Form AEC-313 8-64 * 10 CFR 30	UNITED STATES ATOMIC ENERGY COMMISSION **APPLICATION FOR BYPRODUCT MATERIAL LICENSE**	Form approved Budget Bureau No. 38-R0027

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application or an application for renewal of a license. Information contained in previous applications filed with the Commisson with respect to Items 8 through 15 may be incorporated by reference provided references are clear and specific. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: U.S. Atomic Energy Commission, Washington, D.C., 20545, Attention: Isotopes Branch, Division of Materials Licensing. 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. Include ZIP Code.)*

Department of the Army
US Army Belvoir Research and
Development Center
Fort Belvoir, VA 22060

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

See Supplement A

2. DEPARTMENT TO USE BYPRODUCT MATERIAL

See Supplement A

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

Renewal of NRC License No. 45-00953-01

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.)*

Personnel approved by the Radiation
Control Committee
Belvoir R&D Center

See Supplements B

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.)*

Michael D. Funkhouser, RPO
Ramachandra K. Bhat, ALT RPO
Edwin A. Heck, ALT RPO

See Supplement C

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

Any byproduct material
of atomic numbers
1 through 99;
See Supplement D

(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.)*

See Supplement D

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.)*

Byproduct materials listed at item 6 and Supplement D are transported and utilized for research, testing, development, and evaluation of DA commodities, devices, and equipment. In addition, environmental tracer studies, irradiation studies, instrumention and calibration studies, and safety studies will be made. Calibration standards, reference standards, and check sources will be used prior to routine testing, survey, or demonstration.

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(Continued on reverse side)

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 *(Use supplemental sheets if necessary)*

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection			Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	See Supplement B		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
		See Supplement B		

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)*
See Supplement E					

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

See Supplement F

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

See Supplement G

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

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

See Supplement H

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.

See Supplement B and C - Belvoir R&D Center Reg 385-11

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.

See Supplement I

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.

US Army Belvoir Research and Development Center
Applicant named in item 1

Date _____

By /S/ / Feb 84
T. W. LOVELACE
Technical Director
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 : 1968 O—316-527

Encl 6

SUPPLEMENT B

1. Reference: Item 4, 8, and 9, NRC Form-313.

2. An individual user of NRC byproduct material will be a scientist, engineer, or technician. If the user is not a scientist or an engineer, the supervisor will be a scientist or engineer qualified as a user of NRC byproduct material. Each user will receive radiological and safety training. Each will adhere to local Standing Operating Procedures (SOP) and be alert to prescribed emergency procedures. Personnel from the Belvoir R&D Center Radiation Research Group will provide training and submit SOP's for approval.

3. The Belvoir R&D Center's Radiation Control Committee (RCC) will approve authorized Belvoir R&D Center and NV&EOL personnel assigned work with NRC byproduct material. The RCC will review the training and experience of proposed users. If they lack experience, they will be afforded on-the-job training under the supervision of a qualified user of NRC byproduct material. Training will be locally administered or provided by DA authorized and/or NRC licensed authority.

4. Successful completion of the Belvoir R&D Center RCC training program will authorize assigned personnel access and use of NRC byproduct material.

a. Users will be scientists or engineers, or they will be directly supervised by a scientists or engineer who is a radiation worker.

b. The Radiation Protection Officer (RPO) will:

(1) Review current radiological training methods and proper laboratory techniques.

(2) Review previous occupational experience with radiological sources.

(3) Review SOP's associated with use of radiological sources.

(4) Supervise specific radiological and safety training that:

(a) minimizes exposure to ionizing radiation.

(b) promotes on-the-job safety.

(c) solves radiological protection problems.

c. Users will report any condition which may lead to unnecessary exposure to radiation, radioactive material, or possible violation of regulatory, authorized, or licensed condition. Each will demonstrate knowledge of regulatory, authorized, or licensed requirements that control the use of NRC byproduct materials.

d. Users will demonstrate proper use of radiological devices and protective equipment.

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Supplement B, continued.

e. Users will explain emergency procedures.

f. Users will understand the local radiological protection regulations, Belvoir R&D Center Reg 385-11, and pertinent SOP's.

5. Annex B-1, Department of the Army, US Belvoir Research and Development Center, Regulation Number 385-11, authorizes the Belvoir Research and Development Center's Radiation Control Committee and details requirements of radiation workers from Belvoir R&D Center and NV&EOL.

6. Annex B-2, summarizes the educational, training, and experience of members appointed to the Belvoir R&D Center's Radiation Control Committee.

ANNEX B-2

1. Reference item 4, 8, and 9, NRC Form-313.

2. THOMAS W. LOVELACE, Technical Director, Chariman of the Radiation Control Committee, US Army Belvoir Research and Development Center, Fort Belvoir, Virginia.

a. Education:

(1) 1954, BS in Mechanical Engineering, Virginia Polytechnical Institute, Blacksburg, Virginia.

(2) 1968-1970, Graduate Courses at George Washington University; Washington, DC.

(3) 1981, Graduate of Industrial College of the Armed Forces.

b. Experience:

(1) 1954-1956, Specialist, Armored Vehicle Electrical Systems, Department of the Army, Armored Recommaissance Company, Schofield, Hawaii.

(2) 1957-1961, Engineering Division, Chevrolet, Producting Engineering.

(3) 1961-1967, Engineer, Military Engines, Engineer Research and Development Laboratory (Belvoir R&D Center).

(4) 1967-1968, Manager, International Engineering and Cummins Diesel Engine Company.

(5) 1968-1972, Chief of the Turbine/Advanced Power Systems Branch, Office of Project Manager, Mobile Electric Power.

(6) 1972-1982, Associate Technical Director for Engineering, US Army Mobility Equipment and Research Command (Belvoir R&D Center).

(7) 1982, Technical Director, US Army Belvoir Research and Devleopment Center.

ANNEX B-2, continued.

3. ROBERT C. McMILLAN, Research Physical Scientist, Vice Chairman of the Radiation Control Committee and Chief, Radiation Research Group, US Army Belvoir Research and Development Center, Fort Belvoir, Virginia.

a. Education:

(1) 1953, BA Physics, Southern Missionary College, Collegedale, Tennessee,

(2) 1953-1956, 40 semester hours graduate work in Physics and Mathematics, University of Arkansas, Fayetteville, Arkansas,

(3) 1966-1967, 40 quarter hours graduate work in physics, Chemistry, and Mathematics, University of Utah, Salt Lake City, Utah.

b. Radiation Experience:

(1) 1955, worked with unsealed 137Cs sources in millicurie amounts, University of Arkansas, Fayetteville, Arkansas,

(2) 1956-1967, Conducted basic RTDE and x-ray irradiation of solids at US Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia,

(3) October 1967-present, Chief of Radiation Research Group; Materials, Fuels and Lubricants Laboratory; US Belvoir Research and Development Center, Fort Belvoir, Virginia. Authorized to use and manage the following quantities of radioactivity: 1500 Ci of ^{3}H in radioluminous sources; 500 mCi/source of ^{147}Pm with maximum quantities of 48 Ci; 10 Ci/sources of ^{60}Co; 1 Ci/source of ^{210}Po; 268 mCi ^{252}Cf; 16g of ^{239}Pu in a Pu-Be Neutron source.

(4) March 1968, ^{60}Co Army's radiation calibration set, TS-784/PD, Army Chemical School, Fort McClellan, Alabama.

c. Radiation Training:

(1) 1952-1953, 6 semester hours of Atomic and Nuclear Physics, Southern Missionary College, Collegedale, Tennessee,

(2) 1955, 3 semester hours of Nuclear physics, University of Arkansas, Fayetteville, Arkansas,

(3) March 1968, 82 hours Radiological Safety Course, Class Number Two, covering principles and practices of radiation protection, measurement of radioactivity, mathematical calculations, shielding and the biological effects of radiation at US Army Chemical School, Fort McClellan, Alabama,

ANNEX B-2 continued.

(4) January 1969, 80 hours Occupation Radiation Protection Course 212, Covering principles and practices of radiation protection, evaluation of external and internal exposure to radionuclides and methods for protection against these hazards. Public Health Service. Las Vegas, Nevada,

(5) January 1970, 40 hours USAMC Field Safety agency Laser Safety Course, covered laser theory, laser systems, effects on skin and internal organs, ocular effects, threshold levels for MRD safe exposure criteria, measurement of laser radiation, hazard evaluation of military laser installations, secondary hazard evaluation, medical surveillance, and survey methods and evaluation. University of Cincinnati, Cincinnati, Ohio.

ANNEX B-2 continued.

4. JACK DIXON, Chief, Safety, Health and Environmental Office, US Army Belvoir Research and Development Center, Member of the Radiation Control Committee, Fort Belvoir, Virginia.

a. Education:

(1) 1970, BS in Electrical Engineering, Ohio State University,

(2) 1983, MBA, Southern Illinois University,

(3) Completed 57 credit-hours toward completion of Master of Engineering in Systems Engineering.

b. Safety Training:

(1) System Safety Analysis Course (Institute of System Science),

(2) Risk Analysis (Flow Research),

(3) Industrial Electrical Safety (University of Wisconsin),

(4) System Safety (George Washington University),

(5) Fault Free Analysis (George Washington University),

(6) System Safety Applications (George Washington University),

(7) Armed Safety Program Management Seminar (Fort Rucker, Alabama).

c. Experience:

(1) 1971-1975, Engineer, Safety Research Division, US Navel Surface Weapons Center, Dahlgren, Virginia,

(2) 1975-1977, Integrated Logistic Support Manager/Project Manager, Navel Facilities Engineering Command, Electronics Facilities Project Office,

(3) 1978-Present, Safety Engineer, US Army Belvoir Research and Development Center, Fort Belvoir, Virginia.

ANNEX B-2 continued.

5. CHARLIE WARD TRUSSELL, JR, Physicist, Member of the Radiation Control Committee, US Army Night Vision and Electro-Optical Laboratory, Fort Belvoir, Virginia.

a. Education:

(1) 1965, BS in Physics, Clemson University,

(2) 1969, PHD in Physics, University of Virginia.

b. Experience:

(1) 1969-1973, Research Physicist in Optical Radiation Technical Area, reearched III-V materials and injection lasers,

(2) 1973-1978, Research Physicist in the Injection Laser Team, Image Intensification Technical Area, researched injection lasers and III-V semiconductor materials, and developed monolithic laser arrays,

(3) 1978-1983, Physicist of Near Millimeter Wave Team, Laser Division, managed programs in optical filters, laser measurements, and millimeter wave tehnology,

(4) 1983-Present, Acting Team Leader, E-O Devices Team, Laser Division, manage programs in optical filters, laser measurements, and millimeter wave technology.

ANNEX B-2 continued.

5. WALTER J. KREEGER, US Army Engineer Power Group, Member of the Radiation Control Committee, Fort Belvoir, Virginia.

a. Education:

(1) Completed 1 year at the Engineer College, University of Nebrasks.

(2) Graduate Record Examination in Engineering.

(3) Completed Health Physics - Plant Chemistry Specialty Training Course, and NPPOC, Fort Belvoir, VA.

(4) Installation Management, 3 weeks, US Army Management School, Fort Belvoir, VA.

(5) Calculus, 1 year, University of Virginia.

(6) Management of Radiation Accidents, 1 week, US Public Health Services.

(7) Radionuclide Analysis by Gamma Spectroscopy, 2 weeks, US Public Health Service.

(8) Radionuclide Detection and Analysis in Water, 2 weeks, US Public Health Service.

(9) Fundamentals of Non-Ionizing Radiation Protection, 1 week, US Public Health Service.

(10) Occupational Radiation Protection, 2 weeks, US Public Health Service.

(11) Management Development, 1 week, Fort Belvoir, VA.

(12) Conference Leadership, 1 week, Fort Belvoir, VA.

(13) Thin Layer Chromatography, 1 week, KONTES; Washington, DC.

(14) Methods of Instruction, 2 weeks, Fort Belvoir, VA.

(15) Second International Symposium for Packaging and Transportation of Radioactive Material, 1 week, Gatlinburg, Tennessee.

(16) Medical X-Ray Protection, 2 weeks, US Public Health Service.

(17) Public Health and Medical Aspects of Chemical and Biological defense, 1 week, US Public Health Service.

ANNEX B-2 continued.

b. Experience with Radiation Sources:

1960 to Present - US Army Engineer Power Group (USAENPG), Fort Belvoir, VA.

(1) Shift Supervisor, SM-1 Nuclear Power Plant, 1 year.

(2) Health Physicist, SM-1 Nuclear Power Plant, 1 year.

(3) Health Physicist for PM-2A Nuclear Power Plant defueling and the plant's removal from the Greenland Ice Cap, 1 ½ year.

(4) Health Physicist, USAENPG, Training Division, (Chief, Health Physics - Plant Chemistry Training Section), 15 years.

(5) Radiation Protection Officer, USAENPG, April 1971 to 1 July 1974 and 1 Oct 80 to present.

(6) Leak tested, surveyed and used 100 mCi of Co-60, 4.5 mCi of RaBe and assorted check sources for 15 years.

6. DIANA L. SALZMAN, MAJ, MSC, Environmental Science Officer, MEDDAC, Member of the Radiation Control Committee, Fort Belvoir, Virginia.

a. Education:

(1) May 1971, B.S. Dental Hygiene, Idaho State University, Pocatella, Idaho.

(2) September 1971, Medical Department Officer's Basic Course, Fort Sam Houston, TX.

