worn outside any shielding.

(7) For individuals wearing lead aprons or similar protective garments while practicing medical radiology, the whole-body dosimeter shall be worn inside of any protective garment.

(8) Personnel, such as those working with medical fluoroscopic or cardiac catheterization x-ray equipment, exposed to x-rays scattered from the patient will wear a collar dosimeter and a whole body dosimeter under the protective garment.

e. When not being worn, the personnel monitoring devices will be stored in the designated location approved by the RPO.

f. The department dosimetry coordinator will ensure that the dosimeters are turned in to the activity dosimetry coordinator during the designated exchange periods.

g. Personnel not directly employed by WRAMC, such as independent contractors or temporary workers, shall be issued dosimetry at the discretion of the Health Physics Office.

5-3. SUPPLEMENTAL MONITORING DEVICES. Additional personnel monitoring devices will be provided when necessary to monitor a portion of the body or to obtain more immediate data. These devices will be worn only by individuals to whom they are issued.

5-4. CARE OF MONITORING DEVICES. When not being worn, personnel monitoring devices will be stored in the place designated by the HPO and turned in to the personnel dosimetry coordinator during designated exchange periods. Dosimetry devices are not to be worn during non-duty hours or when the individual is examined in medical or dental clinics.

5-5. TERMINATION OF PERSONNEL DOSIMETRY SERVICE. The Principal User will notify the Health Physics Office of the departure of any department personnel who are enrolled in the personnel dosimetry program.

5-6. BIOASSAY.

a. The HPO will designate individuals to participate in the bioassay program. Once so designated, individuals will participate until released, in writing, by the HPO.

b. Individual Responsibilities.

(1) Appear for the bioassay measurement at the time and place required.

(2) Provide appropriate samples for in-vitro counting.

(3) Inform the Health Physics Office of changes in working conditions or other factors that would influence the type or frequency of bioassay measurement.

5-7. RECORDS.

a. Records of an individual's radiation exposure are provided to the Health Physics Office on an Automated Dosimetry Report (ADR) by the U.S. Army Ionizing Radiation Dosimetry Center. The ADRs are reviewed by the HPO, signed by the RPO, and stored in the HPO as part of and individual's medical record. Annual reports are forwarded to the Service Chiefs or Chiefs of the research groups for review and distribution to individuals.

b. The ADR is covered by the Privacy Act. Therefore, a written authorization, signed by the individual must be forwarded

to the HPO before occupational exposure information can be released to third parties.

CHAPTER 6
Radiation Detection Instruments

6-1. GENERAL. The Health Physics Office will acquire, maintain and provide, to all activities, radiation detection instruments to meet the requirements of WRAMC's NRC licenses.

6-2. CALIBRATION. The HPO will ensure that all instruments are calibrated and will maintain calibration records.

6-3. USER RESPONSIBILITIES. The User is responsible for:

a. Security, proper use, and availability of assigned instruments.

b. Notifying the HPO if an instrument is not functioning properly or is due for calibration.

6-4. SURVEY INSTRUMENTATION.

a. For high energy x-ray, beta, or gamma emitter, use a low-range thin-window G-M survey meter to survey all elution, preparation, and injection areas.

b. Perform a series of wipe tests to measure contamination levels in those areas using low energy beta emitters such as tritium or carbon-14. The method for analyzing wipe tests will be sufficiently sensitive to detect 100 dpm per 100 cm^2 for the contaminant involved.

c. Use a survey instrument capable of detecting dose rates as low as 0.1 mrem/hr for areas where radiopharmaceuticals are prepared for use or administered.

d. Keep a record of ll survey results for three years, including negative results. The record will include:

(1) Location, date, and type of equipment used.

(2) Name of person conducting the survey (signature or initials).

(3) Type, serial number, and calibration date of the portable survey instruments.

(4) A drawing of the areas surveyed with contamination levels and dose rate action levels.

(5) Measured dose rates in mR/hr or contamination levels in dpm/100 cm^2, as appropriate.

6-5. ACTION LEVELS FOR RESTRICTED AREAS.

a. The radioisotope user will clean or decontaminate the area for Action Level I where:

(1) Contamination exceeds 1000 dpm/100 cm^2;

(2) The radiation level is two times the background, or 1 mrem/hr at 30 cm (1 foot) for x-ray or gamma radiation.

b. The radioisotope user will clean or decontaminate the area for Action Level II and contact the Health Physics Office immediately if:

(1) Contamination exceeds 2000 dpm/100 cm^2;

(2) The radiation levels from x-ray or gamma radiation in an unrestricted area exceeds 2 mrem/hr at 30 cm (1 foot).

6-6. ACTION LEVELS FOR UNRESTRICTED AREAS. All unrestricted areas will be maintained at a removable contamination level of less than 200 dpm/100 cm^2.

6-7. SECURITY OF RADIOACTIVE MATERIALS.

a. The Principal User is responsible to ensure that:

(1) Radioactive materials used within their authorization are properly secured.

(2) Radiation hazards are properly posted.

(3) The radioactive material is stored in a locked room, locked refrigerator, or locked container.

(4) If the room is unlocked, and the radioactive material is not secured in a locked container, then someone must be in the room at all times.

b. If any radioactive material is believed to be missing, call the Health Physics Office **IMMEDIATELY** ***(within the same day that the radioactive material is noticed missing)***. The Health Physics Office can then assist your laboratory in locating the radioactive material. In addition, if the quantity of material missing exceeds certain limits, the Health Physics Office may be required to notify the Nuclear Regulatory Commission within 24 hours upon discovery of the event.

CHAPTER 7
Radiation Protection Surveys

7-1. GENERAL. Periodic radiation protection surveys are required in all areas where radioactive materials are used or stored. Requirements and responsibilities for these surveys at WRAMC are contained in this chapter.

7-2. RESPONSIBILITIES.

a. The HPO is responsible for:

(1) Performing all pre-use surveys, weekly, monthly, quarterly, special and final surveys.

(2) Notifying the Principal Users of any deficiencies or radiological hazards noted during their surveys.

(3) Performing a resurvey within five (5) workdays of any areas where:

(a) Levels of removable contamination exceed Action Level II limits of 2000 dpm/100 cm2, or 2 mrem/hr at 30 cm (1 foot) for x-ray or gamma radiation.

(b) Potentially hazardous situations are noted.

b. Principal Users are responsible to:

(1) Perform daily surveys as specified in 7-3.a.

(2) Notify the HPO immediately if levels of removable contamination exceed Action Level II limits of 2000 dpm/100 cm2, or 2 mrem/hr at 30 cm (1 foot) for x-ray or gamma radiation.

(3) Notify the HPO immediately of any accidents or unusual incidents involving radioactive materials.

(4) Provide the HPO with corrective actions taken to rectify items of concern and noncompliance found during a radiation safety survey.

(5) Provide the HPO with a written request for any special surveys (i.e., pre-use, final, or equipment surveys).

(6) Ensure that a pre-use survey has been performed on all areas under their control prior to using or storing radioactive materials.

(7) Ensure that a final survey has been performed and approved in areas under their control prior to releasing the area for non-radioactive use, maintenance or modification.

(8) Request that a room be placed on administrative hold when there will be no use of radioactive material (RAM) for three or more consecutive months.

(9) Request that a room on administrative hold be reactivated at least 48 hours prior to intended use of RAM.

(10) Inform the HPO of any circumstances requiring special protective measures, i.e., chemical or biological hazards, while conducting radiation protection surveys.

7-3. SURVEY REQUIREMENTS.

a. Daily. Daily surveys are required for all areas where radionuclides are used in quantities greater than that listed in Table 7-1. Areas where gamma, x-ray, or high energy beta emitters are used will be surveyed using a low-range, thin-window G-M survey meter. Areas where low-energy beta emitters (such as H-3, C-14, S-35) are used will be surveyed for removable contamination using swipes or smears. The daily survey will be performed by the user at the end of each day of use. Survey results will be recorded, and will include: Date of survey; building; room surveyed; highest level of contamination found; MMCN or serial number of the survey meter; survey meter calibration due date; and the surveyor. The survey log will be kept in the room and will be readily available for review.

TABLE 7-1
10% of 10 CFR 20 Appendix C limits for Radionuclides Commonly Used at WRAMC

The user must conduct contamination surveys if the following activities per protocol or procedure are exceeded.[1]	ACTIVITY (µCi)
^{3}H ^{14}C ^{42}K ^{51}Cr ^{67}Ga ^{99m}Tc ^{201}Tl	100
^{33}P ^{35}S ^{41}Ce ^{45}Ca ^{54}Mn ^{57}Co ^{85}Sr ^{86}Rb ^{99}Mo ^{95m}Nb ^{103}Ru ^{111}In ^{123}I ^{125}Sb	10
^{22}Na ^{32}P ^{36}Cl ^{46}Sc ^{59}Fe ^{89}Sr	1
^{109}Cd ^{125}I ^{131}I	0.1

[1] For any radionuclide not listed, contact the HPO for the appropriate activity limit.

b. No daily survey by the user is required if the activity of the isotopes used during the day is less than the activity shown in Table 7-1; however, it is always good practice to survey the work areas for contamination after using radioactive materials.

c. Weekly surveys by the Health Physics Office will be conducted if the activity of the unsealed radioactive material exceeds 200 µCi.

d. Monthly surveys by the Health Physics Office will be conducted if the activity of the unsealed radioactive material is less than 200 µCi and greater than the value in Table 7-1.

e. A quarterly radiation protection survey will be performed by the HPO staff in unrestricted areas where the HPO believes than an individual member of the public may receive an exposure to ionizing radiation. Quarterly surveys will be performed in areas where quantities do not exceed the values in Table 7-1.

f. Pre-use Survey. A pre-use survey will be performed by the HPO staff in all areas where radioactive materials will be used or stored to ensure the area meets Health Physics criteria.

g. Final Survey. A final radiation protection survey will be performed by the HPO staff in all areas (and on equipment) where radioactive materials have been used or stored prior to:

(1) Releasing the room or equipment for non-radioactive use.

(2) Releasing the room or equipment for maintenance.

(3) Moving the equipment from that location. No action may be taken until survey results are cleared by HPO.

h. Special Surveys. Special radiation protection surveys may be performed by the HPO staff at the discretion of the Health Physics Officer. Additionally, the Chief, Health Physics Office can require Principal Users to perform more frequent surveys in the event of excess contamination or noncompliance with safety procedures.

CHAPTER 8
RADIOACTIVE WASTE MANAGEMENT AND CONTROL

8-1. RESPONSIBILITIES.

a. The HPO is responsible for ensuring that all radioactive waste is managed, controlled, and disposed of according to the directives and guidelines of applicable Army, Federal, and State regulations.

b. Principal Users of radioactive materials at WRAMC are responsible for the collection and handling of radioactive waste in accordance with guidelines in paragraph 8-4., and any special instructions issued as a condition of their WRAMC Radioactive Material Authorizations.

c. The Occupational Health Section will evaluate on a routine basis, the efficiency of ventilation hoods used for temporary storage of radioactive waste.

8-2. POLICY. Radioactive waste from Walter Reed Army Medical Center and tenant activities will be controlled, packaged, transported, and disposed of in accordance with AR 385-11, Ionizing Radiation Protection; Title 10, Code of Federal Regulations; Title 49, Code of Federal Regulations; Nuclear Regulatory Commission Licenses issued to WRAMC; applicable provisions of State Government requirements for waste disposal sites located within their jurisdictions; and the guidelines delineated herein.

8-3. GENERAL. The below listed rules for the safe handling of radioactive materials should be followed:

a. Wear laboratory coats or other protective clothing at all times in areas where radioactive materials are used.

b. Wear disposable impermeable gloves at all times while handling radioactive materials.

c. Monitor hands and clothing for contamination after each procedure or before leaving area.

d. Do not eat, drink, smoke or apply cosmetics in any area where radioactive material is used or stored.

e. Wear assigned personnel monitoring device(s) at all times while in areas where radioactive materials are used or stored. Whole body monitoring device(s) should be worn at chest or waist level.

f. Dispose of radioactive waste only in specially designated receptacles.

g. Confine radioactive solutions to covered containers, plainly identified and labeled with name of compound, radionuclide, date, activity, and radiation level, if applicable.

h. Always transport radioactive materials in appropriately shielded containers.

i. Wash hands after working with radioactive materials.

8-4. RADIOACTIVE WASTE CONTROL IN THE LABORATORY OR CLINIC.

a. Principal Users are responsible for ensuring that radioactive waste is controlled in a manner that meets the safety and security measures prescribed by U.S. Army, Federal, and applicable State Regulations.

b. All Users of radioactive materials are responsible for segregating their radioactive waste into the categories listed below:

(1) Solid. Short half-life, 65 days or less including the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

(2) Solid. Long half-life, greater than 65 days except for the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

(3) Lead. Shielding materials and pigs.

(4) Scintillation Vials. Biodegradable (Bio-safe, etc.) scintillation fluid.

(5) Scintillation Vials. Organic/non-biodegradable scintillation fluid.

(6) Aqueous Liquids. Readily soluble (or readily dispersible biological material) in water and neutralized to pH > 2 and pH < 12.

(7) Organic Liquids. With MSDS and approved Waste Profile Sheet for each chemical.

(8) Animal Carcasses/Excreta/Bedding. Short half-life.

(9) Animal Carcasses/Animal Waste. Long half-life.

(10) Animal Carcasses. ≤ 0.05 µCi H-3 or C-14 per gram of animal tissue averaged over the entire weight of the animal.

(11) Gas. Contact the Health Physics Office.

(12) Sharps. See paragraph 8-5.d.

(13) Stock Source Vials. See paragraph 8-9.

c. Limit the non-radioactive waste that is intermixed with radioactive waste to an absolute minimum.

d. Remove or obliterate all "Radioactive Material" labels on non-radioactive vendor shipping packages and on short half-life radioactive waste. Uncontaminated vendor shipping containers may be disposed of in the normal trash by the users. Short half-life waste will be delivered to Health Physics Office (HPO) collection points for subsequent storage, decay, and ultimate disposal in the normal trash when HPO personnel have determined that the waste has reached natural background radiation levels.

e. Store used Mo-99/Tc-99m generators and other equipment containing radioactive material in designated areas only. The radiation labels will be removed on such items only when they have reached levels indistinguishable from background and have been cleared by the HPO.

f. Maintain on-hand inventories of radioactive waste to a practical minimum.

g. Control radioactive waste in work areas to prevent unauthorized disposal by the custodial service. Properly labeled waste containers will be used for radioactive waste. Labeled radioactive waste containers will not be used for other purposes.

h. Ensure that all radioactive waste is delivered to HPO collection point personnel for ultimate disposal.

i. Mark all radioactive waste containers (receptacles) with the radiation caution symbol and the words "Caution - Radioactive Waste" or "Caution - Radioactive Material" and "DO NOT EMPTY!".

j. Ensure that radioactive material is not released into the sanitary sewage system without the specific approval of HPO.

k. Ensure that decontamination of reusable equipment is performed in laboratory sinks that have been authorized for that purpose. See paragraph 8-6. for specific requirements concerning this procedure.

l. Radioactive waste that is infectious waste must be properly disinfected before it is given to the HPO for disposal. INFECTIOUS WASTE WILL NOT BE GIVEN TO HPO.

8-5. PACKAGING RADIOACTIVE WASTE FOR DISPOSAL.

a. Solid radioactive waste will be placed in plastic bags or a container lined with plastic bags. Only clear bags at least 4 mils thick will be used. Clear bags will allow visual inspection of the waste by HPO personnel at the time of turnin. Bags will be taped closed and tagged with a radiation tag containing the authorization number, radioisotope(s), and activity.

b. Bulk liquid waste retained for disposal shall be collected in plastic bottles or sealed in cans to diminish breakage. Liquid waste that will chemically react with plastic should be placed in glass bottles. The containers will be tagged as stated in paragraph 8-5.a.

c. Scintillation vials will be packaged separately from other materials. They will be tightly closed and placed in a shipping tray that is labeled with the words "Caution - Radioactive Material." Care must be taken to prevent breakage of the vials while in storage or transport. The trays will be tagged as stated in paragraph 8-5.a.

d. All "Sharps" to include syringes with needles, needles and similar items must be separated from other radioactive waste, packaged in cardboard boxes or sharps containers and sealed to prevent personal injury. The sharps containers and boxes will be

tagged as stated in paragraph 8-5.a. All sharps containers with long half-life waste may contain only minimal, residual liquid.

e. Short half-life materials and items contaminated with short half-life materials will be separated from other materials. Radioactive warning labels must be obliterated on all vials and materials prior to placing the items in the plastic bags. The bags will be tagged identifying isotope(s), activity, and authorization number. Do not use "radiation tape" to seals these bags.

f. Biological wastes (animal carcasses/animal waste) will be prepared by the user in a manner that allows the waste to be readily packaged in alternating 10-inch layers of waste and packing materials. Prepared biological waste will be placed in 4 mil clear bags and tagged as previously indicated.

8-6. RELEASE OF RADIOACTIVE MATERIAL INTO THE SANITARY SEWAGE SYSTEM.

a. Liquid radioactive waste will not be released into the sanitary sewage system unless prior approval has been included in the WRAMC Radioactive Material Authorization.

b. Other conditions for the disposal of liquid radioactive waste material (as a byproduct of washing laboratory glassware or equipment) into the sewage system are:

(1) The total quantity of material released by the user in any one month will not exceed 100 µCi. Assume emptied glassware retains one percent of the radioactivity originally contained within the glassware.

(2) The sink must be conspicuously posted with a sign bearing the Radioactive Caution Symbol and words, "Caution - Radioactive Material Wash Sink", and with a notice to the user that radioactive material discharged through the sink must be readily soluble or dispersible in water.

(3) A record of the identity and activity of radionuclides released will be maintained by the Principal User. This record will be reviewed by HPO for compliance with regulatory limits.

8-7. COLLECTION, LOCAL TRANSPORTATION AND STORAGE OF RADIOACTIVE WASTE.

a. Properly packaged radioactive waste will be brought to centralized collection points in Building 40, Building 2, or other designated locations. Under the supervision of the HPO, waste will be placed in barrels or other designated containers. Waste that has not been properly separated and tagged will not be accepted.

b. Principal Users will ensure that packaged radioactive waste brought to the collection points is supervised until accepted by HPO to preclude the possibility of loss or theft.

c. All radioactive waste (except mixed waste which contains a percentage of EPA regulated material) will be transported from the above noted collection points to the Radioactive Material Storage Areas located in Buildings 149A and 516, Forest Glen Section, WRAMC, for ultimate disposal.

d. Building 149A, will be used for storage of radioactive therapy waste and radioactive biological waste. Building 516, may be used to store all categories of radioactive waste.

e. Storage areas are considered "Restricted Areas" and will remain locked to preclude the possibility of loss or theft and protect individuals from exposure to radiation or radioactive materials.

f. Radioactive Material Storage Areas will be posted by Health Physics personnel with the appropriate warning signs prescribed by Title 10 CFR 20.1902.

g. Wastes will be packaged for ultimate shipment and disposal in accordance with the instructions furnished by the waste disposal contractor. The waste disposal contractor is determined by DOD Executive Agency for Low-Level Radioactive Waste, ATTN: AMSIO-DMW, Rock Island, IL 61299 in accordance with AR 385-11.

8-8. RADIOACTIVE WASTE DISPOSAL SUPPLIES.

a. Items of supply used for radioactive waste packaging are stocked by the Supply and Administration Branch, Material Division, Directorate of Logistics, WRAMC. All stockage items meet Federal radioactive material packaging requirements for most types of the radioactive waste resulting from laboratory and/or clinical procedures at WRAMC.

b. Personnel involved with packaging of hazardous chemical radioactive waste will consult the HPO to ensure that the stockage items meet packaging requirements.

c. Principal Users are responsible for funding for materials and supplies used to dispose of radioactive waste. The HPO will order supplies needed to collect and package the waste received at collection points and will cite Clinical Investigation, Department of Pathology/Laboratory Services, Department of Radiology, AFIP, or WRAIR as appropriate. All supply orders submitted by HPO will be prorated to the using services.

8-9. DISPOSAL OF STOCK SOURCE VIALS.

a. All original stock source vials, whether depleted, decayed, or partially used will be turned over to the Health Physics personnel along with the radiation waste.

b. A stock source vial is defined as having an initial activity of at least 50 µCi of any radionuclide.

c. Original stock source vials, whether depleted or not, which are turned in as waste shall be kept separate from other waste.

d. When source vials are turned in to Health Physics, please provide the source HPO identification number (Yellow Tag Number).

e. If there are multiple vials listed under the same identification number, list the vials still in your possession.

f. The inventory log will be adjusted to show the change in the authorization inventory. Health Physics personnel will sign the inventory log if provided at the time of turn-in. In addition, Health Physics personnel will provide a signed receipt for possession of the source vial(s).

CHAPTER 9
Sealed Source Leak Testing and Accountability

9-1. RESPONSIBILITIES.

a. The HPO is responsible for ensuring and documenting that all sealed sources are acquired, inventoried, leak tested, transferred and disposed of in accordance with applicable requirements.

b. Principal Users are responsible for ensuring and documenting that all sealed sources used to support their operation are specifically permitted by their WRAMC Radioactive Material Authorization and that each source is acquired, inventoried, transferred and disposed of in accordance with the requirements of this chapter.

9-2. ACQUISITION OF SEALED SOURCES. Regardless of activity or intended use, the acquisition of each sealed source will be cleared with the HPO prior to any commitment for purchase or receipt. The HPO will determine which Federal regulatory requirements apply to acquisition of the sealed source and provide prospective suppliers with any required certification/NRC license documents.

9-3. INVENTORY OF SEALED SOURCES. A current inventory of all sealed sources will be maintained by the HPO.

a. Each accountable sealed source at WRAMC will be assigned a Health Physics control number by the HPO.

b. Each nonexempt sealed source will be inventoried quarterly and a record maintained by the HPO.

c. The Principle Users shall notify the HPO of any change in location of sealed sources under their control.

9-4. TRANSFER AND DISPOSAL OF SEALED SOURCES. The transfer and disposal of all sealed sources will be coordinated with the HPO.

a. Individual sealed sources will be transferred only to authorized recipients or licensed disposal sites.

b. When items of equipment containing sealed sources are to be transferred or disposed of, the HPO will be notified. After performing a final survey to determine that all sealed sources

have been removed, all radioactive warning labels have been obliterated, and the item is free of radioactive contamination, the HPO will provide written certification that the item does not present a radiation hazard and may be disposed of through normal channels.

9-5. LEAK TESTING OF SEALED SOURCES.

a. Leak Test Requirements.

(1) Each sealed source with a half-life greater than thirty days and in any form other than gas will be tested for contamination or leakage by the vendor or the HPO before use.

(2) Sealed sources designed to emit alpha particles will be leak tested at intervals not to exceed three months. All other sealed sources containing by product material will be leak tested at intervals not to exceed six months. These leak tests will be performed by the HPO.

(3) Sealed sources that contain 100 microcuries or less of beta or gamma emitting material or 10 microcuries or less of alpha emitting material are exempt from such leak tests.

(4) Sealed sources containing only byproduct material with a half-life of less than thirty days or byproduct material as a gas is also exempt from leak tests.

(5) Sealed sources are exempt from six-month periodic testing if they are stored and not being used; however, these sources will be leak tested prior to any use or transfer if testing has not been done within the past six months.

(6) If there is reason to suspect a sealed source has been damaged it will be tested for leakage before further use.

b. Any sealed source with a positive leak test (greater than 0.005 microcuries) will be immediately withdrawn from use by the HPO. The HPO will retest to determine whether or not the source is leaking. If it is leaking, it will be resealed or disposed of in accordance with existing regulations.

c. WRAMC Form 1685 (Sealed Source Inventory and Leak Test Record), or its equivalent, will be used by the HPO to record leak test results. Consecutive entries will be made for each

test including: The date, activity detected in microcuries, and the initials of the person performing the test.

CHAPTER 10
Health Physics Aspects of Patient Care

10-1. GENERAL REQUIREMENTS.

a. It is the responsibility of all personnel who are occupationally exposed to radiation from patients receiving radiotherapy to:

(1) Properly utilize the dosimetry issued to them.

(2) Know and conform to the radiation protection and emergency measures pertaining to their procedures.

b. Radiation safety procedures will not impede emergency medical care, however, a maximum effort will be made to minimize the exposure of individuals performing the treatment.

10-2. RESPONSIBILITIES.

a. The physician performing the therapy procedure will:

(1) Notify the HPO one week prior to the scheduled procedure date (emergency procedures as early as possible) and provide the following information:

(a) Patient's name.

(b) The date and time the procedure will be initiated.

(c) Type and approximate length of the procedure.

(d) Isotope activity.

(e) The location (treatment room, opeating room, or ward room) where the radioactive material will be administered to the patient.

(f) The room and ward to which the patient will be assigned for the duration of the procedure.

(2) Ensure that there is a sufficient availability of personnel (i.e., nursing, health physics) and equipment to support the therapy.

(3) Ensure that the patient is not released without proper HPO clearance.

b. The service performing the procedure, Radiation Therapy, Radiation Oncology, or Nuclear Medicine will ensure that the physician performing the procedure is listed on the appropriate Human Use Authorization which covers the procedure and has been authorized by the RCC.

c. The HPO will:

(1) Establish radiation protection and emergency procedures for each type of therapy.

(2) Brief all personnel (especially the nursing staff) on the radiation protection and emergency procedures associated with that therapy.

(3) Determine, based on the information provided by the physician:

(a) The personnel dosimetry requirements.

(b) The radiation shielding required for the procedure.

(c) When HPO coverage will be required.

(d) Any special radiation protection and emergency procedures required.

(4) Brief the patient on Health Physics aspects of the procedure.

(5) Ensure that the appropriate dosimetry has been issued and is being utilized correctly.

(6) Prepare the room where the radioactive material will be introduced into the patient and where the patient will be located during the procedure to minimize and/or prevent the spread of contamination.

(7) Monitor the dosing of the patient to ensure that the radiation protection procedures are followed.

(8) Post the appropriate forms, signs and labels.

(9) Make periodic visits to the ward throughout the duration of the procedure. The frequency of the visits will be determined by the HPO.

(10) Ensure that all radioactive materials removed from the ward are either returned to storage or disposed of in the appropriate container.

(11) Determine, based upon measurements and regulatory requirements, when the patient will be released from the restrictions required for radiation protection.

(12) Remove all forms, signs and labels at the end of the procedure.

(13) Release the room for general use at the earliest possible time consistent with radiation protection considerations with the exception of dedicated rooms.

d. The nursing staff and ward personnel will:

(1) Comply with radiation protection procedures.

(2) Notify the Health Physics Technician on call for the therapy and the Radiation Oncologist or Nuclear Medicine Physician in the event of patient emergencies, death, or unusual situations as outlined in radiation protection briefings.

e. Chief, Endocrinology Service. Ensure proper notification of nuclear medicine, Kyle Metabolic Unit, and HPO of scheduled ablation therapies to ensure proper and timely preparation.

10-3. EMERGENCY NOTIFICATION. In the event of an emergency or misadministration, notify the Health Physics Office at (202) 356-0058.

CHAPTER 11
Animals Containing Radioactive Material

11-1. RESPONSIBILITIES.

a. The Principal User is responsible to:

(1) Ensure that animals containing radioactive materials are housed only in cages labeled as containing radioactive material. The labels on the cages will indicate the radioisotope, millicurie amount, and date the radioisotope was introduced into each animal.

(2) Ensure that the cages containing radioactive animals are housed only in rooms that have been approved and posted by the HPO.

(3) Ensure the HPO and the Director of Department of Laboratory Animals, Walter Reed Army Institute of Research (WRAIR), are notified prior to the commencement or change in procedure of all projects where radioactive materials are introduced into laboratory animals.

(4) Notify the HPO and the Director of Department of Laboratory Animals, WRAIR, at the termination of studies. Rooms or cages must be cleared and unposted by the HPO prior to release for unrestricted use.

(5) Remove all radioactive materials from rooms used exclusively to house animals.

(6) Ensure that all applicable radiation protection procedures are met.

(7) Notify the HPO of any unusual occurrences or incidents in which radioactive material is involved.

b. The HPO is responsible to:

(1) Ensure that rooms and cages used to perform procedures and house animals are properly posted and labeled.

(2) Inform the Principal User and the animal handlers of any special radiation protection procedures to be observed.

CHAPTER 12
X-Ray Producing Devices

12-1. X-RAY PROTECTION SURVEY REQUIREMENTS.

a. An initial design review or survey of the facility will be made including protective barriers, interlocks, and other associated protective devices of newly procured equipment.

b. An initial radiation protection survey will be performed prior to the routine use of any newly installed, modified, or relocated equipment.

c. All x-ray producing devices intended for human-use will have a radiation survey at least annually by the HPO.

d. All x-ray producing devices not intended for human-use will have a radiation survey at least triennially by the HPO.

e. A resurvey will be performed after every change in equipment, subsystem, component, workload, or operating conditions that might significantly increase the exposure of patients or operating personnel to ionizing radiation.

12-2. RESPONSIBILITIES.

a. The using organization is responsible to:

(1) Ensure that a shielding evaluation is performed prior to the procurement, installation, modification, or relocation of any x-ray producing equipment or facility.

(2) Ensure that a radiation protection survey is performed after acceptance testing and prior to the use of any newly installed, modified, or relocated, x-ray producing equipment or facility.