(3) October 1971, Faculty Development Course, Fort Sam Houston, TX.

(4) December 1975, Medical Department Officer's Advanced Course, Fort Sam Houston, TX.

(5) February 1976, Patient Administration Course, Fort Sam Houston, TX.

(6) December 1979, Masters of Public Health (Environmental Health), university of Minnesota, Minneapolis, MN.

(7) March 1981, Advanced Industrial Hygiene Techniques Workshop, US Army Environmental Hygiene Agency, Aberdeen, Maryland.

b. Experience:

(1) November 1971, to June 1975, Oral Health Manager, Fort Carson, Colorado.

(2) March 1976 to April 1977, Adjutant, MEDDAC, Berlin, Germany.

(3) April 1977 to November 1978, Chief, Plans, Operations and Training, MEDDAC, Berlin, Germany.

(4) December 1979 to February 1981, Environmental Science Officer, Fitzsimons Army Medical Center, Aurora, Colorado.

(5) February 1981 to July 1983, Industrial Hygiene Section, US Army Environmental Hygiene Agency, Regional Division West, Aurora, Colorado.

(6) July 1983 to present, Environmental Science Officer, Fort Belvoir, and Safety Officer, MEDDAC, and alternate RPO, MEDDAC, Fort Belvoir, Virginia.

SUPPLEMENT C

1. Reference item 5, 8, and 9, NRC Form-313.

2. MICHAEL D. FUNKHOUSER, Health Physicist, Action Officer of the Radiation Control Committee and Radiation Protection Officer at the Radiation Research Group (Mar 83), US Army Belvoir Research and Development Center, Fort Belvoir, Virginia.

a. Education:

(1) 1965-1967, A.S. at Young Harris Junior College; Young Harris, Georgia,

(2) 1967-1969, B.S. in Physics at The Univeristy of Florida; Gainesville, Florida,

(3) 1977-1978, M.S.A.N.S. in Health Physics at Georgia Institute of Technology; Atlanta, Georgia.

b. Experience with Radiation:

(1) 1977-1978, Post graduate student at Georgia Institute of Technology; Atlanta, Georgia. Introduced to radiological sources, instrumentation, experimental, and laboratory techniques associated with Nuclear Regulatory Commission (NRC) byproduct, source, and special nuclear materials utilized by Georgia Institute of Technology and its five megawatt research reactor,

(2) 1978-1979, Health Physicist, US Army Communications and Eectronics Materiel Readiness Command; Fort Monmouth, New Jersey. Performed administrative health physics and surveyed command depots that stored, used and transported NRC byproduct, source, and special nuclear materials,

(3) 1979-1981, Health Physicist, Harry Diamond Laboratories (HDL); Adelphi, Maryland. Appointed HDL Radiation Protection Officer. Monitored and surveyed 25,000 curie-Cobalt-60 Irradiator, (milli)curie quantities of ^{3}H, ^{14}C, ^{36}Cl, ^{60}Co, ^{63}Ni, $^{90}Sr/^{90}Y$, $^{137}Cs/^{137m}Ba$, ^{147}Pm, ^{204}Tl, $^{210}Pb/^{210}Bi$, ^{226}Ra, and microcurie quantities of accelerator produced radionuclides.

(4) 1981-Present, Health Physicist, US Army Belvoir Research and Development Center; Fort Belvoir, Virginia. Appointed Belvoir R&D Center and NV&EOL Radiation Protection Officer (Mar 83). Executes the Belvoir R&D Center and NV&EOL Radiation Protection Program. Monitors, tests, surveys, and evaluates NRC/DA Licensed sources and commodities including ^{3}H, ^{14}C, ^{60}Co, ^{63}Ni, $^{90}Sr/^{90}Y$, ^{125}I, $^{137}Cs/^{137m}Ba$, ^{147}Pm, ^{226}Ra, ^{226}Ra, ^{238}U, ^{239}Pu, and ^{241}Am. Coordinates and monitors the Belvoir R&D Center and NV&EOL radioactive waste, calibration, and dosimetry programs, instrumentation and source inventories, and environmental surveillance; conducts routine health physics surveys; generates tehcnical reports and studies; tests and evaluates DA commodities for product assurance; prepare and monitors DA/NRC license applications and requirements.

Supplement C continued.

3. EDWIN A. HECK, Physicist, Secretary of the Radiation Control Committee and alternate Radiation Protection Officer at the Radiation Research Group, US Army Belvoir Research and Development Center, Fort Belvoir, Virginia.

a. Education:

(1) 1948, 89 semester hours at Fairmont State College, Fairmont, West Virginia, with 25 semester hours of Physics.

(2) 1964, 40 hours training in radioisotope radiography at Picker X-ray, Cleveland, Ohio.

(3) Radiological Safety I Course.

b. Radiation Experience:

(1) Member of Radiation Research Group since 1953.

(2) 1955, a member of the US Army Engineer Research and Development Laboratory's Radiological Survey Team. Conducted radiological surveys, leak tests, decontamination and disposal operations at US Army depots.

(3) Has had 29 years experience with radiation conducting radiological surveys, leak tests, decontamination and disposal operations, monitoring and use of radioisotopes for self-luminous sources.

c. Examples of Isotopes Handled and Types of Uses:

(1) Tritium and ^{147}Pm; R & D projects on self-luminous compounds. Testing and evaluation of military items.

(2) ^{60}Co multicurie; radiation field detection and measurements.

(3) ^{147}Pm; 550 millicuries; testing and evaluation of self-luminous tape.

(4) ^{137}Co; 900 millicuries, shielding project.

(5) ^{226}Ra; items such as metascope, transits, compasses, vials, vehicle and personnel markers for leak testing, decontamination and waste disposal.

Supplement C (con't)

4. RAMACHANDRA K. BHAT, Health Physicist, US Army Belvoir Research and Development Center, Fort Belvoir, VA 22060.

a. Education:

(1) 1956-60, Bachelor of Science - 95 credits Karnataka University, Dharwar, India.

(2) 1960-62, Master of Science, 30 credits of each of graduate level and undergraduate level in Chemistry, Karnataka University, Dharwar, India.

(3) 1962-63, One year special training in Physics (4 credits), Electronics (4 credits), and Radiation Spectocopy and Health (3 credits), Chemistry (14 credits), Mathematics (2 credits), Thermodynamics (2 credits), Bhabha Atomic Research Center - Training Division, Bombay, India.

(4) 1968-72, PHD in Chemistry, Karnataka University, Dharwar, India.

b. Radiation Experience:

(1) 1963-75, Scientific Officer, Bhabha Atomic Research Center, India - Health Physics support to the Atomic Fuels Division.

(2) 1975-79, Senior Chemist, M.G. scientific gases. Somerville, NJ - Health physics support for preparing radioactive gas mixtures to the production department.

(3) 1980-82, Radio-chemist, New Jersey State Bureau of Radiation Protection, Trenton, NJ - Member of New Jersey State Nuclear Emergency Response Team. Data collection and report presentation of New Jersey State Radiological Health Surveillance Program.

(4) Feb to July, 1980, Principal Scientist, - NUS Radiological laboratory, Pittsburgh, PA. Set up and supervised an Ultra Modern Computerized Data Based Radiological Laboratory to support the Nuclear Reactor Environmental Radiation Monitoring Program.

(5) July 1980 to present, Health Physicist - US Army Fort Belvoir R&D Center, Fort Belvoir, VA, Alternate Radiation Protection Officer. Member, Raidation Control Committee. Calibration and maintenance of the laboratory instruments. Preparation of Field Task Proposals for project contracts. Special studies include:

(a) Radioactive self luminous exit signs.

(b) Determination of radionuclides in commodities.

(c) Intercomparison counting of samples containing tritium throughout the US Army Material Development and Readiness Command.

c. Radiation Training.

(1) 1962-63, Atomic, Nuclear and Reactor Physics (4 credits); and Radiation, Spectoscopy and Health (3 credits), at Bhabha Atomic Research Center Training Division, Bombay, India.

(2) Feb 10 and 11, 1981, "Nuclear Reactor Emergency Response" arranged by the New Jersey State Department of Environmental Protection."

(3) July 13 to 17, 1981, "Environmental Radiation Surveillance," Harvard School of Public Health, Boston, MA.

(4) Jan to June, 1983, (60 hours), "Preparation Course for the American Board of Health Physics Certification Examination" conducted by the Baltimore - Washington Chapter of Health Physics Society.

SUPPLEMENT D

1. Reference item 6a and 6b, NRC Form 313.

2. Byproduct Material, Chemical and or physical Form, and Maximum Amount of Activity of each radionuclide are listed as follows:

6a Byproduct Material	6b Chemical and Physical Form	Maximum Amount
A. Any byproduct material of atomic numbers 1 through 83, inclusive.	Sealed: Any Chemical Form.	Not to exceed 500 millicuries per radionu - clide and 50 curies of total activity.
B. Any byproduct material of atomic numbers 1 through 83, inclusive.	Unsealed: Any Chemical Form.	Not to exceed 250 millicuries per radionu- clide and 25 curies of total activity.
ADDITIONAL RADIOACTIVITIES		
C. Hydrogen-3	Sealed luminous sources: gas, paint, plastic.	Not to exceed 150 curies per source and 3000 curies of total activity.
D. Hydrogen-3	Unsealed: Any Chemical Form.	Not to exceed 25 curies per source and 100 curies of total activity.
E. Cobalt-60	Sealed: Any gauge, device, or calibration standard.	Not to exceed 10 curies per source and 100 curies of total activity.
F. Cesium-137	Sealed: Any gauge, device, or calibration standard.	Not to exceed 10 curies per source and 100 curies of total activity.

G.	Promethium-147	Sealed: Any gauge, device, or calibration standard.	Not to exceed 1 curie per source and 50 curies of total activity
H.	Polonium-210	Sealed: Any Chemical Form.	Not to exceed 1 curie per source and 2 curies of total activity
I.	Polonium-210	Unsealed: Any Chemical Form.	Not to exceed 250 millicuries per source and 250 millicuries of total activity.
J.	Americium-241	Sealed: Any gauge, device, or calibration standard.	Not to exceed 5 curies per source and 50 curies of total activity
K.	Americium-241/ Cesium-137	Sealed: Any gauge, device, or calibration standard.	Not to exceed 50 mCi of Am-241/ 10 mCi of Cs-137 per item and 3 curies of total activity.
L.	Any byproduct material of atomic numbers 89 through 99, inclusive.	Unsealed: Any chemical form as traceable calibration or reference standard.	Not to exceed 1 millicurie per radionuclide and 10 millicuries of total activity

SUPPLEMENT E

Reference: Item 10, NRC Form-313.

TYPES OF INSTRUMENTS	NUMBER AVAILABLE	RADIATION SELECTED	RANGE	WINDOW THICKNESS	USE
I. Health Physics and Portable Survey Meters.					
1. Eberline, Alpha Scintillation Counter, Mdl PAC-1SA.	3	Alpha	0-2M cpm	1.5 $mg.cm^{-2}$	Survey
2. Eberline, LIN-LOG Alpha, Scintillation Counter, Mdl PAC-4S.	4	Alpha	0-2M cpm	1.5 $mg.cm^{-2}$	Survey
3. Eberline, LIN-LOG Gas Proportional Survey Meter, Mdl PAC-4G-3.	2	Alpha Beta	0-500K cpm	0.85 $mg.cm^{-2}$	Survey
4. Eberline, Geiger-Counter, Mdl E-120 with HP-177C Probe.	1	Beta Gamma	0-50 $mR.hr^{-1}$ 0-70K cpm	30. $mg.cm^{-2}$	
5. Eberline, Geiger-Counter, Mdl E-120 with HP-270 Probe.	3	Beta Gamma	0-50 $mR.hr^{-1}$ 0-70K cpm	30. $mg.cm^{-2}$	Survey
6. Eberline Geiger-Counter, Mdl E-500B with NP-177B Probe.	2	Beta Gamma	0-2K $mR.hr^{-1}$	30. $mg.cm^{-2}$	Survey
7. Eberline, Geiger-Counter, Mdl E-520 with NP-177B Probe.	1	Beta Gamma	0-2K $mR.hr^{-1}$ 0-28K cpm	30. $mg.cm^{-2}$	Survey
8. Eberline, LIN-LOG Pulse Rate Meter, Mdl PRM-5-3, with PG-1 Probe.	2	Alpha Beta Gamma	0-500K cpm	6.8 $mg.cm^{-2}$	Survey
9. Eberline, Teletector Mdl 6112.	2	Beta Gamma	0-50 $mR.hr^{-1}$ 0-1000 $R.hr^{-1}$	25. $mg.cm^{-2}$	Survey
10. Eberline, Portable Ion Chamber, Mdl PIC-6A.	4	Beta Gamma	0-1000 $mR.hr^{-1}$ 0-1000 R.hr	30. $mg.cm^{-2}$	Survey

Supplement F continued.