(3) Notify the HPO of any change in equipment, subsystem, component, workload, or operating conditions.

(4) Report the location of all x-ray producing devices to the HPO.

(5) Collect portable x-ray equipment and make them available in a central location for surveying.

(6) Ensure that written procedures are established to provide radiation protection and emergency procedures for each facility.

(7) Keep exposures of patients or operating personnel to ionizing radiation as low as reasonable achievable.

(8) Ensure that only fully qualified personnel operate the equipment.

(9) If requested, provide an operator for the system during the radiation protection survey.

(10) Maintain a Quality Assurance program.

(11) Notify the HPO of any pregnant patients receiving medical radiation exposure.

(12) Conduct safety defect testing of lead aprons, thyroid collars, lead drapes, and gonadal shields at least annually.

b. Biomedical Electronics, Maintenance Division is responsible to:

(1) Provide written notification to the HPO of all corrections of deficiencies noted on survey reports.

(2) Notify the HPO of any changes in equipment, subsystem, component, or operating conditions.

(3) Provide a semiannual listing to the HPO of all x-ray equipment maintained, serviced, or vendor supported.

c. The HPO is responsible to:

(1) Maintain a registry of all x-ray producing devices within the Walter Reed Army Health Care System.

(2) Perform all radiation protection and compliance surveys, resurveys, and initial radiation protection analyses.

(3) Ensure that only qualified personnel perform radiation protection and compliance surveys.

(4) Conduct fetal dose estimates for pregnant patients receiving medical irradiation.

(5) Calculate and provide patient entrance skin exposures for x-ray systems.

(6) Perform an initial design review or survey of the facility including protective barriers, interlocks, and other associated protective devices of newly procured equipment.

CHAPTER 13
Non-Ionizing Radiation Sources

13-1. PURPOSE. This chapter outlines the non-ionizing radiation safety program for WRAMC and its tenant facilities. The responsibility for implementing and enforcing the non-ionizing radiation safety program rests with the Chief, HPO, WRAMC. To be successful, however, the program must be carried out as a joint venture with the Occupational Health Clinic and the Industrial Hygiene Section of the WRAMC Preventive Medicine Service, the WRAMC Safety Office, as well as the departments and activities that use non-ionizing radiation sources.

13-2. APPLICABILITY. The table located at the end of this chapter lists the individual program elements in the WRAMC non-ionizing radiation protection program and indicates which elements are required for the various types of non-ionizing sources based upon their relative hazards.

13-3. RESPONSIBILITIES.

a. The Chief, HPO, WRAMC:

(1) Review requests for the procurement of equipment which uses or produces microwave or radio frequency radiation, laser radiation, ultrasound, and other high intensity optical radiation, hereafter collectively referred to as non-ionizing radiation.

(2) Maintain an inventory of non-ionizing radiation sources. Submit a copy of the inventory to the Industrial Hygiene Section for inclusion in the Health Hazards Information Module (HHIM) data base. Update the data base as necessary. Coordinate with the Occupational Health Clinic to ensure proper use of the inventory in the Occupational Vision Program.

(3) Ensure that users of non-ionizing radiation equipment and maintenance personnel develop Standing Operating Procedures (SOP). Ensure that users post these SOPs at visible locations in the user/maintenance facilities and that they strictly enforce SOP provisions. Maintain copies of SOPs and ensure users update them as necessary.

(4) Ensure users provide or contract for initial non-ionizing radiation safety training for all users and maintenance personnel.

(5) Coordinate with the U.S. Army Center for Health Promotion and Preventive Medicine for non-ionizing radiation safety surveys.

(6) Notify the Radiological Hygiene Consultants to MEDCOM and to the Office of the Surgeon General within 24 hours of any incident involving non-ionizing radiation sources.

b. Chief, Occupational Health Clinic will routinely review the HHIM database and coordinate with the HPO, and the Industrial Hygiene Section to screen individuals working with non-ionizing radiation for inclusion in the Occupational Vision Program.

c. Chief, Industrial Hygiene Section will coordinate with the HPO to enter non-ionizing radiation source inventories into the HHIM data base and notify the Occupational Health Clinic of these sources.

d. Department heads and activity chiefs who are responsible for the operation of non-ionizing radiation equipment will:

(1) Provide the HPO with the type, model, serial number, maintenance management control number, and location of their non-ionizing radiation equipment.

(2) Receive HPO's review and approval prior to procuring new non-ionizing radiation equipment or modifying existing equipment.

(3) Notify the HPO prior to the relocation or disposal of non-ionizing radiation equipment.

(4) Develop SOPs for the safe use of non-ionizing radiation equipment and submit copies to the HPO. Ensure that they post SOPs at visible locations and strictly enforce SOP provisions.

(5) Coordinate with the HPO to develop a training program for non-ionizing radiation safety. Ensure that all users in the department or activity receive annual training and provide the HPO with training documentation.

(6) Ensure proper maintenance and calibration of non-ionizing radiation sources as required by the manufacturer.

(7) Ensure individuals selected for inclusion in the Occupational Vision Program receive appropriate testing at the Occupational Health Clinic.

(8) Notify the HPO immediately following an incident or suspected incident involving non-ionizing radiation sources to include proper documentation of all background information.

e. Supervisors of personnel responsible for the maintenance of non-ionizing radiation equipment will:

(1) Develop SOPs outlining radiation safety procedures used during the maintenance of non-ionizing radiation equipment and provide copies of the SOPs to the HPO.

(2) Ensure that all maintenance personnel working with non-ionizing radiation sources receive initial safety training and provide training records to the HPO.

(3) Notify department/activity chiefs of suspected incidents involving non-ionizing radiation sources.

TABLE 13-1
Non-Ionizing Radiation Protection Program Requirements

Program Element	Microwave Sources	Laser Sources	High Intensity Optical Sources	UV Sources
HPO Approval for Procurement	All except ovens	Class IIIb and IV	All	All
Source Inventory	All except ovens	Class IIIb and IV	All	All
Hazard Training	Power Density > PEL[1]	Class IIIb and IV	Intensity > MPE[2]	Irradiance > TLV[3]
Area Posting Requirements	Power Density > PEL	Class IIIb and IV	Intensity > MPE	Irradiance > TLV
Ocular Surveillance	All except ovens	Class IIIb and IV	All	All
SOPs	Power Density > PEL	Class IIIb and IV	Intensity > MPE	Irradiance > TLV
Protective Equipment	Not Applicable	Class IIIb and IV	Intensity > MPE	Irradiance > TLV
Facility Surveys	Power Density > PEL	Class IIIb and IV	Intensity > MPE	Irradiance > TLV
HPO Disposal Notification	All except ovens	Class IIIb and IV	All	All

[1] Permissible Exposure Limit.

[2] Maximum Permissible Exposure.

[3] Threshold Limit Value.

CHAPTER 14
Particle Accelerators

14-1. PURPOSE. This chapter outlines the radiation safety program for WRAMC and its tenant facilities for particle accelerators. All individuals associated with the operation of a therapeutic radiation machine shall be instructed in and shall comply with the provisions of the registrant's quality management program.

14-2. GENERAL.

a. Sources and types of radiations from accelerators:

(1) X-rays (bremsstrahlung): Form the interaction of electrons on matter.

(2) Characteristic X-rays: From the interaction of either electrons or ions on matter.

(3) Prompt gamma radiation: From the interaction of either ions or neutrons on matter.

(4) Neutron radiation: From the interaction of either electrons, photons, or ions on matter.

(5) Delayed radiations (beta and gamma rays): From induced radioactivity. There may be several sources of radiation throughout an accelerator, depending on its design and operating condition. Of particular importance at higher particle energies is the significant amount of induced radioactivity.

b. Radiation Equipment and Safety Systems.

(1) Interlocks.

(a) Personnel entrances into any high-radiation area shall be provided with either a door or shielding equivalent to that of the surrounding walls.

(b) All personnel access barriers will be equipped with interlock switches that cause the production of radiation by the accelerator to stop if the access barrier is opened. Interlocks shall also be provided to protect personnel from electrical hazards such as high-voltage power supplies and linear-accelerator modulators. All interlocks shall be tested

and inspected periodically to ensure that they are functioning as designed.

(c) Certain accelerators for radiotherapy can be alternatively used to deliver electron or x-rays to a patient. These shall be provided with a suitable interlock system to prevent inadvertent exposure of the patient to electrons when x-ray exposure is intended. The electron-beam current will be limited to values consistent with electron-beam therapy.

(d) Emergency switches to stop the production of radiation shall be placed conspicuously in high-radiation areas so that personnel within such areas can have ready access to them in the event they are inadvertently caught within the area. The emergency switches shall be part of the interlock system and conspicuously marked as to their function.

(e) Warning signs will be posted and radiation-warning lights shall be designed into the fail safe circuit so that if the light has burned out, no radiation will be produced. The warning signs and lights will be inspected and tested periodically to ensure they are functioning as intended.

(f) Airborne radioactivity may be produced by x-rays from accelerators above 6 MeV, and by all neutron-producing accelerators. The air vented from areas in which airborne radioactivity is suspected shall be dispersed into the atmosphere in a manner to meet existing local, state, and federal regulations.

(g) Induced radioactivity of accelerator components such as cyclotron dee structures, collimating slits, magnet chambers, or beam dumps needs to be considered with respect to possibly limiting access to radioactivity areas until the radioactivity has reached safe levels. Induced radioactivity of accelerator components needs to be considered for safe handling, storage, and transportation or the affected components.

(h) No individual, other than the patient, shall be in the treatment room during treatment or during any irradiation for testing or calibration purposes.

14-3. RESPONSIBILITIES.

a. All physicians, physicists, dosimetrists, and therapists assigned to Radiation Oncology Division are classified as radiation workers.

b. The Staff Physicist shall:

(1) Perform Quality Control measures.

(2) Perform weekly chart review of every patient under treatment.

(3) Maintain calibration of instrumentation, and periodically evaluate equipment function.

(4) Ensure appropriate treatment unit safety and warm-up inspections are performed.

(5) Supervise physical aspects of treatment planning.

(6) Supervise and review the dosimetry.

(7) Assist the dosimetrist in all aspects of treatment planning. Check the accuracy of the treatment plans before any treatment is delivered.

(8) Equipment calibrations.

(a) Spot checks shall be performed during full calibrations and at intervals not exceeding a month thereafter.

(b) Computer codes shall be verified by phantom dose calculations and in comparison to other calculations before being employed in treatment planning.

(9) Physics.

(a) Weekly check the outputs of all treatment beams.

(b) An independent qualified physicist shall check the output of the clinic units within 30 days of the full calibration.

(10) Radiation Safety.

(a) Perform an area survey of the adjoining spaces

(b) Ensure HPO is notified in the event of any incidents, accidents, recordable events, or misadministrations.

c. The Health Physics Office shall:

(1) Maintain the individual dosimetry records.

(2) Schedule calibration of radiation detection instruments.

d. The RCC shall approve authorized users.

14-4. EMERGENCY NOTIFICATION. In the event of an emergency or misadministration, notify the Health Physics Office at (202) 356-0058.

APPENDIX A
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32. Title 10, Code of Federal Regulations, Part 34, Licenses for Radiography and Radiation Safety Requirements for Radiographic Operations.

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35. Title 21, Code of Federal Regulations, Chapter 1, Subchapter J.

36. Title 29, Code of Federal Regulations, Part 1910, Occupational Safety and Health Standards

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GLOSSARY

Activity
The rate of disintegration (transformation) or decay of radioactive material. The units of activity are curie (Ci) and becquerel (Bq). 1 Ci ≡ 3.7 x 10^{10} disintegrations per second, and 1 Bq ≡ disintegrations per second.

ADR
Automated Dosimetry Report.

Adult
An individual at least 18 years of age.

As Low As Reasonably Achievable (ALARA)
The taking of every reasonable effort to maintain exposures to radiation as far below prevailing dose limits as is practicable. These efforts must take into account —

a. State of technology.

b. Economics of improvements in relation to the state of the technology.

c. Economics of improvements in relation to benefits to the public health and safety.

d. Other societal and socioeconomic considerations in relation to use of nuclear energy and radioactive materials I the public interest.

e. Sample of good ALARA practices may be found in the NRC Regulatory Guides 8.10, 8.18, and 10.8.

Authorization
A formal, Radiation Control Committee (RCC) approved document permitting named individuals to order, receive, store, possess, and use radioactive materials.

Bioassay
The determination of kinds, quantities, or concentrations, and in some cases, the locations or retention of radionuclides in the human body, whether by direct measurement (in vitro counting) or by indirect (in vivo) analysis of materials excreted or removed from the human body.

Byproduct Material
Such material includes the following:

a. Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material. Generally, byproduct material is any radioactive material inevitably produced as a byproduct from the neutron-induced fission process within nuclear reactors.

b. The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processing primarily for its source material content including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" regulated by the NRC under 10 CFR.

Committed Dose Equivalent ($H_{T,50}$)
The dose equivalent that will be received from an intake of radioactive material to organs or tissues of reference (T) by an individual during the 50-year period following the intake.

Controlled Area
An area, outside of a restricted area but inside an installation boundary, access to which can be limited by the commander for any reason.

Co-worker
An individual listed on an authorization who possesses qualifications similar to the Principal User.

Deep-Dose Equivalent
This dose applies to external, whole-body exposure and is the dose equivalent at a tissue depth of 1 centimeter (cm) or 1000 mg/cm^2 below the outer skin surface.

Dose Equivalent
The product of the absorbed dose in tissue (D) and the quality factor (Q) at the location of interest where $H_T = D * Q$. The units of dose equivalent are the rem and sievert (Sv). The dose equivalent in rem is equal to the absorbed dose in rads multiplied by the quality factor; 1 rem = 0.01 Sv. Its purpose is to have a single unit, regardless of the type of radiation, describing the radiation effect on man.

Exposure
Ionizing radiation may be either produced from machines (x-ray machines, accelerators, etc.) or spontaneously emitted by radioactive material. An individual located near such machines or materials may be "exposed" to the ionizing radiation emitted; hence, sustain and exposure.

Gieger-Mueller (G-M) Counter
A gas-filled detector which operates with a very high electric field where a single ionization event can trigger an avalanche of ionizations. The G-M detector is very sensitive, but all pulses from the G-M tube are of the same amplitude regardless of the number of the original ion pairs or energy of the incident ionizing radiation. Therefore, the G-M detector functions only as a simple counter of ionization events.

Half-life
Time required for half the atoms in a radioactive substance to disintegrate to another nuclear form. Also called physical half-life, and each radionuclide has its own unique half-life. For the WRAMC NRC license conditions:

a. Short Half-life. Radioactive material containing one or more radionuclides having a radiological half-life of 65 days or less including the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

b. Long Half-life. Radioactive material containing one or more radionuclides having a radioactive half-life of more than 65 days except for the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

HPO
Health Physics Office.

Misadministration
The administration of:

a. A radiopharmaceutical dosage greater than 30 microcuries of either sodium iodide I-125 or I-131:

(1) Involving the wrong patient or human research subject, or wrong radiopharmaceutical; or

(2) When both the administered dosage differs from the prescribed dosage by more than 20 percent of the prescribed dosage and the difference between the administered dosage and prescribed dosage exceeds 30 microcuries.

b. A therapeutic radiopharmaceutical dosage, other than sodium I-125 or I-131:

(1) Involving the wrong patient or human research subject, wrong radiopharmaceutical, or wrong route of administration; or

(2) When the administered dosage differs from the prescribed dosage by more than 20 percent of the prescribed dosage.

c. A gamma stereotactic radiosurgery radiation dose:

(1) Involving the wrong patient or human research subject, or wrong treatment site; or

(2) When the calculated total administered dose differs from the total prescribed dose by more than 10 percent of the total prescribed dose.

d. A teletherapy radiation dose:

(1) Involving the wrong patient or human research subject, wrong mode of treatment, or wrong treatment site;

(2) When the treatment consists of three or fewer fractions and the calculated total administered dose differs from the total prescribed dose by more than 10 percent of the total prescribed dose;

(3) When the calculated weekly administered dose exceeds the weekly prescribed dose by 30 percent or more of the weekly prescribed dose; or

(4) When the calculated total administered dose differs from the total prescribed dose by more than 20 percent of the total prescribed dose.

e. A brachytherapy radiation dose:

(1) Involving the wrong patient or human research subject, wrong radioisotope, or wrong treatment site (excluding, for permanent implants, seeds that were implanted in the correct site but migrated outside the treatment site);

(2) Involving a sealed source that is leaking;

(3) When, for a temporary implant, one or more sealed sources are not removed upon completion of the procedure; or

(4) When the calculated administered dose differs from the prescribed dose by more than 20 percent of the prescribed dose.

f. A diagnostic radiopharmaceutical dosage, other than quantities greater than 30 microcuries of either sodium I-125 or I-131:

(1) Involving the wrong patient or human research subject, wrong radiopharmaceutical, wrong route of administration, or when the administered dosage differs from the prescribed dosage; and

(2) When the dose to the patient or human research subject exceeds 5 rems effective dose equivalent or 50 rems dose equivalent to any individual organ.

Nonstochastic Effects
Also called a deterministic effect. A health effect, the severity of which varies with dose, and for which a threshold is believed to exist. Radiation induced cataract formation and skin erythema are examples of nonstochastic effects.

Occupational Dose

a. The dose received by an individual in a restricted area or in the course of employment in which the individual's assigned duties involve exposure to ionizing radiation from NRC- and non-NRC licensed radioactive materials as well as from machine produced ionizing radiation, whether in the possession of the owner or the radiation source (licensee) or other individual.

b. Occupational dose does not include dose received from background radiation, as a patient from medical or dental procedures, from voluntary participation in human research programs, or as a member of the general public.

Occupationally Exposed Individual
Any individual who receives an occupational dose of radiation as a result of employment in an occupation involving the use of radioactive material or equipment capable of producing ionizing radiation.

Principal User
An individual who possesses adequate training and experience with radioactive materials and bears ultimate responsibility for the ordering, receiving (from the HPO), storing, and inventory of authorized materials. He or she is solely responsible for the implementation of the radiation protection procedures necessary to ensure the safe use of the materials specified in the authorization.

NRC
Nuclear Regulatory Commission.

RAM
Radioactive Material.

RCC
Radiation Control Committee.

RPO
Radiation Protection Officer.

a. A technically competent person designated by management to evaluate safety procedures and to supervise the application of radiation protection regulations.

b. The individual identified as the Radiation Safety Officer on a Nuclear Regulatory Commission license.

Radiation Sources
Material, equipment, or devices which spontaneously generate or are capable of generating ionizing radiation. They include the following:

a. Nuclear reactors.

b. Medical or dental radiographic or fluoroscopic x-ray systems.

c. Particle generators or accelerators.

d. Certain electromagnetic generators, such as klystron, magnetron, rectifier, cold-cathode, and other electron tubes operating at electrical potentials that result in the production of x-rays of such energy as to be of radiological concern.

e. X-ray diffraction, industrial radiographic, and spectrographic equipment.

f. Electron microscopes.

g. Electron-beam welding, melting, and cutting equipment.

h. Nuclear moisture or density gauges.

i. Radioactive materials.

j. Natural or accelerator-produced radioactive materials.

k. Byproduct materials.

l. Source materials.

m. Special nuclear materials.

n. Fission products.

o. Materials containing induced or deposited radioactivity.

p. Radioactive commodities.

Radiation Protection Survey (Radioactive Materials)
The evaluation of various locations to determine existing or potential radiation hazards associated with the use of radioactive materials.

Radiation Protection Survey (X-ray Producing Devices)
An evaluation, under specified conditions, of existing or potential radiation hazards associated with the use of x-ray producing devices.

Radionulcide
A radioactive species of atom characterized by its mass number (A), atomic number (Z), and nuclear energy state, provided that the mean life of the that state is long enough to be observable.

Radioactive Waste

a. Solid, liquid, and gaseous materials that are radioactive or become radioactive and for which there is no further use.

b. Property contaminated with radioactive materials to the extent that decontamination is economically unsound.

Recordable Event
The administration of:

a. A radiopharmaceutical or radiation without a written directive where a written directive is required;

b. A radiopharmaceutical or radiation where a written directive is required without daily recording of each administered radiopharmaceutical dosage or radiation dose in the appropriate record;

c. A radiopharmaceutical dosage greater than 30 microcuries of either sodium iodide I-125 or I-131 when both:

(1) The administered dosage differs from the prescribed dosage by more than 10 percent of the prescribed dosage, and

(2) The difference between the administered dosage and prescribed dosage exceeds 15 microcuries;

d. A therapeutic radiopharmaceutical dosage, other than sodium iodide I-125 or I-131, when the administered dosage differs from the prescribed dosage by more than 10 percent of the prescribed dosage;

e. A teletherapy radiation dose when the calculated weekly administered dose exceeds the weekly prescribed dose by 15 percent or more of the weekly prescribed dose; or

f. A brachytherapy radiation dose when the calculated administered dose differs from the prescribed dose by more than 10 percent of the prescribed dose.

Restricted Area
An area, access to which is limited by the commanders of DA and DLA installations and activities for the purpose of protecting individuals from undue risks associated with exposure to ionizing radiation-producing sources, devices, and radioactive materials.

Restricted areas do not include areas used as residential quarters; however, a separate room in a residential building may be set aside as a restricted area.

SOP
Standing Operating Procedure

Sealed Source
Radioactive materials sealed in an impervious container designed to prevent dispersion under normal use.

Shallow-dose Equivalent
The external exposure of the skin or any extremity which is taken as the dose equivalent at a tissue depth of 0.007 cm (7 mg/cm^2 the average depth of the germinal cell layer) averaged over an area of 1 cm^2.

Shielding Evaluation
An evaluation of the design or modification plans for a fixed radiologic facility to preclude the occurrence of radiation hazards.

Source Material

a. Uranium, thorium, or any combination of uranium or thorium in any physical or chemical form; or

b. Ores which contain by weight one-twentieth of 1 percent (0.05%) or more of uranuium, thorium, or any combination or uranium and thorium.

c. Source material does not include:

(1) Special nuclear material.

(2) Plutonium, ^{233}U, uranium enriched in the isotope 233 or in the isotope 235. Any other material the NRC determines to be special nuclear material as defined by 10 CFR Part 20.

(3) Special nuclear material does not include source material.

Stochastic Effects
Health effects that occur randomly and for which the probability of the effect occurring rather than its severity, is assumed to

be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects.

Total Effective Dose Equivalent (TEDE)
The sum of the H_d (for external exposure) and the CEDE (for internal exposure) expressed in units of either rem or Sv.

TLD
Thermoluminescent Dosimeter.

Technician
An individual who works under the direct supervision of a Principal User or co-worker for the purpose of performing certain routine duties associated with the use of the radioactive materials specified in the authorization.

Trainee
An individual who works under the direct supervision of a Principal User or co-worker for the purpose of obtaining the necessary training and experience to qualify for eventual status as a co-worker or Principal User.

Weighting Factor (w_T)
The decimal fraction specified for an organ or tissue whose magnitude is the quotient of the risk of stochastic effects resulting from the irradiation of that organ or tissue (T) to the total risk or stochastic effects when the whole body is irradiated uniformly. The w_T values used for calculating the H_E are found in 10 CFR Part 20.

Whole Body
The head, trunk (including male gonads), arms above the elbow, or legs above the knee.

The proponent of this regulation is Preventive Medicine Service, Health Physics Office. Users are invited to send suggestions and comments on DA Form 2028 (Recommend Changes to Publications and Blank Forms) to Commander, WRAMC, ATTN: HSHL-H-HP Washington, DC 20307-5001.

FOR THE COMMANDER:

OFFICIAL:

ROBERT J. HECKERT, JR.
Colonel, MS
Deputy Commander for
Administration

JAMES O. FARR, JR.
Major, MS
Executive Officer

DISTRIBUTION:
A

DEPARTMENT OF THE ARMY
HEADQUARTERS, WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

HEALTH PHYSICS OFFICE
RADIOACTIVE MATERIAL AUTHORIZATION CONDITIONS

2 October 1997

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*This document supersedes the previous version, 8 April 1997.

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HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

GENERAL PROVISIONS FOR AUTHORIZED USE OF RADIOACTIVE MATERIAL AT WALTER REED ARMY MEDICAL CENTER

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 40-14, 30 June 1995, Occupational Ionizing Radiation Personnel Dosimetry.

d. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

e. DA PAM 40-18, 30 June 1995, Personnel Dosimetry Guidance and Dose Recording Procedures for Personnel Occupationally Exposed to Ionizing Radiation.

f. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

2. PRINCIPAL USER RESPONSIBILITIES. Principal Users for WRAMC Radioactive Material Authorizations are responsible for compliance with all regulations governing radiation safety in the laboratory and for safe practices of individuals working under their supervision. Principal Users are obligated to:

a. Supervise and train individuals working under their control to enable safe working habits and prevent exposures or contamination to themselves or others. Provide initial and annual briefings to all personnel working in areas designated on their authorization concerning the safe handling of the radioactive materials listed in the authorization, their responsibilities and rights as occupational radiation workers.

b. Ensure individuals working with radioactive materials under their control are aware of all radiation hazards inherent in the work environment and the risks associated with the possession, use, and shipment of the radioactive materials.

c. Ensure individuals working with radioactive materials under their control understand how to avoid any unnecessary exposure, either to themselves or to other workers.

d. Ensure individuals working with radioactive materials know the Army, federal, and state regulations controlling the possession, use, and shipping of radioactive materials.

e. Maintain constant surveillance or adequate controls of all radioactive materials to prevent unauthorized removal or use.

f. Notify the Health Physics Office (HPO) of any personnel changes, changes of radioactive material use areas, or sealed source locations. The HPO must be made aware of any additions or deletions of radioactive materials users.

g. Maintain occupational and environmental ionizing radiation exposure as low is reasonably achievable (ALARA). Current dose limitations are included in Tables General-1, -2:

Table General-1

OCCUPATIONAL EXPOSURE	
Stochastic Limit (TEDE)[1]	5 rem in 1 year
Nonstochastic Limit H_d and CEDE other than eye	50 rem in 1 year
Shallow Dose Equivalent H_s Skin or Extremity	50 rem in 1 year
Lens of the Eye	15 rem in 1 year
Dose to Embryo or Fetus[2]	0.5 rem in gestation period
Planned Special Exposures	Not Allowed Without Waiver
Emergency Exposure Limits (Life Saving)	100 rem
Emergency Exposure Limits (Not Life Saving)	10 rem
[1] Total Effective Dose Equivalent (TEDE) = External Exposure at a depth of 1 cm in tissue (H_d), and committed effective dose equivalent (CEDE) from internal exposure	
[2] H_s to pregnant woman and dose to the embryo or fetus	

Table General-2

FOR OCCASIONALLY EXPOSED INDIVIDUALS AND MEMBERS OF THE GENERAL PUBLIC	
Members of the Public	0.1 rem in any one year
Occasionally Exposed Individuals[1]	0.5 rem in any one year
Occupationally exposed Minors (under 18 years of age)	10% of the annual dose limits for occupationally exposed adults

[1] Individuals who occasionally enter restricted areas must not receive radiation exposure in excess of that permitted for any member of the public, however, transient operations may exist which require exposure of individuals not normally occupationally exposed to be exposed to levels in excess of 0.1 rem limit. Approval for this practice must be obtained in advance from OTSG and the NRC as per 10 CFR 20 for licensees.

h. Obtain and use proper personnel dosimetry devices in accordance with Condition No. 1, Personnel Dosimetry Procedures, for Radioactive Material Authorizations.

i. Contact the HPO Dosimetry Coordinator of any declared pregnant radiation workers for the risks associated with working with radioactive materials while pregnant (Nuclear Regulatory Commission Regulatory (NRC) Guide 8.13 and AR 40-14, paragraph 3-20).

j. Maintain an inventory of the physical and chemical forms of all radioactive materials in accordance with AR 385-11, paragraph 2-11. Keep current records of the receipt and the disposition of all radioactive materials in their possession including research, waste disposal, transfer, and storage. Perform a 100% physical radioisotope inventory every 3 months.

k. Perform radiation surveys of authorized work areas in accordance with Condition No. 2, Area Survey Procedures, for Radioactive Material Authorizations. Surveys for contamination should include not only the work area but also any protective clothing used, bottoms of shoes, and all potentially exposed areas of the body.

(1) The HPO will be notified immediately if contamination during a radiation survey exceeds:

(2) 2000 dpm/100 cm^2 or;

(3) When radiation levels from X-ray or gamma radiation in an unrestricted area exceeds 2 mrem/hr at 30 cm (1 foot).

l. Comply with the provisions of Condition No. 3, General Rules for the Safe Use of Radioactive Material, for Radioactive Material Authorizations.

m. Ensure appropriate radiation warning signs and labels are posted in accordance with 10 CFR 20.1902, and removed when no longer required.

n. Ensure the proper disposal of radioactive materials in accordance with Condition No. 4, Radioactive Waste, for Radioactive Material Authorizations.

o. Notify the HPO promptly of any changes in the use, location, or possession of radionuclides from the terms of this authorization.

p. Secure all radioactive materials to prevent unauthorized removal from the place of storage. Materials kept in unrestricted areas must be under constant surveillance and immediate control of an authorized user.

q. Comply with applicable provisions of Condition No. 5, Procedures for Ordering, Receiving, and Safely Opening Packages Containing Radioactive Material, for Radioactive Material Authorizations. In particular, insure that all NRC licensed or DARA radioactive materials entering Walter Reed Army Medical Center or its supported activities are processed through the HPO unless a special waiver has been granted by the HPO.

r. Do not transfer NRC licensed or Department of the Army Radiation Authorization (DARA) radioactive materials to unauthorized users or outside of the control of WRAMC or its supported activities.

s. In the event of an emergency situation, follow the emergency procedures outlined in Condition No. 6, Emergency Procedures, for Radioactive Material Authorizations.

t. Comply with the applicable provision of Condition No. 7, Requirements for the Use of Radioactive Iodine, Tritium, and Phosphorus-32, for Radioactive Material Authorizations.

u. Comply with the applicable provisions of Condition No. 8, Ventilation Requirements for Radioactive Material Authorizations.

v. Comply with the applicable provisions of Condition No. 9, Gas Chromatograph Requirements for Radioactive Material Authorizations.