TYPES OF INSTRUMENTS	NUMBER AVAILABLE	RADIATION SELECTED	RANGE	WINDOW THICKNESS	USE
11. Eberline, Ion Chamber (Cutie Pie), Mdl RO-3.	2	Beta Gamma f-Neutron X-ray	0-5K $mR.hr^{-1}$ 0-500 $mRem.hr^{-1}$	3.5 $mg.cm^{-2}$	Survey
12. Eberline, LIN-LOG Portable Neutron Counter, Mdl PNC-4.	3	Neutron	0-500K cpm		Survey
13. Eberline, LIN-LOG Portable Neutron REM Counter, Mdl PNR-4, with Bonner Spheres.	2	Neutron	0-5K $mRem.hr^{-1}$		Survey
14. Ludlum, Geiger Counter, Mdl 3.	2	Beta Gamma	0-20 $mR.hr^{-1}$ 0-150 $mR.hr^{-1}$		Survey
15. Nuclear Chicago Neutron Survey Meter, Mdl 2671 (Mdl 2673 Fluence Meter and Mdl 2646 Neutron Probe).	1	f - Neutron t - Neutron	0-25 $n.cm^{-2}.sec^{-1}$ 0-25K $n.cm^{-2}.sec^{-1}$		Survey
16. Victoreen, Survey Meter, Mod 491.	1	Beta Gamma	0-100 $mR.hr^{-1}$ 0-1500 cpm		Survey
17. Victoreen, Cutie Pie, Mdl 740-F.	1	Beta Gamma	0-25,000 $mR.hr^{-1}$		Survey
18. Victoreen, Cutie Pie, Mdl 740-G.	1	Beta Gamma	0-100,000 $mR.hr^{-1}$		Survey

SUPPLEMENT E

Reference: Item 10, NRC Form-313.

TYPES OF INSTRUMENTS	NUMBER AVAILABLE	RADIATION SELECTED	RANGE	WINDOW THICKNESS	USE
II. Fixed-Laboratory Instrumentation and Equipment.					
1. Beckman Liquid Scintillation Counter, Mdl 255.	1	Beta	0-1M cpm		Measure
2. Canberra Series 90, Multichannel Analyzer.	1	Gamma	1-10M cpm		Spectro copy
3. Eberline Radiation Monitor Mdl RM-14.	1	Gamma	0-50K cpm		Air Monitor
4. Eberline Radiation Monitr Mdl RM-15.	1	Alpha	0-50K cpm		Air Monitor
5. Johnson Laboratories Triton B, Mdl 955.	2	Tritium Carbon-14 Gamma	0-10K $uCi.m^{-3}$ 0-1K $uCi.m^{-3}$ 0-50K $uR.hr^{-1}$		Air Mon. Air Mon. Air Mon.
6. Ludlum Rate Meter, Mdl 25.	1	Alpha Beta Gamma	0-1M cpm		Measure
7. Tennelec, Low Background Alpha-Beta Counting System, Mdl LB-5100.	1	Alpha Beta	0-1M cpm	0.08 $mg.cm^{-2}$	Measure
III. Personnel Monitors					
1. Department of Army Photodosimetry and Film Badge Program.		Beta Gamma Neutron			Measure
2. Department of Army Bioassay Program.		Alpha			Measure
3. Eberline, Gamma Dosimeter.	10	Gamma X-ray	0-200 mR		Monitor

SUPPLEMENT E continued.

4. Eberline Gamma/Thermal Neutron Dosimeter.	2	Gamma Neutron	0-120 mRem	Monitor
5. Eberline Dosimeter Charge	1			(Re)charge Zero-set
6. Jordon Electronics Dosimeter Charge.	1			(Re)charge Zero-set
7. Nuclear Associates PRIMA IIa, Personnel Monitor, Mdl 05-204.	3	Gamma X-ray	60 chirps min^{-1} @ 1 $mR.hr^{-1}$	Monitor
8. Radiation IM-E/PD.	3	Gamma X-ray	0-200 mR	Monitor
9. Radiacmeter IM 135/PD.	1	Gamma	0-200 mR	Monitor
10. Victoreen - R Meter, Mdl 570, with six chambers.	1	Gamma	0.25 R 0.25 2.5 2.5 25. 100.	Monitor
11. Vistoreen, VIP Mdl 885-1.	3	Gamma	999 $mR.hr^{-1}$	Monitor

SUPPLEMENT F

1. Reference: Item 11, NRC Form 313.

2. Calibrated standards of tritium (^{3}H), including tritiated toluene or tritiated water, are traceable to the National Bureau of Standards.

3. Portable alpha, beta, gamma, and neutron survey meters are calibrated quarterly as required at the US Navy Electronics System Security Engineering Center (NESSEC), Washington DC. Individual monitoring dosimeters and R-meters are likewise calibrated at NESSEC as required.

4. Beckman Liquid Scintillation Center, Canberra Series 90, Multichannel Analyzer, and Tennelec Low Background Alpha-Beta Counting System are each calibrated with laboratory standards which are traceable to the National Bureau of Standards. Appropriate documents are supplied by this agency.

5. Assorted manufactured, calibrated, fractional micocurie sources of alpha, beta, and gamma are utilized as primary and secondary reference check of laboratory, fixed, and portable scintillators, detectors, and GM tubes.

SUPPLEMENT G

1. Reference: Item 12, NRC Form 313.

2. Beta, gamma, and neutron sensitive film badges are supplyed Army-wide by the US Army Ionizing Radiation Dosimetry Center (IRDC), Lexington, Kentucky. Film badges are exchanged at monthly intervals. Evaluation of employee's film badges is completed by IRDC and measurements of dose equivalent are returned on "Photodosimetry Report, Exposure to Ionizing Radiation." Data is transferred to DD Form 1141, "Record of Occupational Exposure to Ionizing Radiation."

3. Bioassays for tritium are routinely performed as required. Evaluation is completed by US Army Environmental Hygiene agency. Data is returned on Standard Form 557 (NSN 7540-00-181-8344).

SUPPLEMENT H

1. Reference: Item 13, NRC Form 313.

2. Laboratory facilities and equipment consist of enclosed boxes, remote handling equipment, monitors, shielding, storage spaces, prepared surfaces, and forced ventillation.

3. Boxes: Glove boxes or dry boxes are utilized to minimize exposures to unsealed radiological sources, aerosols, or gases as required. Glove boxes provide three full air changes per minute; variable speed blower provides an air flow of 75 cfm. Exhaust is vented to the roof through two outlet filters (MIL-STD-282). Each filter is designed to remove 99.9% of particles of 0.3 microns or greater. Boxes are equipped with electric outlets, switches, and fluorescent light.

4. Equipment: Remote handling tools, tongs, forceps, mirrors, and telescopes are used as necessary to reduce exposures to hands from point sources and intense extended sources.

5. Monitors: Fixed detectors, counting instrumentation, portable survey meters, and employee's monitoring devices are detailed in Supplement E, "Radiation Detection Instruments."

6. Shielding: Lead sheets and bricks and blocks of parafin are arranged to minimize exposure when reduction of exposure from increased distance and limiting periods of exposure is insufficient.

7. Storage: The Radiation Storage Vault, Building 304, and the Radiation Storage Facility, Building 363 C, are designated long term storage sites for unused or unwanted byproduct material for Belvoir R&D Center and NV&EOL. The vault is a detached, dehumidified bunker covered with 18 inches of earth and constructed of reinforced concrete walls of 12 inches, and a high grade steel door. The vault is 120 square feet; it contains 33 storage tubes; each is six inches in diameter and 39 inches in length. The tubes are set inside high density poured concrete. The vault includes four storage pits. Each pit is 24 inches in diameter and 48 inches in depth. Each pit is set inside reinforced concrete floor. Additional repositories include lead and steel pigs from one to six inches in diameter, heavy duty plastic bags, and several 55 gallon, steel grade drums suitable for storage and transportation.

8. Surface: Floors, walls, ceiling, and benches are made of non-porous materials. Absorbent materials cover trays and surfaces to collect spills.

9. Ventillation: The Radioisotope - Radiochemistry Laboratory is equipped with two stainless steel fume hoods with absolute filters and roof-exhaust. The unit is manufactured by Metalab, Incorporated. Flow rates across the face of the hoods are:

a. Hood 1, 150 linear feet per minute (0.75 mps), face raised to 12 inches.

b. Hood 2, 125 linear feet per minute, face raised to 12 inches.

10. Summary: Laboratory facilities and equipment consist of the following radiological safety features:

a. Glove boxes for use of unsealed sources,

b. Variety of special handling tools,

c. Monitors for measurements of radioactivity,

d. Shielded sources of high-level radioactivity,

e. Secured sources of byproduct materials,

f. Ventillation for removing radiological gas and aerosols,

g. Prepared working surfaces for containment of spills.

SUMMARY I

1. Reference: Item 15, NRC Form-313.

2. Unwanted radioactive materials and radiological wastes will be secured in the Radiation Storage Vault, Building 304, and the Radiation Storage Facility, Building 304 C, US Army Belvoir Research and Development Center, Fort Belvoir, Virginia.

3. Unwanted radionuclides or contaminated wastes in solid or liquid form are transported by carrier to licensed authority for disposal IAW local, state, and federal rules and regulations. Advanced instructions are secured from Commander, US Army Armament Materiel Readiness Command (AARCOM), Rock Island, Illinois, prior to preparation and transportation of unwanted radiological materials to ARRCOM.

4. Gaseous or suspended aerosols of radionuclides are filtered and/or scrubbed prior to atmospheric discharge in concentrations not exceeding standards of Title 10, Code of Federal Regulations, Part 20 (10 CFR 20).

5. Solutions of radionuclides are filtered and/or diluted prior to sanitary discharge in concentrations not exceeding standards of 10 CFR 20. Filtered or trapped residues and contaminations are secured as above.

6. Preparation and transportation of radiological wastes for disposal by licensed authorities are regulated by 49 CFR, AR 385-11, and Belvoir R&D Center Reg 385-11.

DEPARTMENT OF THE ARMY

US ARMY BELVOIR RESEARCH AND DEVELOPMENT CENTER'S

ENVIRONMENTAL REPORT

ACCOMPANIED WITH

RENEWAL OF NUCLEAR REGULATORY COMMISSION'S

BYPRODUCT MATERIAL LICENSE NUMBER

45-00953-01

FORT BELVOIR, VA 22060

PREPARED BY Michael D. Funkhouser

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EMIL J. YORK
C, Materials, Fuels and
Lubricants Laboratory

DEPARTMENT OF THE ARMY

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I. Proposal. The US Army Belvoir Research and Development Center proposes to renew its US Nuclear Regulatory Commission's (NRC) Material License Number 45-00953-01, expiration dated 31 Mar 84. This center proposes to receive, use, store, and transport NRC byproduct material whose aggregrate activity (curie) does not exceed the Schedule of limiting Possession Limits at Title 10, Code of Federal Regulations, Part 30, Proposed Rule Making (10 CFR 30). This Environmental Report is submitted concurrent with renewal of NRC Material License Number 45-00953-01, Form-313, Application for Byproduct Material License, IAW 10 CFR 30.

II. Purpose. This center is a leading research, development, testing, and evaluation (RDTE) laboratory which reports through the US Army Troop Support Command to the US Army Material Development and Readiness Command (DARCOM), a Department of the Army (DA) Major Command. Concurrent DA, DARCOM, Night Vision and Electro-Optical Laboratory, and Belvoir R&D Center contractural agreements, military specifications, and mission requirements authorize the procurement, receipt, use, storage, and transfer of NRC byproudct material which are incorporated as manufactured commodities, devices, equipment, gauges, and radiological standards.

A. The Belvoir R&D Center proposes to continue its use and storage of the following NRC authorized byproduct materials:

Byproduct Material	Chemical and Physical Form	Maximum Amount
1. Any byproduct material of atomic numbers 1 thru 83, inclusive.	Sealed: Any Chemical Form	Not to exceed 500 millicuries per radionuclide and 50 curies of total activity.
2. Any byproduct material of atomic numbers 1 thru 83, inclusive.	Unsealed: Any Chemical Form	Not to exceed 250 millicuries per radionuclide and 25 curies of total activity.
	Additional Radioactivities	
3. Hydrogen-3	Sealed luminous sources: gas, paint, plastic.	Not to exceed 25 curies per source and 1500 curies of total activity.
4. Hydrogen-3	Unsealed: Any Chemical Form	Not to exceed 25 curies per source and 100 curies of total activity.

5. Cobalt-60	Sealed: Any gauge, device or calibration standard.	Not to exceed 10 curies per source and 100 curies of total activity.
6. Cesuim-137	Sealed: Any gauge, device, or calibration standard.	Not to exceed 10 curies per source and 100 curies of total activity.
7. Promethium-147	Sealed: Any gauge, device, or calibration standard.	Not to exceed 1 curie per source and 50 curies of total activity.
8. Polonium-210	Sealed: Any Chemical Form	Not to exceed 1 curie per source and 2 curies of total activity.
9. Polonium-210	Unsealed: Any Chemical Form	Not to exceed 250 millicuries per source and 250 millicuries of total activity.
10. Americium-241	Sealed: Any gauge, device or calibration standard.	Not to exceed 5 curies per source and 50 curies of total activity.
11. Americium-241/Cesium-137	Sealed: Any gauge, device, or calibration standard.	Not to exceed 50mCi of Am-241/ 10mCi of Cs-137 per item and 3 curies of total activity.
12. Any byproduct material of atomic numbers 89 through 99, inclusive.	Unsealed: Any chemical form as traceable calibration or reference standard.	Not to exceed 1 millicurie per radionuclide and 10 millicuries of total activity.

B. The Belvoir R&D Center further proposes to reduce and maintain unnecessary exposure to dose equivalent (millirem) that is as low as reasonably achievable (ALARA) which is detailed at 10 CFR 20, Belvoir R&D Center Reg 385-11 Safety: Radiaton Protection Program, and written standing operating procedures.