Approved:

William B. Johnson

WILLIAM B. JOHNSON
COL, MS
Chief, Health Physics Office

HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

CONDITION NO. 1
RADIOACTIVE MATERIAL AUTHORIZATIONS
PERSONAL DOSIMETRY PROCEDURES

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-14, 30 June 1995, Occupational Ionizing Radiation Personnel Dosimetry.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. AR 385-30, 18 November 1971, Safety Color Code Markings and Signs.

e. DA PAM 40-18, 30 June 1995, Personnel Dosimetry Guidance and Dose Recording Procedures for Personnel Occupationally Exposed to Ionizing Radiation.

f. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

g. DD Form 1952, 1 November 1981, WRAMC Revision, 1 Nov 95, Dosimeter Application and Record of Occupational Radiation Exposure.

h. WRAMC Form 538, 1 November 1981, Radiation Worker Briefing.

2. PERSONNEL DOSIMETRY ASSIGNMENT LEVELS.

a. Appropriate personnel monitoring devices will be assigned to each individual as required by the Health Physics Office. In addition, other personnel monitoring techniques e.g., whole body counting or bioassay will be utilized to evaluate personnel dosimetry as deemed necessary by the Health Physics Officer.

b. Personnel monitoring devices will be assigned when adults could potentially receive an occupational exposure from external radiation in excess of 10% of the levels in the following table for occupational exposure in a calendar year (Tables 1-1, 1-2).

Table 1-1

OCCUPATIONAL EXPOSURE	
Stochastic Limit (TEDE)[1]	5 rem in 1 year
Nonstochastic Limit H_d and CEDE other than eye	50 rem in 1 year
Shallow Dose Equivalent H_s Skin or Extremity	50 rem in 1 year
Lens of the Eye	15 rem in 1 year

[1] Total Effective Dose Equivalent (TEDE) = External exposure at a depth of 1 cm in tissue (H_d), and committed effective dose equivalent (CEDE) from internal exposure

Table 1-2

MEMBERS OF THE GENERAL PUBLIC, DECLARED PREGNANT WORKERS, AND MINORS	
Members of the Public	0.1 rem in any one year
Dose to Embryo or Fetus[1]	0.5 rem in gestation period
Minors (under 18 years of age)	10% of the annual dose limits for occupationally exposed adults

[1] H_d to pregnant woman and dose to the embryo or fetus (after notifying the RPO in writing)

c. Dosimetry is required for all individuals entering a high or very high radiation area.

d. An ALARA investigation will be initiated if personnel dosimetry monitoring devices indicate an exposure level exceeding the amounts in Table 1-3:

Table 1-3

ALARA INVESTIGATIONAL LEVELS		
(mrems per calendar quarter)	Level I	Level II
Whole Body[1]	125	375
Lens of the Eye	375	1,125
Other[2]	1,250	3,750

[1] TEDE

[2] Other includes: Shallow-dose equivalent (H_s) to the skin or to any extremity, or the sum of the deep-dose equivalents (H_d) and the committed dose equivalents (H_T) to any individual organ or tissue other than the lens of the eye.

e. Personnel dose less than Investigation Level I — the RPO may make ALARA recommendations.

f. Personnel dose greater than Investigation Level I but less than Investigation Level II – the RPO will conduct an investigation of the dose and provide a report to the Radiation Control Committee (RCC) each quarter.

g. Personnel dose greater than Investigation Level II – RPO will investigate in a timely manner, take appropriate action to keep exposures ALARA, and provide a report to the Radiation Control Committee (RCC) each quarter.

3. APPLICATION FOR PERSONNEL DOSIMETRY SERVICE.

a. Supervisors of individuals who are potentially exposed to internal or external ionizing radiation hazards must require those individuals to submit a Dosimeter Application and Record of Occupational Radiation Exposure (DD Form 1952) to the WRAMC HPO prior to assignment.

b. The procedures and responsibilities for processing the application follow:

(1) Individual Application for Personnel Dosimetry Service: The applicant has the responsibility to furnish:

(a) Individual identification data;

(b) Previous occupational radiation exposure history.

(2) The supervisor has the responsibility to furnish:

(a) A statement of the type of exposures in the worker's environment (e.g., X-ray, neutron, radioactive isotopes);

(b) Complete WRAMC Form 538 indicating that the applicant has been instructed concerning the safe handling and usage of the radioactive materials listed in the authorization permit.

(c) The responsibilities and rights of an occupational radiation worker.

4. USE OF PERSONNEL MONITORING DEVICES.

a. Immediate supervisors must ensure that the dosimeter issued to one occupational worker is not used by another individual.

b. WRAMC issued dosimeters shall not be worn by any personnel when occupationally exposed at other facilities away from their designated Government job site. However, if an individual wears a different dosimeter while working at other facility, the individual will inform the Supervisor or Principal User and the HPO of the off-duty (moonlighting) dose records no later than 2 months after such records are received by the individual or 4 months following termination of such moonlighting employment, whichever is earlier.

c. Whole body dosimetry will be worn:

(1) Below the shoulders.

(2) Above the hips.

(3) Outside the clothing.

(4) On the portion or area of the body nearest the radiation source.

(5) With the dosimeter window facing out (away) from the body, and towards the radiation source.

(6) For individuals wearing a protective garment such as a lead apron while practicing radiology, the whole-body dosimeter shall be worn inside of any protective garment.

(7) Personnel, such as those working with fluoroscopic or cardiac catheterization X-ray equipment, exposed to X-rays scattered from the patient will wear a collar dosimeter (above the protective garment) and a whole body dosimeter (under the protective garment).

d. When not being worn, the personnel monitoring devices will be stored in the designated location approved by the RPO.

e. The department dosimetry coordinator will ensure that the dosimeters are turned in to the activity dosimetry coordinator during the designated exchange periods.

5. TERMINATION OF PERSONNEL DOSIMETRY SERVICE. The Principal User will notify the HPO of the departure of any department personnel who are enrolled in the personnel dosimetry program.

6. BIOASSAY.

a. Individuals who are required to participate in the Bioassay Program due to use of radioactive iodine, tritium, or phosphorus will continue to participate in the Bioassay Program until released in writing by the Health Physics Officer.

b. The Principal User will ensure that personnel required to participate in the Bioassay Program:

(1) Appear for measurement at the designated time and place.

(2) Provide appropriate samples for in-vitro counting.

(3) Inform the Health Physics Officer of changes in working conditions or other factors that would influence the type, or frequency of bioassay measurement.

7. PREGNANCY SURVEILLANCE PROGRAM.

a. Declared pregnant radiation workers have lower permissible dose limits to the embryo or fetus during the course of the pregnancy. A female does not fall under the lower limits for pregnant radiation workers until she formally declares her pregnancy, in writing, to the RPO. A formal declaration of pregnancy is the prerogative of each female radiation worker.

b. The RPO must provide instructions regarding the prenatal exposure risks and concerns to the developing embryo or fetus. A copy of NRC Regulatory Guide 8.13 will be given to the declared pregnant radiation worker.

c. The written declaration shall be made on an SF 600 (Health Record — Chronological Record of Medical Care) and placed in the woman's health record.

d. Nursing mothers who are potentially exposed to the intake of radionuclides require special consideration to limit the dose to the child.

Approved:

William B. Johnson

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Chief, Health Physics Office

HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

CONDITION NO. 2
RADIOACTIVE MATERIAL AUTHORIZATIONS
AREA SURVEY PROCEDURES

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

d. NRC Regulatory Guide 8.23, Revision 1, Radiation Safety Surveys at Medical Institutions.

2. SURVEY REQUIREMENTS.

a. Surveys by the radioisotope user will be conducted if the activity of the unsealed radioactive material exceeds the activity listed in Table 2-1.

Table 2-1

10% of 10 CFR 20 Appendix C limits for Radionuclides Commonly Used at WRAMC	
The user must conduct contamination surveys if the following activities per protocol or procedure are exceeded.[1]	ACTIVITY μ(~~n~~Ci)
^{3}H ^{14}C ^{42}K ^{51}Cr ^{67}Ga ^{99m}Tc ^{201}Tl	100
^{33}P ^{35}S ^{45}Ca ^{54}Mn ^{57}Co ^{85}Sr ^{86}Rb ^{99}Mo ^{95m}Nb ^{103}Ru ^{111}In ^{123}I ^{125}Sb ^{141}Ce	10
^{22}Na ^{32}P ^{36}Cl ^{46}Sc ^{59}Fe ^{89}Sr	1
^{109}Cd ^{125}I ^{131}I	0.1

[1] For any radionuclide not listed, contact the HPO for the appropriate activity limit.

b. Conduct the survey after completion of work, or at the end of the day if more than one protocol is performed during the day.

c. No daily survey is required if the activity of the isotope used is less than the activity shown in the table; however, it is always a good practice to survey work areas for contamination after using unsealed radioactive materials.

d. Weekly surveys by the Health Physics Office will be conducted if it is possible that more than 200 μCi of unsealed radioactive material could be used in the room.

e. Monthly surveys by the Health Physics Office will be conducted if less than 200 μCi and greater than 10 percent of the value in 10 CFR 20, Appendix C of unsealed radioactive material could be used in the room.

f. Quarterly surveys by the Health Physics Office will be conducted if less than 10 percent of the value in 10 CFR 20, Appendix C of unsealed radioactive material could be used in the room.

3. SURVEY INSTRUMENTATION.

a. Gieger-Mueller (G-M) counter. A gas-filled detector that operates with a very high electric field where a single ionization event can trigger an avalanche of ionizations. The G-M detector is very sensitive, but all pulses from the G-M tube are of the same amplitude regardless of the number of the original ion pairs or energy of the incident ionizing radiation. Therefore, the G-M detector functions only as a simple counter of ionization events.

b. For high energy x-ray, beta, or gamma emitter, use a low-range thin-window G-M survey meter to survey all elution, preparation, and injection areas.

c. Liquid Scintillation Counter (LSC). The sample is placed inside a vial containing a suitable liquid scintillation fluid. Using an LSC eliminates problems related to sample self-absorption, attenuation of particles by detector windows, and beta backscattering from the detector. These advantages are particularly important for low-energy radiations such as beta particles emitted from carbon-14 and tritium.

d. Perform a swipe survey to measure contamination levels in those areas using low energy beta emitters such as tritium or carbon-14. The method for analyzing wipe tests will be sufficiently sensitive to detect 100 dpm per 100 cm^2 for the contaminant involved.

e. Ion Chamber. An air filled ion chamber is primarily used to measure gamma-ray exposure. Because exposure is defined as ionization charge created in air, measurement of the ionization current with an ion chamber will correspond to the exposure rate.

The exposure unit roentgen (R) is also closely related to the absorbed dose unit rad in air (1 R = 0.877 rad).

f. Use a survey instrument capable of measuring exposure rates as low as 0.1 mR/hr for areas where radiopharmaceuticals are prepared for use or administration.

g. Keep a record of all survey results, including negative results for a period of three years. The survey results record will include:

(1) Location, date, and type of equipment used.

(2) Name of person conducting the survey (signature or initials).

(3) Type, serial number, and calibration date of the portable survey instruments.

(4) A drawing of the areas surveyed with contamination levels and dose rate action levels.

(5) Measured dose rates in mR/hr or contamination levels in dpm/100 cm^2, as appropriate.

4. ACTION LEVELS FOR RESTRICTED AREAS.

a. The radioisotope user will clean or decontaminate the area for Action Level I where:

(1) Contamination exceeds 1000 dpm/100 cm^2;

(2) The radiation level is two times the background, or 1 mrem/hr at 30 cm (1 foot) for X-ray or gamma radiation.

b. The radioisotope user will clean or decontaminate the area for Action Level II and contact the Health Physics Office immediately if:

(1) Contamination exceeds 2000 dpm/100 cm^2;

(2) The radiation levels from X-ray or gamma radiation in an unrestricted area exceeds 2 mrem/hr at 30 cm (1 foot).

5. ACTION LEVELS FOR UNRESTRICTED AREAS. All unrestricted areas will be maintained at a removable contamination level of less than 200 dpm/100 cm^2.

6. SECURITY OF RADIOACTIVE MATERIALS.

a. The Principal User is responsible to ensure that:

(1) Radioactive materials used within their authorization are properly secured.

(2) Radiation hazards are properly posted.

(3) The radioactive material is stored in a locked room, locked refrigerator, or locked container.

(4) If the room is unlocked, and the radioactive material is not secured in a locked container, then someone must be in the room at all times.

b. If any radioactive material is believed to be missing, call the Health Physics Office **IMMEDIATELY *(within the same day that the radioactive material is noticed missing)***. The Health Physics Office can then assist your laboratory in locating the radioactive material. In addition, if the quantity of material missing exceeds certain limits, the Health Physics Office may be required to notify the Nuclear Regulatory Commission within 24 hours upon discovery of the event.

Approved:

William B. Johnson

WILLIAM B. JOHNSON
COL, MS
Chief, Health Physics Office

HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

CONDITION NO. 3
RADIOACTIVE MATERIAL AUTHORIZATIONS
GENERAL RULES FOR THE SAFE USE

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

e. DA Form 3862, 1 June 1972, Controlled Substances Stock Record.

2. RESPONSIBILITIES.

a. Principal Users of radioactive material at WRAMC are responsible for incorporating all applicable precautions listed in this Condition into their procedures and assuring their implementation by personnel listed on their Radioactive Material Authorization.

b. Principal Users of radioactive material at WRAMC are responsible for maintaining a current inventory of all radioactive material on DA Form 3862 or on a computer format that records the equivalent information.

3. LABORATORY PRECAUTIONS. The following are general rules for the safe use of radioactive materials:

a. Always wear laboratory coats or other protective clothing while actively involved in the use of unsealed radioactive material. To preclude the possible spread of contamination, only wear laboratory coats or other protective clothing in the designated work areas.

b. Always wear disposable gloves while handling radioactive materials, except:

(1) When quantities less than those specified by WRAMC general license for the use of byproduct material for certain in-vitro clinical or laboratory testing (less than 10 µCi of ^{125}I, ^{131}I, ^{14}C, and ^{75}Se; less than 20 µCi of ^{59}Fe; and 50 µCi of ^{3}H).

(2) When handling totally encapsulated sealed sources of beta or gamma emitting radionuclides that are exempt from leak testing requirements (see WRAMC Reg 40-10).

(3) During injection of a radiopharmaceutical when the loss of tactile sensation would hinder venipuncture technique potentially resulting in infiltrations, thereby requiring repeat studies and increasing patient exposure.

c. Monitor hands and clothing for contamination after each procedure or before leaving the controlled area.

d. Do not eat, drink, smoke, or apply cosmetics in any area where radioactive material is used or stored.

e. Do not store food, drink, or personal effects in areas where radioactive materiel is used or stored.

f. Always wear assigned personnel dosimetry while in radioactive materials use or storage areas. Whole body dosimeters should be worn at chest or waist level. Finger or extremity dosimeters should be worn close to and facing sources handled. When not being worn, store dosimeters in the approved low-background storage location.

g. Dispose of radioactive waste only in specifically designated, labeled, and if necessary shielded receptacles.

h. Never pipette by mouth.

i. Confine radioactive solutions in containers plainly identified and labeled with name of compound, radionuclide, date activity, and radiation level, if applicable.

j. Always store and transport radioactive materials in appropriate shielded containers.

k. When transporting radioactive materials and waste, use items such as carts or wheelchairs to avoid contact with the surface of the container.

4. NUCLEAR MEDICINE PRECAUTIONS. The following are additional general rules specifically applicable to preparation and use of radioactive materials for human use.

a. Use syringe shields for preparation of patient doses and administration to patients except in circumstances such as pediatric cases when their use would compromise the patient's well-being. Consider other protective methods such as remote handling if syringe shields cannot be used.

b. Assay each patient dose in the dose calibrator before administration. Do not use any doses that differ from the prescribed dose by more than 10%. Check the patient's name, identification, the prescribed radionuclide, chemical form, and dosage before administering to the patient.

c. Wear a finger dosimeter during elution of generator, preparation, assay, and injection of radiopharmaceuticals.

d. Survey Generator, kit preparation, and injection areas for contamination after each procedure or at the end of the day. Decontaminate if necessary.

5. VENTILATION IN RESTRICTED AREAS.

a. Conducting procedures resulting in the generation of radioactive aerosols, dusts, or gaseous products in a hood, dry box or other suitable closed system.

b. Store radioactive gases or material with gaseous radioactive daughters in gas tight containers in areas having approved ventilation.

c. Use an average velocity through openings of 100 fpm when handling low to moderate levels of radioactive materials. For highly toxic or high-level radioactive material, raise the velocity through the openings to an average of 125 - 150 fpm.

d. Multiuse containers of ^{133}Xe will be stored in the fume hood.

Approved:

William B. Johnson

WILLIAM B. JOHNSON
COL, MS
Chief, Health Physics Office

HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

CONDITION NO. 4
RADIOACTIVE MATERIAL AUTHORIZATIONS
RADIOACTIVE WASTE

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

e. Title 49, Code of Federal Regulations, Transportation.

2. GENERAL. Radioactive waste from Walter Reed Army Medical Center and tenant activities will be controlled, packaged, transported, and disposed of in accordance with AR 385-11, Ionizing Radiation Protection; Title 10, Code of Federal Regulations; Title 49, Code of Federal Regulations; Nuclear Regulatory commission Licenses issued to WRAMC; applicable provisions of State Government requirements for waste disposal sites located within their jurisdiction; and the guidelines delineated herein.

3. RADIOACTIVE WASTE CONTROL IN THE LABORATORY OR CLINIC.

a. Principal Users are responsible for assuring that radioactive waste is controlled in a manner that meets the safety and security measures prescribed by U.S. Army, Federal, and applicable State Regulations.

b. All Users of radioactive materials are responsible for segregating their radioactive waste into the categories listed below:

(1) Solid. Short half-life, 65 days or less plus the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

(2) Solid. Long half-life, greater than 65 days except for the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

(3) Lead. Shielding materials and pigs.

(4) Scintillation Vials. Biodegradable (Bio-safe, etc.) scintillation fluid.

(5) Scintillation Vials. Organic non-biodegradable scintillation fluid.

(6) Aqueous Liquids. Readily soluble (or readily dispersible biological material) in water and neutralized to pH > 2 and pH < 12.

(7) Organic Liquids. With MSDS and approved Waste Profile Sheet for each chemical.

(8) Animal Carcasses/Excreta/Bedding. Short half-life.

(9) Animal Carcasses/Animal Waste. Long half-life.

(10) Animal Carcasses. $\leq$ 0.05 µCi H-3 or C-14 per gram of animal tissue averaged over the entire weight of the animal.

(11) Gas. Contact the Health Physics Office.

(12) Sharps. See paragraph 5.e.

(13) Stock Source Vials. See paragraph 9.

c. Limiting the non-radioactive waste that is intermixed with radioactive waste to an absolute minimum.

d. Removing or obliterating all "Radioactive Material" labels on non-radioactive vendor shipping packages and on short half-life radioactive waste. Uncontaminated vendor shipping containers may be disposed of in the normal trash by the users. Short half-life waste will be delivered to Health Physics Office (HPO) collection points for subsequent storage, decay, and ultimate disposal in the normal trash when HPO personnel have determined that the waste has reached natural background radiation levels.

e. Storing used Mo-99/Tc-99m generators and other items of equipment containing radioactive material in designated areas only. The radiation labels will be removed on such items only when they reached levels indistinguishable from background and have been cleared by the HPO.

f. Maintaining their inventory of radioactive waste to a practical minimum.

g. Controlling radioactive waste in their work areas to prevent unauthorized disposal by the custodial service. Properly labeled waste containers will be used for radioactive waste. Labeled radioactive waste containers will not be used for other purposes.

h. Ensuring that all radioactive waste is delivered to HPO collection point personnel for ultimate disposal.

i. Marking all radioactive waste containers with the radiation caution symbol and the words "Caution - Radioactive Waste" and/or "Caution - Radioactive Material" and "DO NOT EMPTY!".

j. Ensuring that radioactive material is not released into the sanitary sewage system without the specific approval of the Health Physics Officer.

k. Ensuring that decontamination of reusable equipment is only performed in laboratory sinks that have been authorized via their Radioactive Material Authorization. See paragraph 6. for specific requirements concerning this procedure.

l. Radioactive waste that is infectious waste must be properly disinfected before it is given to the HPO for disposal. INFECTIOUS WASTE WILL NOT BE GIVEN TO HPO.

4. DISPOSAL OF RADIOACTIVE MATERIALS. All Users of radioactive materials will package their materials for disposal as follows:

a. Segregate radioactive waste into the proper category as defined in paragraph 3.b.

b. Solid radioactive waste shall be placed in plastic bags or a receptacle lined with plastic bags. Only clear bags at least 4 mils thick will be used. Clear bags will allow visual inspection of the waste by HPO personnel at the time of turn-in. Bags will be taped closed and tagged with a radiation tag containing the authorization number, radioisotope(s), and activity.

c. Bulk liquid waste retained for disposal shall be collected in plastic bottles or sealed in cans to diminish breakage. Liquid waste that will chemically react with plastic should be placed in glass bottles. The containers will be tagged as stated above.

d. Scintillation vials shall be packaged separately from other materials. They will be tightly closed and placed in a shipping tray that is labeled with the words "Caution - Radioactive Material." Care must be taken to prevent breakage of the vials while in storage or transport. The trays will be tagged as previously indicated.

e. All "Sharps" to include syringes with needles, needles and similar items must be separated from other radioactive waste, packaged in cardboard boxes or sharps containers and sealed to prevent personal injury. The sharps containers and boxes will be tagged as previously indicated. All sharps containers with long half-life waste may contain only minimal, residual liquid.

f. Short half-life materials and items contaminated with short-half-life materials shall be separated from other materials. Radioactive warning labels must be obliterated on all vials and materials prior to placing the items in the plastic bags. The bags will be tagged identifying isotope(s), activity, and authorization number. Do not use "radiation tape" to seal these bags.

g. Biological wastes (animal carcasses or animal waste) shall be prepared by the User in a manner that allows the waste to be readily packed in alternating 10-inch layers of waste and packing materials. Prepared biological waste shall be placed in 4 mil clear bags and tagged as previously indicated.

5. RELEASE OF RADIOACTIVITY INTO THE SANITARY SEWAGE SYSTEM.

a. Liquid radioactive waste will not be released into the sanitary sewage system unless prior approval has been included in the WRAMC Radioactive Material Authorization.

b. Other conditions for the disposal of liquid radioactive waste material (as a byproduct of washing laboratory glassware or equipment) into the sewage system are:

(1) The total quantity of material released by the user in any one month will not exceed 100 microcuries. Assume emptied glassware retains one percent of the radioactivity originally contained within the glassware.

(2) The sink must be conspicuously posted with a sign bearing the Radioactive Caution Symbol and words, "Caution Radioactive Material Wash Sink," and with a notice to the user that radioactive material discharged through the sink must be readily soluble or dispersible in water.

(3) A record of the identity and activity of radionuclides released will be maintained by the Principal User. This record will be reviewed by HPO for compliance with regulatory limits.

6. COLLECTION, LOCAL TRANSPORTATION, AND STORAGE OF RADIOACTIVE WASTE.

a. Properly packaged radioactive waste will be brought to centralized collection points in Building 40, Building 2, or other designated locations. Under the supervision of the HPO, waste will be placed in barrels or other designated containers. Waste that has not been properly separated and tagged will not be accepted.

b. Principal users will ensure that packaged radioactive waste brought to the collection points is supervised until accepted by HPO to preclude the possibility of loss or theft.

c. All radioactive waste (except mixed waste that contains a percentage of EPA regulated material) will be transported from the above noted collection points to the Radioactive Material Storage Areas located in Building 516, Forest Glen Section, WRAMC, for ultimate disposal.

d. Building 516 may be used to store all categories of radioactive waste.

e. Storage areas are considered "Restricted Areas" and will remain locked to preclude the possibility of loss or theft and protect individuals from exposure to radiation or radioactive materials.

f. Radioactive Material Storage Areas will be posted by Health Physics personnel with the appropriate warning signs prescribed by Title 10 CFR 20.1902.

g. Waste will be packaged for ultimate shipment and disposal in accordance with the instructions furnished by the waste disposal contractor.

h. The waste disposal contractor is determined by the DOD Executive Agency for Low-Level Radioactive Waste, ATTN: AMSIO-DMW, Rock Island, IL 61299 in accordance with AR 385-11.

7. RADIOACTIVE WASTE DISPOSAL SUPPLIES.

a. Items of supply used for radioactive waste packaging are stocked by the Supply and Administration Branch, Material Division, Directorate of Logistics, WRAMC. All items will meet

Federal radioactive material packaging requirements for most types of the radioactive waste resulting from laboratory or clinical procedures at WRAMC.

b. Personnel involved with packaging of hazardous chemical radioactive waste will consult the HPO in order to ensure that the stockage items meet packaging requirements.

c. Principal users are responsible for funding for materials and supplies used to dispose of radioactive waste. The HPO will order supplies needed to collect and package the waste received at collection points and will designate Clinical Investigation, Department of Pathology and Laboratory Services, Department of Radiology, AFIP, or WRAIR as appropriate. All supply orders submitted by HPO will be prorated to the using services.

8. DISPOSAL OF STOCK SOURCE VIALS.

a. All original stock source vials, whether depleted, decayed, or partially used will be turned over to the Health Physics personnel along with the radiation waste.

b. A stock source vial is defined as having an initial activity of at least 50 µCi of any radionuclide.

c. Original stock source vials, whether depleted or not, which are turned in as waste shall be kept separate from other waste.

d. When source vials are turned in to Health Physics, please provide the source HPO identification number (Yellow Tag Number).

e. If there are multiple vials listed under the same identification number, list the vials still in your possession.

f. The inventory log will be adjusted to show the change in the authorization inventory. Health Physics personnel will sign the inventory log if provided at the time of turn-in. In addition, Health Physics personnel will provide a signed receipt for possession of the source vial(s).

Approved:

William B. Johnson

WILLIAM B. JOHNSON
COL, MS
Chief, Health Physics Office

HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

CONDITION NO. 5
RADIOACTIVE MATERIAL AUTHORIZATIONS
PROCEDURES FOR ORDERING, RECEIVING AND SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

e. Title 49, Code of Federal Regulations, Transportation.

f. NRC Regulatory Guide 10.8, Revision 2, Guide for the Preparation of Applications for Medical Use Programs.

2. GENERAL. Radioactive material for Walter Reed Army Medical Center (WRAMC) and tenant activities will be ordered, received and secured in accordance with US Army Regulations, Title 10, Code of Federal Regulations, and the provisions of WRAMC's Nuclear Regulatory Commission License.

3. PRINCIPAL USER'S RESPONSIBILITIES.

a. WRAMC Principal Users are responsible for ordering and receiving radioactive material in accordance with the instructions outlined below.

b. A Principal User may procure only those radioisotopes currently authorized for his use by the WRAMC Radiation Control Committee, subject to the limitations of their authorization.

c. Unless specified prior arrangements have been made with the Health Physics Office, the maximum quantity that may be ordered at any time is limited by the maximum activity of that radioisotope permitted by the authorization.

d. Specific prior approval of a Health Physics Officer shall be required before receiving or transferring radioactive material. This procedure applies in those instances where normal supply channels are not utilized. All radioactive material will be delivered to the Health Physics Office unless alternate arrangements are specifically approved by the Health Physics Office.

4. ORDERING PROCEDURES.

a. The Principal User shall submit a completed Purchase Request through normal supply channels for the procurement of all radioactive materials.

b. In addition to the information required by WRAMC Procurement Regulations, each purchase request shall contain the following:

(1) Radionuclide, chemical form, and total activity [Activity is given as microcurie (µCi), millicurie (mCi), or curie (Ci)]; for natural radioactive materials microgram (µg), milligram (mg), gram (g), kilogram (kg), or milligram radium equivalent (mg Ra eq) may be used where appropriate.

(2) The following notice will be typed after the item description:

RADIOACTIVE MATERIAL
NOTIFY THE HEALTH PHYSICS OFFICE
PRIOR TO PLACING AN ORDER
TELEPHONE NUMBER (202) 356-0058

(3) The WRAMC Radioactive Material Authorization Number will be indicated in the "Attention Line" of the "Ship To" address.

(4) Date required or delivery date.