III. Alternatives. Substitution of nonradioactive nuclides will preclude performance of select Belvoir R&D Center mission directives which are subordinate to Department of the Army (DA) quality assurance procedures, military specification, ongoing contractural agreements, and DA rules and regulations. The radioactive nature of NRC byproduct material is incidental to their electrical, optical, mechanical, luminescent, and physical properties which are characteristic of alloys, devices, gauges, meters, phosphors, and reference standards. NRC byproduct materials are essential for accurate calibration of radiation detecting and measuring devices, gauges, luminescent sources, radiography, and environmental samples. Analyses identify inherent radiological properties essential to sound radiation protection practices as detailed at Belvoir R&D Center Reg 385-11. Materials of required properties can not be separated from their incidental radiological characteristics. The Belvoir R&D Center can not complete select mission requirements with nonradioactive substitutes.

IV. Environmental Impact. All NRC byproduct materials are controlled and used by authorized civilian and military personnel following approval from the Belvoir R&D Center Radiation Control Committee (RCC). Radioactive materials are confined, secured, and utilized in specially designated laboratory rooms and storage vaults. Personnel are monitored with thermoluminescent dosimeters, pocket dosimeters, or film badges, which are attached to their wearing apparel. Individual bioassay samples are collected and evaluated monthly as required. Designated laboratory rooms are equipped with continuous environmental air monitors. Individual and environmental monitors document exposures to dose equivalent (millirems) that is ALARA in compliance with state, local, and federal rules and regulations as referenced at para VII. Unwanted radioactive materials and contaminated wastes in solid or liquid forms are collected and packaged at Belvoir R&D Center for transportation by carrier to a NRC licensed authority for disposal in accordance with local, state, and federal rules and regulations. Advanced instructions are secured from Commander, US Army Armament, Munitions, and Chemical Command (AMCCOM), Rock Island, Illinois, prior to preparation and transportation of unwanted radioactive materials and contaminated wastes to AMCCOM. Gaseous or suspended aerosols of radionuclides are filtered or scrubbed prior to atmospheric discharge in concentrations not exceeding the standards listed in 10 CFR 20. Solutions of radionuclides are filtered or diluted prior to sanitary discharge in quantities not exceeding standards listed in 10 CFR 20.

Periodic, routine, or daily radiological measurements, calculations, and surveys document control and regulatory compliance of NRC byproduct materials which are stored or used at Belvoir R&D Center. Contaminated wastes are transported to NRC licensed authority. Discharge of radioactive liquids and gases is negligible. Continued use and storage of NRC byproduct materials at Belvoir R&D Center presents no adverse environmental impact upon renewal of NRC Byproduct Material License Number 45-00953-01, Application for Byproduct Material License, Form NRC-313, 10 CFR 30.

V. Compliance. As described in this Environmental Report, the Belvoir R&D Center is in compliance with all applicable NRC, EPA, DOT, and DA rules and regulations authorizing receipt, use, and transportation of NRC byproduct materials. The following inspections by independent federal agencies further demonstrate compliance with local, state, and federal rules and regulations:

A. US Nuclear Regulatory Commission's "Inspection Findings and License Acknowledgements," Form NRC-591, 1980.

B. DARCOM Field Safety Activity's "Safety Program Evaluation," 1981.

C. DARCOM Field Safety Activity's "Safety Program Evaluation," 1982.

D. US Army Environmental Hygiene Agency's "Radiation Protection Survey," 1981.

VI. Persons consulted:

A. Mr. Jack Dixon, Chief, Safety, Health and Environmental Office, ATTN: STRBE-Q, Ft. Belvoir, VA, 22060.

B. Dr. Vincent J. Ciccone, Safety, Health, and Environmental Office, Environmental Consultant, ATTN: STRBE-Q, Ft. Belvoir, VA, 22060.

C. Mr. Robert C. McMillan, Chief, Radiation Research Group; Materials, Fuels and Lubricants Laboratory, ATTN: STRBE-VR, Ft. Belvoir, VA, 22060.

D. Dr. Ramachandra Bhat, Health Physicist, Radiation Research Group; Materials, Fuels and Lubricants Laboratory, ATTN: STRBE-VR, Ft. Belvoir, VA, 22060.

E. Mr. Michael Funkhouser, Radiation Protection Officer, Radiation Research Group; Materials, Fuels and Lubricants Laboratory, ATTN: STRBE-VR, Ft. Belvoir, VA, 22060.

VII. References.

A. Army Regulation 40-14, Medical Services: Control and Recording Procedure for Occupational Exposure to Ionizing Radiation, Headquarters, Department of the Army, Washington, DC, 1975.

B. Army Regulation 200-2, Environmental Quality: Environmental Effects of Army Actions, Headquarters, Department of the Army, Washington, DC, 1981.

C. Army Regulations 385-11, Safety: Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety), Headquaters, Department of the Army, Washington, DC, 1980.

D. Belvoir R&D Center Reg 11-5, Army Programs: Belvoir R&D Ctr Environmental Control/Enhancement (EC/E) and Hazardous Material Disposal (HMD) Program, Belvoir R&D Ctr, Ft. Belvoir, VA, 1983.

E. Belvoir R&D Center Reg 385-11, Safety: Radiation Protection Program, Ft. Belvoir, Virginia, 1983.

F. US Nuclear Regulatory Commission Rules and Regulations, Title 10-Chapter 1, Code of Federal Regulations (CFR), Washington, DC, 1981.

SUPPLEMENT A

1. Reference: Item 1b, NRC Form-313.

2. Research, testing, development, and evaluation (RTDE) will be conducted at US Army Belvoir Research and Development Center, US Army Night Vision and Electro-Optical Laboratory (NV&EOL), and US Army tenantlike sites and facilities located at Fort Belvoir, Virginia.

3. Demonstration and RTDE of experimental commodities, systems, and byproduct materials will be conducted and preformed by authorized personnel of Belvoir R&D Center or NV&EOL. Mission directives may require demonstration, field evaluation, and recommended modifications of experimental items at Department of Defense (DoD) installations, CONUS.

4. Upon shipment of experimental devices incorporating byproduct materials to DoD facilities, the following procedures are followed:

a. Request for permission from the installation's Commander to receive radioactive materials.

b. Monitor and survey radioactive sources for leakage and mechanical integrity.

c. Ship and transport radioactive devices IAW applicable NRC, DOT, and DA rules and regulations.

d. Supervise use of radioactive device by qualified radiation worker as authorized at Supplement B, Annex B-1, Belvoir R&D Center Reg 385-11.

5. Authorized, site, radiation worker will:

a. Secure radioactive devices from loss or misplacement.

b. Secure appropriate radiation monitors.

c. Alert observers of possible radiological exposure and take appropriate precautions to minimize exposures that are ALARA.

d. Remove damaged items from site of demonstration.

e. Recover broken parts.

f. Decontaminate ruptured source, device, or personnel if contaminated by radioactive materials.

g. Notify local RPO for assistance and call Belvoir R&D Center's RPO, AUTOVON 354-5437, for guidance.

h. Return all radioactive devices or parts to Belvoir R&D Center.

DEPARTMENT OF THE ARMY
US ARMY BELVOIR RESEARCH AND DEVELOPMENT CENTER
FORT BELVOIR, VIRGINIA 22060

BELVOIR R&D CENTER
REGULATION 385-11*

SAFETY

Radiation Protection Program
(Microwave, RF, Laser, X-Ray, and Radionuclide)

17064

BELVOIR R&D CENTER
REGULATION 385-11

CHAPTER 1.
RADIOLOGICAL PROTECTION PROGRAM
Section I. INTRODUCTION

1-1. Purpose. This regulation establishes the Belvoir R&D Center Radiation Protection Program and the Belvoir R&D Center Radiation Control Committee (RCC). It outlines the duties and responsibilities of the Belvoir R&D Center Radiation Protection Officer (RPO), the Belvoir R&D Ctr Laser Safety Officer (LSO), the Belvoir R&D Center Radiation Research Group (RRG), and authorized RADIATION WORKERS. It prescribes regulatory requirements and safety practices for all individuals authorized to receive, procure, use, possess, store, transport, or dispose of high intensity NONIONIZING and IONIZING SOURCES (HIN&IS) of RADIATION. (See GLOSSARY for terms and definitions as indicated in capital letters).

1-2. Scope.

a. This regulation applies to all military and civilian personnel assigned duties at Belvoir R&D Center and US Army Night Vision and Electro-Optics Laboratory (USNV&EOL) under Interservice Support Agreement; and who receive, use, store, transport, or dispose of HIN&IS of radiation. It likewise applies to all personnel from Government and non-Government agencies authorized to receive, use, store, transport, or dispose of HIN&IS of radiation under the administrative control of the Commander, Belvoir R&D Center, and the Director, USNV&EOL.

b. Each tenant organization, under the administrative control of the Commander, US Army Engineer Center and Fort Belvoir, Fort Belvoir, Virginia, that receives, procures, uses, possesses, stores, transports, or disposes of HIN&IS of radiation must develop a "Safety, Radiation Protection Program" in accordance with (IAW) DARCOM-R 385-100.

1.3. Definitions. See GLOSSARY for terms identified in CAPITAL LETTERS. Ionizing terms listed at para 2-9; nonionizing terms listed at para 3-11.

1-4. Policy.

a. HIN&IS of radiation shall be utilized toward the accomplishment of assigned research, testing, evaluation, and development of command missions and directives.

b. Proposals to procure and use HIN&IS shall be submitted to the RCC through the RPO/LSO. Complete standing operating procedures (SOP) must be submitted, and approved facilities and safety equipment must be furnished prior to utilization and operation of HIN&IS. Authorized personnel and radiation workers shall be trained and medically examined; applicants shall be approved by the RCC. Furthermore, radiation workers shall be issued individual copies of this regulation. Each shall read its directives and applicable SOP's before engaging assigned tasks with HIN&IS of radiation.

c. The following radiological standards shall be rigorously enforced.

(1) Protracted exposure to high intensity ionizing radiation may inflict an acute or chronic radiological injury or adverse HEMATOPOIETIC response which can be life-threatening. Therefore, all personal exposures to radiations shall be reduced and maintained at levels that are as low as reasonably achievable (ALARA) and ideally at DE MINIMIS. Personal exposure to ionizing radiation shall not exceed those QUANTITIES as specified in the ionizing radiological protection standards and promulgated at:

(a) Title 10, Code of Federal Regulation (10 CFR),
(b) AR 40-14, Medical Services: Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials,
(c) DARCOM-R 385-1, Safety Preparations of Standing Operating Procedures (SOP) for Ammunition Operations.

(2) Protracted exposure to high intensity nonionizing LASER RADIATION may inflict serious skin-burn or adverse ocular impairment. Therefore, all personal exposures shall not exceed those QUANTITIES as specified in the nonionizing radiological protection standards as promulgated at:

(a) AR 40-46, Medical Services: Control of Health Hazards from Lasers and Other High Intensity Optical Sources,

(b) TB MED 279, Department of the Army Technical Bulletin: Control of Hazards to Health from Laser Radiation. (To be superseded by TB MED 524.)

(3) Protracted exposure to high intensity nonionizing MICROWAVE or RADIOFREQUENCY (R/F) radiation can also inflict serious skin-burn, adverse lenticlar opacities, or adverse physiological response. Therefore, all personal exposures shall not exceed those QUANTITIES as specified in the nonionizing radiological protection standards as promulgated at:

(a) AR 40-583, Medical Services: Control of Potential Hazards to the Health from Microwave and Radio Frequency Radiation,

(b) TB MED 523, Technical Bulletin, Control of Hazards to Health from Microwave and Radiofrequency Radiation and Ultrasound.

d. These regulatory standards follow the recommendations of the following acknowledged national and international authorities on radiological protection:

(1) American National Standards Institute (ANSI),

(2) Bureau of Radiological Health (BRH),

(3) International Atomic Energy Agency (IAEA),

(4) International Commission on Radiation Units and Measurements (ICRU),

(5) International Commission on Radiological Protection (ICRP),

(6) National Council (Committee) on Radiation Protection and Measurements (NCRP).

e. A radiological accident or incident shall be reported to the Commander, Belvoir R&D Center; the RCC membership, the Pubic Affair's Officer, and appropriate authorities IAW 10 CFR and AR 385-11.

1-5. Medical.

a. Radiation workers, who are assigned duties at designated RADIATION AREAS, and individuals who might be potentially exposed to high intensity IONIZING RADIATION shall complete a preplacement occupational health examination IAW AR 40-14. Initial, periodic, and final eye examinations are performed by the Occupational Health Clinic, HSXA-PVM, X45322, as required. Medical surveillance shall include preplacement, occupational, and terminal medical examination. The examination shall include medical history of previous occupational radiological, or unusual medical exposures to ionizing radiation. Baseline blood count (white cell count with differential, platelet count, and hemoglobin) will be performed. Bioassay, ophthalmic, slit-lamp, or total body count shall be selectively performed by competent medical authority as required.

b. Authorized personnel who are assigned duties at high intensity LASER sites and facilities and individuals who might be potentially exposed to high intensity nonionizing coherent OPTICAL RADIATION shall complete a preplacement occupational health examination IAW AR 40-46 and TB MED 279 (524). Initial, periodic, and final eye examinations are performed at the Occupational Health Clinic, HSXA-PVM, X45322, as required.

c. Authorized personnel assigned duties at high intensity MICROWAVE or RADIOFREQUENCY (R/F) sites and facilities and who might be potentially exposed to high intensity nonionizing microwave and R/F radiation shall complete a preplacement occupational health examination IAW AR 40-583 and TB MED 523. Initial, periodic, and final eye examinations are performed at the Occupation Health Clinic, as required.

d. Request for preplacement, annual, periodic, or terminal occupational health examinations shall be forwarded by the RPO/LSO IAW this regulation.

1-6. Dosimetry.

a. Each occupationally exposed individual shall wear a personal primary whole-body film badge upon entering a controlled RADIATION AREA. Film badges shall be worn between the shoulders and the hips and securely attached to a garment. Additional film badges can be promptly obtained from the RPO. DO NOT exchange or borrow unassigned film badges. Promptly report all suspected personal film badge exposures. Secure film badges at designated control sites upon leaving controlled radiation areas.

b. Auxiliary wrist-film badge may be worn to measure localized exposure as required. Finger badges, pocket chambers, or thermoluminescent dosimeter may also be worn as appropriate to specified radiological fields.

c. All dosimeters are controlled, issued, and processed periodically for evaluation by the RPO.

Section II. COMMAND RESPONSIBILITIES

1-7. Commander, Belvoir R&D Center. The Commander will formally authorize the following radiation protection program:

a. Authorize a formal written Radiation Protection Program. This program will incorporate pertinent rules and regula-

tions ensuring safe and productive utilization of HIN&IS of radiation necessary to accomplish mission goals and command directives.

b. Exercise compliance with all Federal, State, and local rules and regulations. In particular, the following provisions shall be vigorously enforced:

(1) 10 CFR 19, "Notices, Instructions, and Reports to Workers; Inspections,"

(2) 10 CFR 20, "Standards for Protection Against Radiation,"

(3) 10 CFR 21, "Reporting of Defects and Noncompliance."

c. Appoint in writing the Radiation Protection Officer (RPO) and the alternate RPO. (Does not denote commissioned status.)

d. Appoint in writing the Laser Safety Officer (LSO) and Laser Range Safety Officer (LRSO) as required. (Does not denote commissioned status.)

e. Create the Radiation Control Committee (RCC) and appoint in writing qualified members to the RCC. Membership to the RCC will consist of the following personnel:

(1) Chairman: Representative of the Commanding Officer, Belvoir R&D Center, Headquarters.

(2) Vice Chairman: Chief, Radiation Research Group.

(3) Action Officer: Radiation Protection Officer (RPO).

(4) Secretary: Representative from the Radiation Research Group.

(5) Member: Alternate RPO's; representative(s) each from the Safety, Health and Environmental Office, MEDDAC, FESA, and NV&EOL.

(6) Co-member: Representative(s) from tenant organization; Fort Belvoir, Virginia, as appointed in writing.

(7) Guest: Invited representatives from the Federal Government or tenant organization on official business.

f. Authorize application of required Nuclear Regulatory Commission (NRC) material licenses and Department of the Army Radiation Material Authorizations (DARMA) or permits.

1-8. Commander, Tenant Organization. Depending on the requirements of the mission, the Commander will authorize the following radiation protection program:

a. Authorize a formal, written radiation protection program IAW DARCOM-R 385-100.

b. Exercise compliance with all Federal, State, and local rules and regulations.

c. Appoint in writing a tenant organization Radiation Protection Officer. (Does not denote commissioned status.)

d. Appoint in writing a tenant organization Laser Safety Officer (LSO) and/or Laser Range Safety Officer (LRSO) as required. (Does not denote commissioned status.)

e. Create a tenant organization's Radiation Control Committee (TORCC) and appoint in writing qualified members to the TORCC.

f. Authorize application of required NRC specific licenses and DARMA.

g. Limits this regulation to Belvoir R&D Center and USNV&EOL under Interservice Support Agreement, and tenant organizations as specified by this regulation.

1-9. Commander, Medical Department Activity, (MEDDAC). The Commander will execute the following functions:

a. Enforce medical standards and formulate policies.

b. Perform relevant physical examinations and conduct clinical laboratory investigations IAW Department of the Army (DA) rules and regulations.

c. Act as custodian of employee's record of DOSE EQUIVALENT on DD Form 1141, "Record of Occupational Exposure to Ionizing Radiation."

d. Extend critical medical services to individuals and personnel bearing physical or radiological injury following unplanned exposure to high intensity nonionizing, optical, laser, or ionizing radiation.

1-10. Director, USNV&EOL. Under the Interservice Support Agreement, the Belvoir R&D Center RPO/LSO shall serve as USNV&EOL RPO/LSO. This regulation applies to all military and civilian personnel assigned duties at the USNV&EOL who procure, receive, use, store, transport, or dispose of HIN&IS of radiation. The RPO/LSO shall obtain required NRC specific licenses and DA radioactive material authorizations or permits toward accomplishment of USNV&EOL mission directives. Request for microwave, laser, x-ray, DA, or NRC local permits to procure, receive, use, store, transport, or dispose of HIN&IS of radiation shall be submitted to the RCC for approval through RPO/LSO, X45437 or X45133, STRBE-VR, Building 363. The RPO/LSO shall exercise all duties and responsibilities as specified in this regulation and applicable DA radioactive material authorizations or permits and NRC specific license requirements.

1-11. Director, Procurement and Production Directorate. The Director, Procurement and Production Directorate, shall confirm the RPO/LSO's approval for requisitioner's purchase of high intensity nonionizing and ionizing sources of radiation. Such sources can include microwave and radiofrequency klystrons, or magnetrons; commercial lasers or military exempt lasers (AR 385-9 and AR 385-16); electronic x-ray units; DA commodities or NRC licensed radionuclides, or any item of issue that incorporates sources of coherent nonionizing or ionizing radiation.

1-12. Chief, Supply and Property Accounting Division. The Chief of Supply and Property Accounting Division will promptly inform the RPO, X45437 or X45133, and the receiving tenant organization of shipments containing radiological sources including DA commodities or NRC licensed materials that incorporate ionizing sources of radiation. Following a radiological survey by the RPO, ionizing sources may be delivered to the principal user of the requesting tenant organization.

1-13. Chief, Safety Health and Environmental Office. The Chief of the Safety Office will inform and advise the RPO/LSO of general issues of health and safety that may impact on the local Radiation Protection Program.

1-14. Tenant Project Managers.

a. Tenant Project Managers who service DA commodities that incorporate DA/NRC radiological materials will consult with the RPO for guidance concerning procurement, fielding, training, user instructions, control, storage, transportation, maintenance, disposal, and radiological issues that impact on health and safety.

b. Specific Federal, DoD, and DA requirements will be reviewed and enforced IAW:

(1) Title 10, Code of Federal Regulations,

(2) Title 49, Code of Federal Regulations,

(3) AR 385-11, Safety: Ionizing Radiation Protection (Licensing, Control Transportation, Disposal, and Radiation Safety),

(4) AR 700-64, Radioactive Commodities in the DoD Supply Systems,

(5) AR 40-14, Medical Servies: Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials,

(6) "Notice of Radioactive Materials" Clause from The Armed Services Procurement Regulation (ASPR) Clause 7-104.80,

(7) AR 385-16, System Safety Engineering and Management,

(8) AR 385-9, Safety: Requirements for Military Lasers.

Section III. ORGANIZATIONAL RESPONSIBILITIES

1-15. Belvoir R&D Center Radiation Control Committee (RCC). The RCC will perform the following functions:

a. Inform the Commander of relevant Federal, DA, DARCOM and Nuclear Regulatory Commission (NRC) rules and regulations which impact on the Commander's directives.

b. Advise the Commander of current radiological health and safety issues and their impact on the requirements of the mission and command directives.

c. Call the Commander's attention to semiannual meetings of the RCC by DF to the Technical Director from the RPO.

d. Conduct routine business with the Commander and the membership of the RCC by mail ballots.

e. Document attendance, expedite matters of concern, resolve conflicts, discuss and (dis)approve proposed actions, and recommend policy to the Commander.

f. Prepare and forward minutes of the RCC to the Commander and membership.

g. Coordinate administrative issues among the membership of the RCC.

h. Set safety policies and guidelines at local labs, sites, and facilities that procure, receive, use, possess, store, transport, or dispose of HIN&IS of radiation.

i. Recommend disciplinary action following any radiological safety infraction in violation of the Nuclear Regulatory Commission (NRC) and RCC guidelines and local standing operating procedures (SOP).

j. Discuss and resolve conflicts between regulatory requirements and Commander's directives.

k. Review and comment on applications and amendments to NRC specific license and DA radiation authorization.

l. Review educational standards and credentials for proposed radiation workers; set training standards and testing criteria; and enforce regulatory requirements and local SOP's.

m. Investigate hazardous radiological incidents and personal overexposure to HIN&IS of radiation; rectify faulty equipment and procedures; remonstrate unsafe and careless behavior; submit required reports to DA, DARCOM, and NRC authorities.

n. Delegate authority to the Radiation Research Group which shall perform each and all duties and functions commensurate with Federal, State, DA, DARCOM, DOT, NRC, and local rules and regulations authorizing procurement, receipt, use, storage, transfer, and disposal of HIN&IS of radiation.

o. Consider proposed local recommendations which impact on the Radiation Safety Program. Review, amend, and approve relevant SOP's that minimize radiological hazards.

p. Authorize procurement, acquisition, and replacement of HIN&IS of radiation as required.

q. Admonish each individual, radiation worker, and supervisor to read and adhere to the established rules and regulations.

1-16. Belvoir R&D Center Radiation Protection Officer (RPO). The RPO is a member of the Radiation Research Group; Material, Fuels, and Lubricants Laboratory; Building 363; Fort Belvoir, Virginia. The RPO will exercise the following functions:

a. Advises the Commander of current radiological issues of health and safety that impact on the requirements of the mission and directives of the Commander through the RCC.

b. Authorizes the suspension of potentially hazardous proceedings and workmanship with HIN&IS of radiation pending recommendations of the RCC.

c. Serves on the RCC as Action Officer who is the Radiation Protection Officer (RPO) and Laser Safety Officer (LSO). Under the Interservice Agreement, the RPO/LSO also serves as USNV&EOL RPO/LSO.

d. Promotes and extends local radiological protection services limiting potentially hazardous exposures to high intensity microwave, optical, laser, and ionizing sources of radiation at the USNV&EOL under the Interservice Support Agreement.

e. Serves on the Fort Belvoir Ionizing Radiation Control Committee as Belvoir R&D Center liasion and coordinator to the US Army Engineer Center and Fort Belvoir; Fort Belvoir, Virginia.

f. Approves contracts, requisition, purchase, and transfer of HIN&IS of radiation.

1-17. The Belvoir R&D Center Radiation Research Group (RRG). The Radiation Research Group will execute the following functions under the authority of the Commanding Officer, the Radiation Control Committee (RCC), and the Chief of the RRG:

a. Enforce radiological rules and regulations as promulgated by Federal, State, DA, DARCOM, DOT, NRC, and local authorities

b. Execute provisions and recommendations of the RCC.

c. Advise, assist, and instruct the Commander, supervisors, project managers, radiation workers, and authorized personnel on relevant radiological issues that impact on health and safety.

d. Prepare documents, coordinate agreements, compose amendments, and submit timely application for/or renewal of Nuclear Regulatory Commission (NRC) specific license and (DARMA).

e. Schedule periodic radiological safety orientation; develop training materials; and instruct radiation workers and authorized personnel upon assignment to RADIATION AREAS.

f. Issue radiological permits to local functional units which are authorized to procure, receive, store, and utilize HIN&IS of radiation.

g. Perform and document routine microwave, radiofrequency, laser, DA, or NRC radiological survey and inspection at local sites and facilities where HIN&IS of radiation are stored and utilized IAW DA, NRC, and local rules and regulations.

h. Evaluate and test safety systems, personal protection devices, and contingency plans (alarms, goggles, shields, refractors, SOP's).

i. Investigate suspected and reported overexposures to HIN&IS of radiation in excess of DA and NRC radiological protection standards. Prepare and maintain documentation of radiological incident; impose disciplinary recommendations; remove and replace faulty component, amend procedure; and submit formal reports to the Commanding Officer, Belvoir R&D Center; the RCC, and required DA, DARCOM, Office of The Surgeon General, and NRC authorities as required by AR 385-40.

j. Verify completion of required medical examination by radiation workers IAW AR 40-5, AR 40-46, AR 40-583, TB MED 279 (524) and TB MED 523.

k. Review and coordinate requisitions for procurement of all HIN&IS of radiation.

l. Conduct a semiannual inventory of local HIN&IS of radiation.

m. Maintain monthly radiation protection records of dose equivalent on DA Form 3484, "Photodosimetry Report-Exposure to Ionizing Radiation," and DD Form 1141, "Record of Occupational Exposure to Ionizing Radiation."

n. Provide personal monitoring devices and radiological protection services for radiation workers and authorized personnel as needed.

o. Monitor shipments and packages incorporating radionuclides; verify pertinent DA, NRC, and DOT requirements.

p. Procure, operate, and maintain radiological detection and electronic equipment; calibrate survey instruments as required.

q. Maintain records of receipt, transfer, and disposal of HIN&IS of radiation.

r. Perform radiological decontamination functions as required; seek competent assistance as needed.

s. Escort authorized DA and NRC inspectors and visitors as required; reply to their recommendation.

t. Request special safety surveys through DARCOM, Headquarters, ATTN: DRCSF, upon development and testing of novel HIN&IS of radiation as needed.