(5) The proper shipping address for any radioactive material not specifically exempted by the HPO is:

Health Physics Office
Walter Reed Army Medical Center
6825 16th Street NW
Building 41, Room [ ]
ATTN: Authorization No. _____
Washington, DC 20307-5001

Ex 2

(6) Two specific approved exemptions are:

(a) The Forensic Toxicology Drug Testing Laboratory, Ft. Meade, MD is authorized to order I-125 drug testing kits to be shipped to the following address:

Radiation Protection Officer
Forensic Toxicology Drug Testing Laboratory
Building 2490
Fort Meade, Maryland 20755

(b) The WRAMC Nuclear Medicine Clinic is authorized by MOU dated 26 Jan 96 to order radiopharmaceuticals used for patient treatment. All chemical and physical forms of I-125 and sealed sources will be sent to the Health Physics Office address listed in paragraph 4.b.(5). Shipments to the Nuclear Pharmacy will be addressed to:

Walter Reed Army Medical Center
Nuclear Pharmacy
Building 2, Room
Washington, DC 20307-5001

5. RECEIVING PROCEDURES.

a. All incoming shipments of radioactive material will be sent to the Health Physics Office during duty hours and will be received in building 41, room . Shipments after duty hours or on weekends will be delivered to WRAIR, building 40, room Shipments to Fort Meade or the WRAMC Nuclear Medicine Clinic will be delivered to the addresses shown in paragraph 4.b.(6)(a) or 4.b.(6)(b). The Health Physics Office must be notified immediately of any shipment delivered to an unapproved address.

b. All shipments will be processed using the model procedure in Appendix L to Regulatory Guide 10.8, Revision 2 for safely receiving and opening packages containing radioactive material. All incoming packages of radioactive material will be examined for damage immediately upon receipt. Any packages that appear to be wet, punctured, crushed, or otherwise damaged will be considered to be contaminated until it can be determined that they are not.

c. Incoming radioactive material shipments must be immediately secured against unauthorized removal or tampering.

Ex 2

d. The measured exposure rate adjacent to the secured storage area may not exceed 0.5 mR/hr.

6. SHIPMENT MONITORING & DELIVERY TO AUTHORIZED RECIPIENTS.

a. All shipments of radioactive material must be inspected to insure that the shipment does not exceed the possession limits of the Authorization under which it is ordered. Unauthorized shipments will be returned to the vendor when possible, disposed of as radioactive waste, or held by the Health Physics Office until the Principal User obtains an amended Radioactive Material Authorization allowing receipt of the material. Unauthorized shipments will not be held by Health Physics for more than ninety (90) days.

b. Shipments will be delivered to Principal User by the Health Physics Office after package receipt procedures have been completed.

7. FINAL SOURCE CONTAINER CHECK. The Principal User is responsible for making a final check of the radioactive materials source container once it is received. This check will follow the steps outlined below:

a. Put on gloves.

b. Visually inspect the package for any sign of damage. If any damage is noted, stop the procedure and call the Health Physics Office.

c. Open the outer package, following the manufacturer's directions, if supplied, and remove the packing slip.

d. Open the inner package and verify that the contents agree with the contents listed on the packing slip.

e. Check integrity of the final source container. Look for broken seals or vials, loss of liquid, condensation, or discoloration of packaging material. If anything is other than expected, stop and notify the Health Physics Office.

f. Before disposing of clean outer packaging, ensure that any "radioactive" labels or statements have been defaced or removed.

g. Verify that the items received are the correct items ordered and that a receiving report is completed for Logistics.

Approved:

William B. Johnson

WILLIAM B. JOHNSON
COL, MS
Chief, Health Physics Office

HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

CONDITION NO. 6
RADIOACTIVE MATERIAL AUTHORIZATIONS
EMERGENCY PROCEDURES

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

e. NRC Regulatory Guide 10.8, Revision 2, Guide for the Preparation of Applications for Medical Use Programs.

2. DETERMINATION OF MAJOR VERSUS MINOR SPILLS.

a. A spill is considered major if there is an accidental or uncontrolled release of 1 mCi or more of any radionuclide.

b. The exception to this rule is Tc-99m and Tl-201 used in the Nuclear Medicine pharmacy where a spill is considered major if 100 mCi or more is released.

c. The decision to implement a major spill procedure instead of a minor spill procedure depends on many incident specific variables. Some variables to consider include;

(1) Number of individuals affected.

(2) Other hazards present.

(3) Likelihood of spread of contamination.

(4) Types of surfaces contaminated.

(5) Radiotoxicity of the spilled material.

d. For some short-lived radionuclides, the best spill procedure may be restricting access to the area pending complete decay of the radionuclide.

3. MAJOR SPILLS OF LIQUIDS AND SOLIDS.

a. Clear the Area. Notify all persons not involved in the spill to vacate the room.

b. Prevent the spread of contamination by covering the spill with absorbent pads, but do not attempt to clean it up. Confine the movement of all personnel potentially contaminated to prevent the spread of contamination.

c. Shield the source if possible. This should be done without further contamination or a significant increase in radiation exposure.

d. Notify the Health Physics Officer immediately.

e. Conduct limited decontamination by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with mild soap. Do not use brushes or any other abrasive substances. Limit the spread of contamination by consolidating and keeping contaminated personnel in one location. Wait for Health Physics personnel to arrive and evaluate personnel before attempting further decontamination. Retain contaminated clothing and materials used in decontamination for further analysis by the Health Physics Office.

f. Initiate a radioactive spill report. A sample radioactive spill report is included at the end of this Condition.

4. MINOR SPILLS OF LIQUIDS AND SOLIDS.

a. Notify persons in the area that a spill has occurred.

b. Prevent the spread of contamination by covering the spill with absorbent paper.

c. Clean up the spill wearing disposable gloves, using remote handling tongs and absorbent paper. Carefully fold the absorbent paper with clean side out and insert it into a plastic bag. Transfer the plastic bag to a radioactive waste container. Place other contaminated materials, such as disposable gloves, and any other contaminated disposable material into the plastic bag.

d. Survey the area with a low-range radiation detector survey meter. Check the area around the spill, hands, shoes, and clothing for contamination.

e. Report the incident to the Health Physics Officer.

f. Initiate a radioactive spill report. A sample radioactive spill report is included at the end of this Condition.

5. EMERGENCY NOTIFICATION. In the event of an emergency notify the Health Physics Officer at (202) 356-0058.

Approved:

William B. Johnson

WILLIAM B. JOHNSON
COL, MS
Chief, Health Physics Office

Radioactive Spill Report _____

The spill occurred at ____:____ *am* *pm* on ____/____/____ Room _____

Instrument used to check for decontamination:_____

Meter Model:_____ SN:_____ Probe Model:_____ SN:_____

Personnel Present Personnel Contamination Results

_____

_____

_____

On the back of this sheet, list personnel, any decontamination, additional monitoring, or care instituted.

Survey the spill area to identify hot spots and begin decontamination. Conduct a post-decontamination wipe test.

Radioisotopes present or suspected in the spill:

_____ mCi of _____ as _____

_____ mCi of _____ as _____

_____ mCi of _____ as _____

Give a brief description of the accident:

Give a brief description of the follow-up actions taken to prevent reoccurrence:

WRAMC Health Physics Office Name:_____
(202) 356-0058 Date:_____

HEALTH PHYSICS
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, DC 20307-5001

CONDITION NO. 7
RADIOACTIVE MATERIAL AUTHORIZATIONS
USE OF RADIOACTIVE IODINE, TRITIUM, AND PHOSPHORUS-32

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

e. Title 10, Code of Federal Regulations, Part 35, Medical Use of Byproduct Material.

f. NRC Regulatory Guide 10.8, Revision 2, Guide for the Preparation of Applications for Medical Use Programs.

g. ICRP Publication 26, Recommendations of the International Commission on Radiological Protection.

h. ICRP Publication 30, Limits for Intakes of Radionuclides by Workers.

2. GENERAL. This condition delineates responsibilities and requirements for utilizing radioactive iodine, tritium or phosphorus-32 in amounts of 1.0 millicurie or greater. Principal Users of radioactive material at WRAMC and tenant activities are responsible for incorporating all applicable precautions listed in this condition into their procedures and assuring that all applicable precautions are followed by the personnel listed on their Radioactive Material Authorizations.

3. RADIOACTIVE IODINE RADIATION SAFETY PRECAUTIONS.

a. The general rules for the safe use of radioactive material specified in Condition 3 for Radioactive Material Authorizations will be followed.

b. All laboratory facilities authorized to use radioactive iodine will be equipped with a suitable survey meter. Survey meters will be calibrated by the Health Physics Office. The individual user is responsible for conducting a thorough survey of the work area and immediate vicinity upon completion of all procedures involving more than 0.1 microcurie of radioactive iodine.

c. Perform all procedures involving the use of 1.0 millicurie or more of radioactive iodine in a Health Physics Office approved iodinization box within a ventilation hood. Procurement of the Iodination Box is the responsibility of the individual department and users. Charcoal filters for the iodination boxes will be exchanged by the Health Physics Office on a periodic basis.

d. Perform procedures involving less than 1.0 millicurie of radioactive iodine in ventilation hoods approved by the Health Physics Office. Iodination boxes are not required for these procedures.

e. In the case of therapeutic usage, vent the radioactive iodine vial inside an approved iodination box prior to transport to the patient care area.

f. Coordinate Nuclear Medicine procedures involving the administration of 33 millicuries or more of radioactive iodine-131 with the Health Physics Office as soon as possible in advance of a scheduled treatment.

g. Air monitoring requirements.

(1) In order to assure personnel safety, the following air samples will be collected and evaluated.

(a) Breathing Zone: Collect a sample of the air from the vicinity of the user's mouth and nose throughout each procedure involving volatile radioactive iodine. The user collects this sample using the equipment and instructions provided by the Health Physics Office. Secure breathing zone samples in a container to prevent contamination and turn in to the Health Physics Office for analysis.

(b) Room Air: Continuously collect an air sample that is representative of the air within the room where iodination procedures for a period of one week. Installation, removal and analysis of the filter are the responsibility of the Health Physics Office. Users will assure the sample collection system

is operational and report duration of all accidental sampling interruption to the Health Physics Office.

(c) Environmental Effluent Air: Collect a sample of air that is representative of the air being discarded to the environment by the fume hood used for iodination procedures continuously for a period of one week. Installation, removal and analysis of these filters are the responsibility of the Health Physics Office. Users will assure the sample collection system is in continuous operation, and report the duration of all accidental sampling interruptions to the Health Physics Office.

h. Use the below listed equipment (or its equivalent) for collecting air samples:

(1) Vacuum System: A vacuum pump or an in-house vacuum line capable of maintaining a flow rate of 10 liters per minute (lpm) is acceptable. In all cases where an in-house vacuum line is utilized, an additional charcoal impregnated filter will be installed between the vacuum source and the filter used for the same collection.

(2) Collection Filters: The Health Physics Office will supply the two-inch charcoal filters for the collection of the air samples.

i. Bioassay requirements.

(1) The Health Physics Office conducts the bioassay program. Objectives of the program are to:

(a) Indicate whether entry of radionuclides into the body (above background levels) has occurred.

(b) Determine the activity of the intake, dose equivalent to thyroid and committed effective dose equivalent resulting from ingestion or inhalation of radionuclides.

(c) Determine how, when, and why the ingestion or inhalation of the radionuclide occurred to prevent the problem and possible reoccurrence.

(d) Identify any systemic problems with procedures, engineering controls, or protective equipment.

(2) An investigation will be performed when bioassay results indicate the 72-hour thyroid scan exceeds the derived investigation level (DIL) for I-131 where the ALI is 2.0E6 Bq:

Table 7-1

Time Post Intake	IRF Total Body	IRF 24-hour urine	IRF Thyroid	DIL Total Body (Bq)	DIL 24-hour urine (Bq)	DIL Thyroid (Bq)
1 day	0.274	0.304	0.133	450	500	219
5 day	0.125	0.00131	0.120	1,027	10.8	986

(3) The Health Physics Office will determine which personnel require bioassay monitoring and the frequency of monitoring based on the minimum detectable activity (MDA) of the counting system and the time post intake that would exceed 5% of the ALI.

(4) The Principal User will monitor the amounts of iodine used by personnel working under their authorizations and assure their participation in the bioassay program as required.

(5) Monitoring for acute internal deposition of radionuclides will normally be performed under the following circumstances:

(a) When laboratory surveys indicate frequent or gross contamination.

(b) When air sampling indicates levels of airborne contamination exceeding 10% of maximum permissible concentration.

(c) When internal deposition of radioactive material is known or suspected.

(d) When the total amount of I-125 or I-131 handled in any three-month period exceeds the value listed below, all individuals handling this material will participate in a thyroid uptake bioassay program.

Table 7-2

Type of Operation	Volatile or Dispersible	Nonvolatile Agent
Processes in open room or bench with possible escape of iodine from process vessels	0.1 mCi	1 mCi
Processes with possible escape of iodine carried out within a fume hood of adequate design face velocity, and performance reliability	1 mCi	10 mCi
Processes carried out within glove boxes, ordinarily closed, but with possible release exposure to contaminated box and box leakage	10 mCi	100 mCi

(e) In compliance with 10 CFR 35, bioassays of each individual that helped prepare or administer at least 33 millicuries of I-131 in either capsules or liquid will be performed within three days after administering the I-131.

(f) All personnel in the Nuclear Medicine Service that works with or around I-125 or I-131 will have routine quarterly bioassay's performed.

4. TRITIUM SAFETY PRECAUTIONS.

a. The general rules for the safe use of radioactive material specified in Condition No. 3 for Radioactive Material Authorizations will be followed.

b. All procedures involving the use of 10.0 millicuries or more of tritium in one month (1.0 millicurie for processes utilizing nucleoside precursors) should be performed in ventilation hoods approved by the Health Physics Office.

c. Bioassay requirements.

(1) The Health Physics Office will conduct the bioassay program. Objectives of the program are to:

(a) Indicate when entry of radionuclides into the body has occurred.

(b) Determine the activity resulting from the ingestion or inhalation of radionuclides.

(c) Determine how, when, and why the ingestion or inhalation of the radionuclide occurred to prevent the problem and possible reoccurrence.

(d) Identify any systemic problems with procedures, engineering controls, or protective equipment.

(2) An investigation will be performed when bioassay results indicate the 24-hour urine sample exceeds the derived investigation level (DIL) where the ALI is 3.0E9 Bq:

Table 7-3

Time Post Intake	IRF Total Body	IRF 24-hour urine	DIL Total Body (Bq)	DIL 24-hour urine (Bq)
1 day	0.932	0.0392	2,296,000	96,660
5 day	0.705	0.0296	8,690,000	364,900

(3) The Health Physics Office will determine which personnel require bioassay monitoring and the frequency of monitoring based on the minimum detectable activity of the counting system (MDA) and the time post intake that would exceed 5% of the ALI.

(4) The Principal User will monitor the amounts of tritium used by personnel working under their authorizations and assure their participation in the bioassay program as required.