u. Review standing operating procedures (SOP) for accuracy and completeness; coordinate copies of SOP with members of the RCC, supervisors, radiation workers, and authorized personnel.

v. Post relevant DA, DARCOM, NRC, DOT documentation and local SOPs as required. Retain complete DA radiation authorization, NRC specific licenses, and their supporting documentation at the office of the Radiation Research Group, Room 136, Building 363. Inspection of authorized documentation is invited.

w. Receive and prepare local radiological wastes for storage and disposal.

x. Conduct radiological testing and evaluation of DA commodies as directed; record data and supply documentation and recommendations.

y. Monitor environmental background radiation and radionuclides released into the environment; prepare documentation and submit Environmental Impact Statement as required.

z. Study prescribed technical documents, tests, and analyses; report radiological health implications to DARCOM H quarters and Major Commands.

aa. Write and forward minutes of the RCC to the Commander and membership.

ab. Write technical procedures for inclusion in military specifications and technical bulletins as required.

ac. Preserve and utilize the Radiation Research Group's Technical Library; obtain pertinent Federal regulations, national and international publications, and texts of health physics and radiological protection; subscribe to related technical journals and publications; and procure texts, brochures, pamphlets, films, slides, and educational paraphernalia as needed.

ad. Maintain and preserve comprehensive file of records and documents as required by the Radiation Protection Program. Periodic inspection of files is required by authorized personnel from DA, DARCOM, and NRC.

ae. Maintain and refine critical procedures contingent upon unplanned radiological incident or emergency.

af. Monitor all shipments of devices incorporating radionuclides arriving at Belvoir R&D Center, Chief of Supply and Property Accounting Division, Building 335, within three hours of its arrival during business hours or within 18 hours of its arrival during evening or weekend hours. Equivalent dose rates greater than ten mrem/hr at three feet or 200 mrem/hr on contact or removable radioactive contamination in excess of 22,000 dpm (0.01 microcurie) per 100 square centimeters of package requires regulatory response IAW 10 CFR 20.205.

ag. Survey high voltage power supplies over 15,000 volts for collateral generation of x-rays including x-ray tubes, electronic microscopes, diffractometers, magnetrons, klystrons, and accelerators.

ah. Perform periodic physical inventory and survey of DA/NRC licensed materials IAW relevant criteria at 10 CFR, 49 CFR, AR 700-64, AR 385-11, and local SOP's.

CHAPTER 2
THE IONIZING RADIATION PROTECTION PROGRAM
Section I. INDIVIDUAL RESPONSIBILITIES

2-1. Belvoir R&D Center and USNV&EOL Supervisors of Ionizing Radiation Workers. Supervisors of ionizing radiation workers assigned duties in RADIATION AREAS will execute the following functions:

a. Apply, prior to procurement, for a local x-ray, DA, or NRC permit for radionuclide for each function element; submit an application by DF to the RCC through the RPO, ATTN: STRBE-VR, Building 363, before acquisition of x-ray tubes, DA, or NRC licensed materials. (This action alerts this office of its responsibilities to comply with applicable NRC, DOT, DA, DARCOM, and local rules and regulations.)

b. Coordinate contract, requisition, or purchase of x-ray units, DA, or NRC licensed materials with the RPO. Clearly note RPO's signed approval on all applicable documents.

c. Complete STRBE FM 1-33, Appendix A(1), "Ionizing Inventory of NRC/DA Radionuclides," or

d. Complete STRBE FM 1-34, Appendix A(2), "Ionizing Inventory of Electronic X-Ray Devices," and

e. Co-sign with applicant STRBE FM 6-19, Appendix A(3), "Profile of Ionizing Radiation Worker."

f. Prepare a signed SOP outlining procedures that limit exposures to quantities of ionizing radiation that is ALARA. Post copies of SOP and forward signed copy to the RPO. Enforce safety procedures as outlined in SOP.

g. Instruct radiation workers and demonstrate proper use of radiological devices, materials, commodities, or sources of ionizing radiation.

h. Observe posted radiological signs and labels of warning, caution, or danger. Read posted notices and documents:

(1) NRC Form 3.

(2) Statement: "Energy Reorganization Act," P.L. 93-438, Sec. 206.

(3) DF, STRBE-VR, Subject: "Title 10 CFR 21, Reporting of Defects and Noncompliance."

(4) Procedures for Identifying Items to be Reported to The Nuclear Regulatory Commission (NRC) under 10 CFR 21.

(5) Notice to Works: Copies of NRC License A45-00953-01, DA Authorizations A45-95-03 and A45-95-04; NRC Rules and Regulations: 10 CFR and 10 CFR 19,20, and 21 can be examined at the Material, Fuels, and Lubricants Laboratory; Building 363; Chief, Radiation Research Group, Room 136, Phone X45437.

(6) Belvoir R&D Center-R 385-11. Safety: Radiation Protection Program (Microwave, RF, Laser, X-ray, and Radionuclide).

(7) SOP'S.

i. Maintain current inventory and location of IONIZING SOURCES of radiation. Secure them against unauthorized use.

j. Coordinate by DF to the RPO changes in inventory or personnel. Submit timely amendments or cancellation of local permits.

k. Report abnormal operating parameters or radiological exposures to the RPO. Secure maintenance and radiological survey prior resumption of normal operating procedures.

l. Assist RPO and investigate suspected injuries or unusual exposures to ionizing radiation in EXCESS of 10% of the regulatory standards. Supply documentation, contact medical authorities; report FIRE to the fire department.

m. Prohibit eating, drinking, pipetting, chewing, smoking, and application of cosmetics in RADIATION AREAS.

n. Separate and identify contaminated laboratory refuse by radionuclide and activity.

o. Transfer all unwanted DA/NRC licensed radionuclides to the radiological storage vault. (The RPO will assist transfer.)

2-2. Local Permits.

a. Each local function element shall apply for a local radiological permit to procure, receive, use, store, and transport ionizing sources of radiation IAW the requirements of the mission and this regulation. Application shall be submitted through the RPO to the RCC. Application shall include information at Appendix A(1), or Appendix A(2). In addition, application shall include relevant SOP that specifies use and procedures that will minimize potentially hazardous exposure to ionizing radiation that is ALARA.

b. Non-Army agencies including civilian contractors located on Army installations shall be issued local permit upon receipt of approved Department of the Army (DA) radioactive material permit. Permits shall authorize use and storage of ionizing soruces of radiation at Army installations as specified. Application for DA permit are completed IAW AR 385-11, Chapter 2.

c. Federal or non-Federal agencies may be issued temporary permits of less than 15 calendar days for use, storage, or demonstration of items incorporating sealed radionuclides provided agency retains relevant NRC license or Agreement State license and coordinates its use with the Fort Belvoir Radiation Control Committee.

d. Each tenant organization shall request amendment of local permit upon change of inventory of ionizing sources of radiation or upon change of personnel assigned work with ionizing sources of radiation. Each additional source of ionizing radiation (DA authorized or NRC licensed material) shall be inventoried at Appendix A(1) or A(2) by DF. New personnel assigned work with ionizing sources of radiation shall complete Appendix A(3).

2-3. Standing Operating Procedures (SOP).

a. A SOP shall be included with each local permit IAW paragraph 2-2. A SOP establishes an essential link between successor's assigned common duties. It details a precise sequence of actions and events that conclude a given assignment expeditiously and safely. A SOP is therefore required to

a given task. A local x-ray, DA, or NRC permit for acquisition and use of a radionuclide must include a SOP that specifies actions, methods, or techniques that minimize exposure to ionizing radiation that is ALARA. The following outline should be developed IAW the severity of the radiological hazards associated with analysis, application, calibration, development, dosimetry, evaluation, gauging, quality control, research, survey, testing, transportation, study, or waste of IONIZING SOURCES:

(1) Identification; see Appendix A.

(2) Personal conduct, monitors, and precautions; see paragraph 2-4.

(3) Exposure limits; see paragraph 1-4.

(4) Assignment and safety instructions.

(5) Equipment and materiels orientation.

(6) Hoods, respirators, shielding, tools, ventilation.

(7) Interlocks.

(8) Methods and techniques.

(9) Decontamination.

(10) Emergency response.

b. The following references can provide significant guidance and details that supplement required SOP's:

(1) AMCR 385-25, Safety: Radiation Protection

(2) ANSI Standards.

(3) AR Technical Bulletins.

(4) AR Technical Manuals.

(5) BRH Publications

(6) DARCOM-R 385-100

(7) IAEA Safety Series.

(8) ICRP Publications.

(9) ICRU Reports.

(10) NBS Handbooks.

(11) NCRP Reports.

2-4. Belvoir R&D Center and USNV&EOL Ionizing Radiation Workers. Radiation workers assigned duties at RADIATION AREAS will complete the following administrative and regulatory requirements:

a. Complete, STRBE FM 6-19, Appendix A(3), "Profile of Ionizing Radiation Worker." In addition, each applicant shall complete a Radiological Orientation, Training, and Protection Review as instructed by the RPO or alternate RPO IAW paragraph 1-4.

b. Complete preplacement occupational health examination IAW paragraph 1-5.

c. Receive personal monitor from the RPO and secure its use IAW paragraph 1-6.

d. Observe posted radiological signs and labels of warning, caution, or danger. Read posted notices and documents as listed at paragraph 2-1g and 1-6b.

e. Report abnormal operating parameters or radiological exposures to the supervisor.

f. Report lost or misplaced film badge and secure replacement from RPO.

g. Avoid eating, drinking, pipetting, chewing, smoking, and application of cosmetics in RADIATION AREAS. Avoid cross contamination.

h. Identify contaminated laboratory refuse by radionuclide and activity.

i. Will not attempt unauthorized repair, dismemberment, transfer, or disposal of an ionizing source of radiation.

j. Wear protective apparel, gloves, shoe covers, or respirator as prescribed by local SOP.

k. Utilize exhaust hoods, vents, traps, vacuum chambers, or glove boxes whenever radiological gases, fluids, aerosols, grindings, or unsealed sources are manipulated.

l. Continually monitor hands, shoes, and apparel. Wash hands thoroughly following contact with radionuclide.

m. Leave RADIATION AREA if skin is broken, cut, or scraped; notify RPO.

n. Keep work surfaces neat, clean, and free of extraneous objects and equipment; cover surfaces with absorbent material.

o. Use stainless steel trays or pans to limit and collect spillage.

p. Minimize radiological exposure that is ALARA.

q. Notify the RPO upon indication of pregnancy.

2-5. Employee's Exposures. All personal exposures to ionizing radiations shall not exceed those QUANTITIES as specified in the Nuclear Regulatory Commission's (NRC) Rules and Regulations: Title 10, Code of Federal Regulation (CFR), Part 20, "Standards for Protection Against Radiation," and AR 40-14. To insure that documented quantities of ABSORBED DOSE are "as low as reasonably achievable" (ALARA), individuals entering a controlled RADIATION AREA shall wear a personal dosimeter as specified by the RPO. Individual exposures shall be documented on DA Form 3484, "Photodosimetry Report - Exposure to Ionizing Radiation," and DD Form 1141, "Record of Occupational Exposure to Ionizing Radiation." Individual reports are available upon request to the RPO IAW 10 CFR 19, "Notices, Instructions, and Reports to Workers; Inspections."

2-6. Training.

a. Each individual working in or frequenting any portion of a controlled RADIATION AREA shall be informed of the storage, use, and transfer of ionizing sources of radiation. Radiological hazards, exposure levels, precautions, safety tools and techniques, reporting responsibilities, and emergency

response shall be specifically developed commensurate with the severity of the particular radiological hazard.

b. Each proposed ionizing radiation worker shall complete Appendix A(3). In addition, each shall complete a "Radiological Orientation, Training, and Protection Review" as instructed by the RPO or alternate RPO. Each applicant shall be informed of the following relevant requirements of the NRC rules and regulations at 10CFR:

(1) 10 CFR 19, "Notices, Instructions, and Reports to Workers; Inspections."

(2) 10 CFR 20, "Standards for Protection Against R ' tion."

(3) 10 CFR 21, "Reporting of Defects and Noncompliance."

(4) AR 40-14, Medical Services: Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials.

(5) Belvoir R&D Center-R 385-11, Safety: Radiation Protection Program.

c. More comprehensive instruction and training shall be provided to radiation workers, supervisors, and chiefs as requested. Instruction shall be commensurate with the severity of the radiological hazards and level of responsibility. Instructions shall include: fundamentals of radiation, radiological protection (ALARA), measurements (dosimetry, instrumentation, survey, mathematics), biological effects, and emergency response.

2-7. ALARA.

a. Personal exposure to ionizing radiation shall be ALARA. Administrative, engineering managing, and personal attention to the principles of radiological protection are essential qualities that minimize individual exposure to ionizing radiation. The judicious use of time, the imposition of shielding, and maximizing distance between the individual and sou ce of ionizing radiation together minimize ABSORBED DOSES that is ALARA. These principles are universally applicable.

b. Prompt completion of assign duties in RADIATION AREAS minimize ABSORBED DOSE. Isolation of ionizing sources of radiation in storage containers or repositories, walled enclosures or rooms, or incorporation as a sealed source, or commodity not only shields the source but also maximizes distances between the individual and the isolated source.

c. Manipulating point sources of radiation with extendable tools, maintaining arm's length between source and one's abdominal-chest can reduce ABSORBED DOSE to ionizing radiation by several orders of magnitude. Even the air, wearing apparel, and skin can function as significant shielding from external radiological sources of ionizing radiation. Dilution and physical decay of radionuclei can also significantly reduce EXPOSURES to ionizing radiations.

d. The principles of ALARA shall be exercised upon utilization, survey, decontamination, and disposal of any radiological source. Because of the extreme range by ten to twelve orders of magnitude of QUANTITIES that characterize ionizing sources of radiation, relevant SOP's, technical bulletins (TB's), documents, and regulations must be consulted to optimize the principles of ALARA for each radiological source IAW paragraph 2-3.