(5) Monitoring for acute internal deposition of radionuclides will normally be performed under the following circumstances:

(a) When laboratory survey indicates frequent or gross contamination.

(b) When internal deposition of radioactive material is known or suspected.

(c) When the total amount of tritium processed by an individual at any one time, or the total amount processed in any one month exceeds the values listed below, the using individual will participate in the bioassay program.

Table 7-4

Type of Operation	RTO & Other Tritiated Compounds including nucleotide precursors	HT or T_2 Gas in Sealed Process Vessels	HTO Mixed with more than 10 kg of Inert H_2O or Other Substances
Processes in open room or bench with possible escape of tritium from process vessels	10 mCi	10 Ci	1 mCi/kg
Processes with possible escape of tritium carried out within a fume hood of adequate design face velocity, and performance reliability	100 mCi	100 Ci	10 mCi/kg
Processes carried out within glove boxes, ordinarily closed, but with possible release of tritium from process & occasional exposure to contaminated box and box leakage	1 Ci	1000 Ci	100 mCi/kg

5. PHOSPHORUS-32 RADIATION SAFETY PRECAUTIONS.

a. Phosphorus-32 is the highest energy radionuclide commonly encountered in research laboratories and as such requires special care. If millicurie quantities are used, finger dosimeters should be worn. The production of bremsstrahlung (x-rays) from β-particles increases with the density of the material, therefore low density materials such as Plexiglas are used as shielding material when quantities greater than 10 mCi are being handled.

b. Always use remote handling tools or lead impregnated rubber gloves.

c. Avoid direct contact with containers of Phosphorus-32.

d. Always use safety glasses.

e. The applicable general rules for the safe use of radioactive material specified in Condition No. 3 for Radioactive Material Authorizations will also be followed.

f. Bioassay requirements.

(1) The Health Physics Office will conduct the bioassay program. Objectives of the program are to:

(a) Indicate when entry of radionuclides into the body has occurred.

(b) Determine the activity resulting from the ingestion or inhalation of radionuclides.

(c) Determine how, when, and why the ingestion or inhalation of the radionuclide occurred to prevent the problem and possible reoccurrence.

(d) Identify any systemic problems with procedures, engineering controls, or protective equipment.

(2) An investigation will be performed when bioassay results indicate the following limit for class D inhalation of P-32 has been exceeded where the ALI is 3.0E7 Bq:

Table 7-5

Time Post Intake	IRF Total Body	IRF 24-hour urine	DIL Total Body (Bq)	DIL 24-hour urine (Bq)
1 day	0.523	0.0676	12,896	1,667
5 day	0.319	0.0171	39,329	2,108

(3) The Principal User will determine which personnel require bioassay monitoring based on the amounts and usage of P-32. The Principal User will monitor the amounts of P-32 used by personnel working under their authorizations and assure their participation in the bioassay program as required.

(4) Monitoring for internal deposition of radionuclides will normally be performed under the following circumstances:

(a) When laboratory Survey indicate frequent or gross contamination.

(b) When internal deposition of radioactive material is known or suspected.

(c) When the total amount of Phosphorus-32 processed by an individual at any one time exceeds 25 millicuries the individual will participate in the bioassay program.

Approved:

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CONDITION NO. 8
RADIOACTIVE MATERIAL AUTHORIZATIONS
VENTILATION REQUIREMENTS

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

2. GENERAL. Procedures resulting in the generation of radioactive aerosols, dusts or gaseous products shall be conducted in hood, dry box, iodine box or other suitable closed system. Radioactive gases or material with radioactive gaseous daughters shall be stored in gas tight containers and kept in areas having approved ventilation. For handling low to moderate levels of radioactive material, the average velocity through openings in the hood shall be 100 fpm. For highly toxic or high-level radioactive material, the velocity through the opening will be raised to an average of 125 - 150 fpm. The ventilation system will be designed to permit air flow in such a direction that any radioactive material picked up by air will flow away from the worker. The air flow should always be from a non-contaminated area toward the contaminated area. Laboratory ventilation will confine the toxic contaminant, exhaust it with suitable duct work and fans, and pass the material through a collector, scrubber or filter as needed before releasing it to the environment. The ventilation system will also provide sufficient air to make up for the amount exhausted

3. EQUIPMENT DESIGN.

a. Hood design.

(1) A laboratory hood is a simple enclosure in which work can be carried out without toxic materials escaping. In order to keep the material from escaping the enclosure, sufficient air must be exhausted to create an indraft through the face of the hood. This indraft must be strong enough to overcome the actions that allow materials to escape.

(2) Instrument checks on the velocity of air entering the hood will be performed under various conditions encountered during actual operations. Checking air flow patterns with a small source of smoke will be performed indicate the presence of cross drafts that could pull material from the hood.

(3) In general, a hood should be located well away from any doorway where supply air must enter in order to avoid cross drafts.

(4) During periods when the hood is unattended, it may be practical to use somewhat lower velocities, 75 to 80 fpm. Dual speed fans will permit operation at the higher velocity while the hood is in use at the lower velocity when it is closed.

b. Exhaust System.

(1) The exhaust system is designed to remove the airborne materials that are picked up in the hood. To safely vent the contaminated air, it may need to be filtered, or otherwise treated, before discharge to the environment. Cleaning equipment will be selected with view to the corrosive and toxic materials handled and the varying requirements for removal of radioactive materials.

(2) The duct work inside the building will be under negative pressure. Under these conditions any leakage in the duct system will be into the ducts and the radionuclides will be confined. To accomplish this, the fan must be located at the point where the exhaust leaves the building. Duct work connecting several hoods will have streamlined connections. Branch duct should enter at angles of 30 to 45 degrees in order to permit better passage of air at high velocities. In such multiple installations, care should be taken to see that the exhaust system is balanced so that one hood does not provide the bulk of the air for the system.

(3) Velocities of air in ducts should be great enough to maintain minimum transport velocities for the material being conveyed. Usual range of transport velocities for particulate material is 3500 to 4500 fpm.

(4) In hoods where large quantities of water are handled, it is necessary to provide some means of removing the condensation that collects in the duct. When the system is intended to handle corrosive materials, the duct work should be of material resistant to corrosion.

(5) The discharge should be at least five to ten feet above the laboratory roof, located so the fumes will not be carried back into the laboratory or into the air, intake of adjacent buildings.

(6) Clean air must be supplied to replace the air removed by the exhaust system. If adequate air is not supplied to the room, the capacity of the exhaust system and the air velocity at the face of the hood is reduced. If there are multiple exhaust hoods and no makeup air, the airflow may be reversed through a hood that has a smaller fan or is turned off.

4. PROPER USE OF HOODS.

a. Inspect the hood and insure all components are in proper working conditions. Defective components must be repaired or replaced.

b. Insure the direction of air flow into the hood.

c. When the hood door must be partially closed to achieve the proper flow rate, assure the hood door is positioned at the proper heights.

d. Keep sources of contamination, vapor, and flames at least six inches inside the hood.

e. Avoid leaning into the hood.

f. In the event that the hood requires maintenance or is broken, notify the Health Physics Office at (202) 356-0058.

Approved:

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CONDITION NO. 9
RADIOACTIVE MATERIAL AUTHORIZATIONS
GAS CHROMATOGRAPH REQUIREMENTS

2 October 1997

1. REFERENCES.

a. WRAMC Regulation 40-10, 6 September 1996, Health Physics.

b. AR 40-5, 15 October 1985, Preventive Medicine.

c. AR 385-11, 1 May 1980, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety).

d. Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation.

2. GENERAL. Some gas chromatograph detectors currently used at WRAMC have a radioactive source as a supply of electrons to effect the detection of gasses according to their molecular weights and holdup times.

a. Tritium Foil Type Detectors. Tritium is usually bound to a copper or stainless steel foil as titanium tritide. The binding agent may begin to break down and allow liberation of tritium at temperatures as low as 150° C. The gas chromatograph units should have a built-in thermocouple to shut the unit off at 220° C since the tritium would probably be entirely evolved at this temperature.

b. ^{226}Ra, ^{210}Pb, ^{90}Sr and ^{63}Ni Type Detectors. Temperatures below 500° C are not sufficient to break down the binding of these metallic isotopes to the detector foils. Therefore, moderately high temperatures are not a consideration in their operation. These sources may be partially exposed when dismantling the detector unit and therefore the detector units shall not be dismantled without Health Physics Office approval.

c. Vented Detectors. Some of the detectors are equipped with exit ports for venting potentially contaminated gases. These detectors while in use should be vented into an operating Health Physics approved fume hood.

3. RESPONSIBILITIES.

a. The gas chromatograph detector shall be used only by, or under the supervision of, the Principal User. The Principal User is responsible for:

(1) Control, safe operation and security of the gas chromatograph unit.

(2) Training selected individuals in its safe use and operation in accordance with the procedures outlined herein.

(3) Ensuring that these instructions, WRAMC Regulation 40-10, and other pertinent documents are available at all times and are complied with.

(4) Promptly reporting any accident that could result in an unsafe condition to the WRAMC Health Physics Officer at (202) 356-0058.

b. Individual operators are responsible for:

(1) Operating the unit in a safe manner at all times.

(2) Being familiar with the contents of these instructions, WRAMC Regulation 40-10, and other data as prescribed by the Principal User.

(3) Reporting all accidents or abnormal operating conditions that could result in an unsafe condition or exposure of personnel promptly to the Principal User.

4. EMERGENCY PROCEDURES.

a. In the event of an emergency, the following individuals will be notified after turning the power to the instrument off:

(1) The Principal User.

(2) Health Physics Officer, WRAMC (202) 356-0058.

b. In the event of **FIRE** in the room, the following will be done **immediately:**

(1) Notify the WRAMC Fire Department (Main Section - (202) 782-3317; Forest Glen Section - (301) 295-7543.

(2) Notify the Principal User.

(3) Notify the Health Physics Officer, (202) 356-0058.

(4) The senior individual at the site should clear the area of personnel and attempt to turn off the power to the instrument.

c. Power Failure: In the event of a power failure, no danger exists.

d. Health Physics notification is required prior to any maintenance, change of location, or turn-in of the gas chromatograph. Health Physics coordination must be requested through the Chief, Operations, Health Physics Office.

Approved:

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APPENDIX A
DEFINITIONS AND ABBREVIATIONS

2 October 1997

1. DEFINITIONS.

a. Activity: The rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci ≡ 3.7×10^{10} disintegrations per second), and the becquerel (Bq ≡ 1 disintegration per second).

b. Adult: An individual 18 or more years of age.

c. ALARA: Acronym for "As Low As is Reasonably Achievable" means making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relations to utilization of nuclear energy and licensed materials in the public interest.

d. Annual Limit on Intake (ALI): The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. The ALI is the smaller of the value of intake that would result in a committed effective dose equivalent of 5 rems or a committed dose equivalent of 50 rems to any organ or tissue.

e. Background Radiation: Radiation from cosmic sources; naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material) and global fallout as it exists from the testing of nuclear explosive devices. "Background radiation" does not include radiation from source, byproduct, or special nuclear materials regulated by the Nuclear Regulatory Commission.

f. Bioassay: The determination of kinds and quantities or concentrations of radioactive material in the human body. Can be made using direct measurements (in vivo counting) or by analysis of materials excreted or removed from the human body (in vitro).

g. Byproduct Material: Such material includes the following:

(1) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material. Generally, byproduct material is any radioactive material inevitably produced as a byproduct from the neutron-induced fission process within nuclear reactors.

(2) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" regulated by the NRC under 10 CFR.

h. Code of Federal Regulations (CFR)

i. Committed Dose Equivalent: The dose equivalent to organs or tissues that will be received from intake of a radioactive material by an individual during the 50-year period following intake.

j. Committed Effective Dose Equivalent: The sum of the products of the weighting factors applicable to each of the body organs or tissues and the committed dose equivalent to these organs or tissues.

k. Department of the Army Radiation Authorization: DARA

l. Declared Pregnant Woman: A woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

m. Deep-dose Equivalent: External whole body exposure dose equivalent at a tissue depth of 1 cm.

n. Derived Investigation Level: Based on ICRP 26 recommendation of 0.3 * f * ALI, where f is the fraction of the year to which the monitoring applies and ALI is the annual limit on intake from ICRP 30.

o. Dose Equivalent: The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem or sievert (Sv).

p. Half-life, Radioactive: Time required for half the atoms in a radioactive substance to disintegrate to another nuclear form. Also called physical half-life, and each radionuclide has its own unique half-life.

q. Dose Equivalent: The product of the absorbed dose in tissue and the quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

r. Gray (Gy): The SI unit of absorbed dose. One Gy is equal to an absorbed dose of 1 Joule/kilogram (1 Gy = 100 rad).

s. High Radiation Area: An area accessible to individuals in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 mrem in 1 hour at 1 foot from the radiation source or any surface the radiation penetrates.

t. Health Physics Office: HPO

u. Minimum Detectable Activity: MDA

v. Nuclear Regulatory Commission: NRC

w. Quality Factor: A modifying factor for the type of radiation to derive dose equivalent from absorbed dose.

x. Rad: The special unit of absorbed dose. One rad is equal to a dose of 100 ergs/gram (1 rad = 0.01 Gy).

y. Radioactive Material: Any material or combination of materials that spontaneously emits gamma rays, X-rays, alpha particles, beta particles, neutrons, or other atomic particles that are capable of producing ions, directly or indirectly by their passage through matter.

z. Radioactive Waste: Solid, liquid, and gaseous materials from nuclear operations that are radioactive or become radioactive and for which there is no further use. Property contaminated with radioactive material to the extent that decontamination is economically unsound.

(1) Short Half-life Radioactive Waste: Radioactive waste containing one or more radionuclides having a radiological half-life of 65 days or less plus the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

(2) Long Half-life Radioactive Waste: Radioactive waste containing one or more radionuclides having a radioactive half-life of more than 65 days except for the following radionuclides; sulfer-35 (87.44 d), cobalt-58 (70.8 d), iridium-192 (74.02 d), and scandium-46 (83.8 d).

aa. Rem: The special unit of dose equivalent. The absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 Sv).

ab. Restricted Area: An area where access is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.

ac. Sievert (Sv): The SI unit of the dose equivalent. The absorbed dose in Gy multiplied by the quality factor (1 Sv = 100 rem).

ad. Specific Activity: Total activity of a given radionuclide per unit mass or volume of a compound, element, or radioactive nuclide.

ae. Total Effective Dose Equivalent: The sum of the deep-dose equivalent and the committed effective dose equivalent.

af. Very High Radiation Area: An area accessible to individuals in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads in 1 hour at 1 meter from the radiation source or any surface the radiation penetrates.

ag. Whole Body: For the purpose of external exposure, head, trunk, arms above the elbow, and legs above the knee.