2-8. Emergency Response.

a. Notify supervisors and the RPO upon loss of ionizing source, spillage of radiological liquids, or release of radiological gases. The RPO will coordinate emergency personnel. Areal restrictions, continuous air and personal monitoring, use of prescribed chemical decontamination, selection of shielding, apparel, respirators, and absorbents, washing techniques, effluent control, and disposal of contaminated materials shall be assessed IAW paragraph 2-4, paragraph 2-5, relevant SOP, and the nature and severity of the radiological incident.

b. Fires shall be reported to the fire department. Use of carbon dioxide fog shall be emphasized. Fog minimizes spread of contamination. Liquid effluents shall be monitored.

Section II. GLOSSARY

2-9. Definitions.

a. ALARA. "As Low as Reasonably Achievable" is a NRC regulatory principle which limits exposure to ionizing radiation as far below the regulatory limits at 10 CFR 20 and AR 40-14 as practicable which are consistent with socio-economic interests and mission requirements.

b. De Minimis. An exposure to a quantity of ionizing radiation whose calculated biological risk of genetic or somatic injury is a "trifle and of no regulatory interest." A calculated stochastic risk of one radiation-induced-cancer-fatality per million per lifetime (70 years) represents a de minimis dose equivalent of 0.1 mrem per year.

c. Hematopoietic. Biological system which includes the blood, blood-components, and blood forming organs. Those somatic cells and tissues which are especially radiosensitive to adverse effects from exposure to ionizing radiation.

d. Ionizing Radiation. Subatomic or electromagnetic radiation capable of generating molecular ions in air or tissue. Subatomic radiation includes high velocity alphas, betas, protons (cosmic), neutrons; and electromagnetic radiation includes electronic or atomic x-rays or nuclear gamma radiation.

e. Ionizing Radiation Area. A controlled and restricted place that encloses a radiological field of ionizing radiation whose exposure rate exceeds two milliroengtens per hour but less than 100mR.hr^{-1}

f. Ionizing Radiation Source. Any material, commodity, equipment, or device which is capable of generating ionizing radiation.

(1) Nuclear reactors.

(2) Radiographic or fluoroscopic x-ray systems.

(3) Particle generators and accelerators.

(4) Klystrons, magnetrons, rectifiers, cold cathodes, or electron tubes operating at electric potentials above 10 kilovolts.

(5) X-ray diffractometers and spectrographic equipment.

(6) Electron microscopes.

(7) Electron-beam welding, melting, or cutting equipment.

(8) Radionuclides:

(a) Natural or accelerator produced radioactive materials (Co-57, Ra-226, Th-234, U-238).

(b) Byproduct materials (H-3, Co-60, Cs-137).

(c) Source materials (nat Th, nat U).

(d) Special nuclear materials (U-233, U-235, Pu).

(e) Fission products.

(f) Materials containing induced or deposited radionuclides.

g. Ionizing Radiation Worker. An individual who is occupationally exposed to ionizing radiation and assigned duties in a controlled and restricted ionizing radiation area.

h. Radiation. Transport of subatomic particles or electromagnetic energy at or near the speed of light. See IONIZING RADIATION at paragraph 2-9d and NONIONIZING RADIATION at paragraph 3-11d.

i. Radiation Area. See IONIZING RADIATION Area at paragraph 2-9e.

j. Radioactive Material. See IONIZING RADIATION Source at paragraph 2-9f.

k. Radionuclide. Any substance that spontaneously disintegrates liberating ionizing radiation. Uniquely characterized by its chemical symbol and mass number (Am-241).

1. Regulatory Standards. Federally imposed limits against exposure to ionizing radiation as promulgated at 10CFR, 49CFR, and AR 40-14.

2-10. Quantities and Limits.

a. Absorbed Dose. The amount of energy imparted from an ionizing source of radiation to a volume of irradiated tissue or matter divided by the mass of this volume. The gray is a SI unit of absorbed dose. One gray (Gy) equals one joule per kilogram. Also one gray equals 100 rads where one rad equals 100 ergs per gram.

b. Activity. The number of nuclear transformations or transitions occurring in an amount of a radionuclide or in a radioactive material. The becquerel is a SI unit of activity. One becquerel (Bq) equals one disintegration per second (dis sec^{-1}). One curie (Ci) equals thirty-seven billion becquerel.

c. Dose Equivalent. The amount of biologically significant dose. The sievert (Sv) is a SI unit of dose equivalent. One sievert is the product of the absorbed dose, quality factor, and distribution factor as assigned each type of ionizing radiation. One sievert equals 100 rem of biologically significant dose equivalent. A quality factor of one rem per rad of absorbed dose is assigned x-ray, gamma radiation, and soft beta particles. A quality factor of 10 rem per rad of absorbed dose is assigned high energy neutrons, protons, or alphas. Heavy recoil nuclei are assigned a quality factor of 20 rem per rad of absorbed dose. Values assigned to quality factor can vary depending on the biological effect and the energy distribution of the ionizing radiation. A unitless biological distribution factor of one has been recommended by the International Commission or Radiological Units.

d. Exposure. The amount of ionization or electric charge generated in air by x-ray or gamma radiation. The roentgen is a special unit of exposure. One roentgen (R) equals 258 microcoulombs per kilogram of air.

2-11. References. Extensive listing of radiological terms, definitions, quantities, and units are listed at references at paragraph 2-3b and at each AR and TB MED cited in Chapter 1 and Chapter 2.

CHAPTER 3
THE NONIONIZING RADIATION PROTECTION PROGRAM
Section I. INTRODUCTION

3-1. Scope. This program extends to all Belvoir R&D Center and NV&EOL function-elements which procure, store, utilize, and dispose of laser sources of coherent radiation. As a potentially hazardous source of high intensity NONIONIZING RADIATION, commerical, communication, educational, industrial, medical, military, and research lasers are classified potentially hazardous by the American National Standards Institute (ANSI) and the Bureau of Radiological Health (BRH). Sanctioned by the Federal Register and the Code of Federal Regulations, each laser is characterized by its Laser Hazard Classification (LHC). Accordingly, each laser is designated Class I, Class II, Class IIIa, Class IIIb, Class IV, or Class V, enclosed.

3-2. Policy. The nonionizing radiation protection program consists of five managerial principles. Prudent and reasonable application of administrative controls, engineering safeguards, medical surveillance, responsible conduct, and prompt response to an unplanned radiological incident will greatly expedite compliance with Department of the Army (DA) rules and regulations and promote a safe and healthful working environment. Application and enforcement of each principle is adapted to the laser's graduated LHC. Lasers are stored and utilized at designated indoor laboratory facilities. Laboratories perform RDT&E services for DA/DARCOM by skilled scientists and technicians and conscientious observers.

3-3. Laser Hazard Classification (LHC).

a. The LHC is an alpha-numeric scale applied to each manufactured laser. Each class denotes a relative degree of hazard associated with inadvertent or careless exposure to laser radiation. The principal biological hazard is a measured retinal or corneal LESION, charring of skin, or destruction of sensitive ocular tissues following direct, diffuse, specular, or reflected exposure to intense coherent laser radiation. Each LHC further connotes a level of managerial control designed to alert investigators and casual observers of serious biological and remedial consequences following careless or cavalier attention to pertinent safety precautions. The LHC assigned each laser depends upon the laser's wavelength, pulse mode, period of exposure, and magnitude of irradiation.

b. The protection standards applied to each LHC include well defined maximum permissible exposures (MPE). These values and quantities are listed at:

(1) ANSI Z136.1-1980, "American National Standard for The Safe Use of Lasers."

(2) TB MED 279 (524), Control of Hazards to Health from Laser Radiation.

(3) AR 40-46, Medical Service: Control of Health Hazards from Laser and Other High Intensity Optical Sources.

(4) DARCOM-R 385-29 Safety, Laser Safety.

3-4. Special Definitions.

a. Class I: Exempt laser devices incapable of emitting hazardous laser radiation in excess of maximum permissible exposures for any particular wavelength, exposure period, or viewing condition. This includes selected IR, visible, and UV laser devices.

b. Class II: Low power, visible laser devices incapable of exceeding one milliwatt of radiant power. There are no invisible (IR or UV) laser emissions of this classification.

c. Class IIIa: Medium power, visible, continuous laser devices capable of one to five milliwatts of radiant power whose irradiance does not exceed 2.5 mW cm .

d. Class IIIb: Medium power, continuous laser devices capable of one to 500 milliwatts of radiant power (Class IIIa excepted). Includes selected IR, visible, UV, and pulsed laser devices.

e. Class IV: High power, visible, continuous laser devices capable of exceeding 500 milliwatts of radiant power. This includes selected IR and UV pulsed laser devices.

3-5. Safety Precautions. Safety precautions include a prudent combination of administrative measures, engineering safeguards, personal admonishments, and critical response to a nonionizing radiological incident. The following criteria is applicable to each LHC.

a. Class I.

(1) Inherently safe under prolonged intrabeam viewing of laser beam with or without optical aids.

(2) Special controls and labels are unnecessary.

b. Class II.

(1) Affix caution label to laser housing which alerts reader, "CAUTION: DO NOT STARE INTO LASER BEAM." Forced staring (overcoming one's natural ocular aversion reflex) is hazardous!

(2) Report persistent after-image following ocular exposure to the Occupational Health Nurse for immediate attention.

c. Class IIIa.

(1) Affix caution label to laser housing which alerts reader, "CAUTION: DO NOT STARE INTO LASER BEAM: DO NOT VIEW LASER BEAM WITH UNFILTERED OPTICAL INSTRUMENTS." (Examples include transits, mirrors, lens, telescopes, microscopes, or binoculars.)

(2) Report persistent after-image following ocular exposure to the Occupational Health Nurse for immediate attention.

d. Class IIIb. (Admonishments).

(1) Affix warning label which alerts reader, "DANGER: DO NOT LOOK INTO LASER BEAM; DO NOT POINT AT SPECULAR SURFACES; DO NOT AIM AT PERSONNEL."

(2) Authorized personnel use only.

(3) Avoid careless discharge of laser toward explosive materials - liquids, gases, or vapors - or toxic combustibles.

(4) Avoid discharge of laser into corridors and unguarded hallways outside of secure laboratory bays.

(5) Avoid hand, arm, head, and eye contact with laser beam.

(6) Avoid use of unfiltered optical instruments during prescribed intrabeam viewing.

(7) Be informed of all potentially hazardous chemical, cryogenic, electrical, fire, ocular, skin, and x-ray emissions associated with a laser facility.

(8) Inspect laser safety goggles for required optical density, proper usage, and defects IAW TB MED 279 and ANSI Z136.1-1980.

(9) Practice good housekeeping.

(10) Read and understand relevant SOP's, protection standards, maximum permissible exposure (MPE), safety precautions, DARCOM-R 385-29, Belvoir R&D Center-R 385-11, TB MED 279, and ANSI Z136.1-1980.

(11) Remove reflective buttons, badges, emblems, rings, mirrors, spectacle frames, and wrist watches; and eliminate inadvertent reflection of hazardous laser radiation.

(12) Report persistent after-image following ocular exposure to the Occupational Health Nurse for immediate attention.

(13) Secure all doors whenever continual laser action is unattended.

(14) Wear laser safety goggles of optimum optical density commensurate with the wavelength of the laser's output.

e. Class IIIb. (Engineering Safeguards).

(1) Contain or enclose laser beam whenever practical with baffels, guards, or fire brick.

(2) Disengage power prior to maintenance.

(3) Secure interlock or removable key before and after laser action is terminated.

(4) Terminate beam with nonreflective, fire resistive material (don't use asbestos).

(5) Utilize baffles, beam stops, beam enlargers, enclosures, shields, and shutters to control stray and incidental reflections and enhance safety.

f. Class IV:

(1) Capable of serious ocular damage and skin burn from specular and diffuse reflection.

(2) Alert personnel of imminent discharge of laser radiation.

(3) Apply admonishments and engineering safeguards from Class III lasers as practical.

(4) Apply diffuse nongloss paint, varnish, or substance to walls and ceiling.

(5) Cover windows and secure a light-tight room.

(6) Discharge capacitors prior to repair or maintenance.

(7) Enclose megajoule lasers in light-tight boxes with interlocks or discharge from remote control site.

(8) Immobilize laser to fixed positions and prescribed beam paths.

(9) Remove chrome and polished surfaces, door knobs, clocks, glass, and mirrors.

(10) Report persistent after-image, vision impairment, or skin burn to the Occupational Health Nurse, or MEDDAC.

(11) Secure door-interlocks at points of entry; engage red warning lamp; post placard at door that reads, "DANGER, DO NOT ENTER."

(12) Terminate beam with diffusers, beam stops, non-reflective, or fire resistive material.

(13) Utilize baffles, beam enlargers, optical filters, polorizers, and shields to minimize incidential diffuse hazardous reflections.

(14) Wear laser safety goggles of optimum optical density commensurate with the wavelength of the laser's output.

g. Collateral Hazards:

(1) Label x-ray emissions from power supplies of greater than 15,000 volts; wear assigned film badge as directed.

(2) Ground frames, enclosures, and noncurrent-carrying metallic components of the laser system through continuous conductor which is connected to suitable electrical grounding post IAW DARCOM-R 385-100.

(3) Install prescribed fuses, circuit breakers, alarms, and red warning lamps.

(4) Secure cryogenic fluids from spillage, personal contact, and explosive expansion from laser beam impact.

(5) Secure combustible solvents, dyes, and materials from stimulated ignition from laser beam impact.

(6) Shield high voltage terminals and electrical components; denote ON-OFF switches with label.

(7) Ventilate noxious compounds, oxides, ozones, and volatiles if generated.

Section II. INDIVIDUAL RESPONSIBILITIES

3-6. Belvoir R&D Center and USNV&EOL Supervisors of Nonionizing Workers. Supervisor of nonionizing radiation workers assigned duties at laser or microwave (R/F) labs, rooms, sites, or facilities will execute the following functions:

a. Apply, prior to procurement, for a local microwave or laser permit for each function-element; submit an application by DF to the RCC through the RPO/LSO, ATTN: STRBE-VR, Building 363, before acquisition of microwave or laser device. (This action alerts this office of its responsibilities to comply with applicable BRH, FDA, DA, DARCOM and local rules and regulations.)

b. Coordinate contract, requisition, or purchase of microwave or laser device. Clearly note RPO/LSO's signed approval on all applicable documents.

c. Complete STRBE FM 1-35, Appendix B(1), "Nonionizing Inventory," and co-sign with applicant STRBE FM 6-20, Apppendix B(2), the "Proposed Nonionizing Radiation Worker."

d. Prepare a signed SOP IAW paragraph 3-5 outlining procedures that limit skin and ocular exposure to QUANTITIES of nonionizing radiation that is less than regulatory standard as specified at:

(1) AR 40-46, Medical Services: Control of Health Hazards from Lasers and Other High Intensity Optical Sources.

(2) TB MED 279 (524), Department of the Army Technical Bulletin Control of Hazards to Health from Laser Radiation.

(3) DARCOM-R 385-29, Safety: Laser Safety.

(4) ANSI Z136.1-1980, American National Standard for the Safe Use of Lasers.

(5) AR 40-583, Medical Services: Control of Potential Hazards to Health from Microwave and Radiofrequency Radiation.

(6) TB MED 523, Department of the Army Technical Bulletin Control of Potential Hazards to Health from Microwave and Radiofrequency Radiation.

e. Inform Project Managers and contractors of military laser systems of the DA requirements at AR 385-16, System Safety Engineering and Management.

f. Prepare "Appendix B Annual Status Report of Exempted Lasers (RCS-0201-HEW-AN)" at AR 385-9, Safety: Requirements for Military Lasers.

g. Report development and testing of novel, high intensity microwave, radiofrequency, or laser devices to the RPO/LSO; request evaluation by US Army Environmental Hygiene Agency (USAEHA) of potentially hazardous QUANTITIES of nonionizing radiation to health and safety as advised; prepare correspondence IAW AMCR 385-7, Procedures for Obtaining the Services of the USAEHA; forward copies to the RCC for Command review.

h. Instruct nonionizing radiation workers and demonstrate proper use of nonionizing radiological devices-microwave units, R/F generators (klystrons & magnetrons), and laser systems.

i. Observe posted radiological signs and labels of warning, caution, or danger. Read posted notices and documents:

(1) DARCOM-R 385-29, Safety: Laser Safety.

(2) Belvoir R&D Center Reg 385-11, Safety: Radiation Protection Program.

(3) SOP's.

j. Maintain current inventory and location of microwave, R/F, and laser systems. Secure them against unauthorized use.

k. Coordinate by DF to the RPO/LSO changes in inventory or personnel. Submit timely amendments or cancellations of local permits.

l. Report abnormal operating parameters or radiological exposures to the LSO. Secure maintenance prior to resumption of normal operating procedures.

m. Assist LSO and investigate suspected injuries or unusal skin or ocular exposures to nonionizing radiation in EXCESS of the regulatory standards. Supply documentation, contact medical authorities, report FIRE to the fire department.

3-7. Local Permits.

a. Each local function-element shall apply for permit to procure, receive, store, transport, and dispose of microwave or laser sources of nonionizing radiation IAW the requirements of the mission and this regulation. Application shall be submitted through the LSO to the RCC. Application shall include information at Appendix B(1). In addition, application shall include relevant SOP that specifies use and procedures that will minimize potentially hazardous exposure to nonionizing radiation.

b. Each tenant organization shall request cancellation of local permit upon disposal, property excess, or cannibalization of nonionizing sources of radiation. Request shall be sent by DF to tne RPO/LSO.

c. Each function-element shall request amendment of local permit upon change of inventory of nonionizing sources of radiation or upon change of personnel assigned work with nonionizing sources of radiation. Each additional source of nonionizing radiation (laser or microwave) shall be inventoried at Appendix B(1) by DF. New personnel assigned work with nonionizing sources of radiation shall complete Appendix B(2).

3-8. Standing Operating Procedures (SOP).

a. A SOP shall be included with each local permit IAW paragraph 3-5 and paragraph 3-6. A SOP establishes an essential link between successor's assigned common duties. It details a precise sequence of actions and events that conclude a given assignment expeditiously and safely. A SOP is therefore required to identify potentially hazardous implications and safety guide personnel through a given task. A local permit for acquisition and use of a microwave or laser device must include a SOP that specifies actions, methods, and techniques that minimize skin or ocular exposures to nonionizing radiation. The following outline should be developed IAW the severity of the radiological hazards associated with analysis, application, development, evaluation, gauging, rangefinding, research, spectroscopy, testing, or study of mircowave or laser sources of nonionizing radiation:

(1) Identification; see Appendix B.

(2) Personal conduct and precautions.

(3) Exposure limits and reflection hazards; see paragraph 3-3, paragraph 3-5, and paragraph 3-6.

(4) Assignments and safety instructions; see paragraph 3-5.

(5) Equipment and materiels' orientation.

(6) Attenuators, goggles, hoods, tools, ventilation.

(7) Beam controls.

(8) Interlocks.

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(9) Methods and techniques.

(10) Electrical and chemical hazards.

(11) Emergency response.

b. The following references can provide significant guidance and details that supplement required SOP's:

(1) ANSI Z136.1-1980, American National Standard for the Safe Use of Lasers.

(2) AR 385-9, Safety: Requirements for Military Lasers.

(3) AR 385-16, System Safety Engineering and Management.

(4) DARCOM-R 385-29, Safety: Laser Safety.

(5) DARCOM-R 385-100, Safety: Safety Manual.

(6) Sliney and Wallarsht, Safety with Lasers and Other Optical Sources, Plenum Press; NY,NY; 1980.

(7) TB MED 279 (524), Control of Hazards to Health from Laser Radiation.

(8) TB MED 523, Control of Hazards to Health from Microwave and Radiofrequency Radiation and Ultrasound.

3-9. Laser Range Safety Officer.

a. Designated Laser Ranger Safety Officers shall be appointed as required wherever laser target practice and laser ranges are established. The following regulations shall be enforced:

(1) AR 385-63, Chapter 20, "LASERS," Safety: Policies and Procedures for Firing Ammunition for Training, Target Practice, and Combat (MCOP 3570.1).

(2) DARCOM-R 385-29.

(3) TB MED 279.

b. Local SOP shall be written for designated laser ranges. Each SOP shall address safety issues at paragraph 3-5 in addition to reflection hazards, surveillance, communication, and laser range safety features (backstops, protective filters and eyewear, and personal instruction).

3-10. Belvoir R&D Center and USNV&EOL Nonionizing Radiation Workers. Nonionizing radiation workers assigned duties at high intensity microwave and laser labs, sites, or facilities will complete the following administrative and regulatory requirements:

a. Complete STRBE FM 6-20, Appendix B(2), "Profile of Nonionizing Radiation Worker."

b. Complete preplacement occupational health examination IAW paragraph 1-5.

c. Observe posted microwave or laser signs and labels of warning, caution, or danger. Read posted documents at paragraph 3-6i.

d. Report abnormal operating parameters, skin, or ocular exposures to the supervisor; report overexposures to the Occupational Health Nurse for immediate medical attention. Notify the RPO/LSO, X45437.

e. Do not attempt unauthorized repair, dismemberment, transfer, or disposal of a microwave, or laser system.

f. Report changes in inventory, transfer, or disposal of microwave or laser systems at Appendix B(1); and send copy to the RPO/LSO, ATTN: STRBE-VR, Building 363.

g. Wear protective apparel and eyewear IAW the Laser Hazard Classification at paragraph 3-3 and paragraph 3-4.

h. Utilize exhaust hoods and vents whenever hazardous or toxic compounds are volatilized.

Section III. GLOSSARY

3-11. Definitions.

a. Laser. An acronym for Light Amplification by Stimulated Emission to Radiation. A device which incorporates a characteristic solid, liquid, dye, or gaseous medium capable

of "population inversion" and emission of high intensity, coherent, optical radiation.

b. Lesion. Any injury, wound, or local morbid change in tissue or organ. A characteristic biological hazard associated with unsafe exposure to high intensity, directional, coherent (laser), optical radiation.

c. Microwave Spectra. Electromagnetic radiation of a frequency range between 100 MHz and 300,000 MHz (300 GHz) or corresponding wavelength between 3m and 1mm.

d. Nonionizing Radiation. Electromagnetic radiation incapable of generating molecular ions in air or tissue. Radiation characteristic of microwave, radiofrequency, and optical spectra.

e. Optical Spectra. Electromagnetic radiation of a range of wavelengths between 1.0E+06 nanometers (1mm) and 1.0E+02 nanometers. The optical spectra is divided between infrared, light, and ultraviolet radiation.

f. Radiofrequency Spectra. Electromagnetic radiation of a frequency range between 10 MHz and 100 MHz or corresponding wavelengths between 30m and 3m.

g. Ultrasound. Nonelectromagnetic radiation. Acoustic or sound energy of a frequency greater than 20,000 Hz.

3-12. Quantities and Units.

a. Angstrom (A). A unit of distance or wavelength equals 1.0E-10 meter or 0.1 nanometer or 1.0E-04 micrometer.

b. Energy. A conserved universal quantity capable of doing work. A joule (J) is a unit of energy characteristic of the radiant output of microwave or laser devices.

c. Micrometer (um). Formally a "micron" a unit of distance or wavelength equals 1.0E-06 m or 1000 nanometers.

d. Nanometer (nm). A unit of distance or wavelength equals 1.0E-09 m or 0.001 um.

e. Power. A quantity of energy transferred per unit time. A watt (W) is a unit of power or J sec characteristic of the output of a microwave or laser device.

3-13. References. Extensive listing of nonionizing radiological terms, definitions, quantities, and units are listed at paragraph 3-8b and at each AR and TB MED cited in Chapter 3.

(STRBE-VR)

FOR THE COMMANDER:

IRVING BIRMINGHAM
LTC, EN
Executive Officer

DISTRIBUTION: C (Materials, Fuels and Lubricants Laboratory) 80 cys-V

A-1

IONIZING INVENTORY OF NRC OR DA RADIONUCLIDES				
1. Device and Radionuclide Location:		2. Division:		3. Team Leader:
4. Ofc Sym:	5. Bldg. No.:	6. Room No.:	7. Supervisor:	8. Phone No.:
9. Device and Radionuclides Identification:				
10. Manufacturer:		11. Model No.:		12. Serial No.:
13. Property No./HRA Acct.:		14. Local RCC Radionuclide Permit No.:		15. DA/NRC Mat'l License No.:

16. RADIONUCLIDE CHEMICAL			
a. Chemical Symbol	b. Activity uCi, mCi, Ci	c. Half-Life days, yrs	d. Date Measured or Calculated

17. User(s) of Device Incorporating DA Authorized Source or NRC Licensed Radionuclide

a. Name	b. SSN	c. Position	d. Phone	e. Date Transferred

18. SOP Title	19. Posted	20. Bldg.	21. Room

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IONIZING INVENTORY OF ELECTRONIC X-RAY DEVICES

1. Electronic X-Ray Device Location:	2. Division:	3. Team Leader:

4. Ofc Symbol:	5. Bldg. No.:	6. Room No.:	7. Supervisor:	8. Phone No.:

9. X-Ray Device Identification: (If other, specify)	10. X-Ray Device:
____ Diffraction ____ Fluorescope ____ Other ____ Electron-Microscope ____ Spectrometer	___ Protective ___ Unattended ___ Enclosed ___ Open

11. Classification	12. Manufacturer:	13. Model Number:

14. Serial Number:	15. Property No./HRA Acct. No.:	16. Local RCC X-Ray Permit No.:

17. X-RAY DEVICE OPERATING CHARACTERISTICS (Complete as applicable)

a. Voltage (kVp)	b. Current (mA)	c. Duration Pulse, Continuous	d. Average Use Daily, Weekly, Monthly	e. Target

18. ELECTRONIC X-RAY DEVICES USER(S)

a. Name	b. SSN	c. Position Title	d. Phone No.	e. Transfer Date

19. SOP

Title	Posted	Bldg. No.	Room No.

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1 Dec 83 PREVIOUS EDITIONS OF THIS FORM WILL BE USED UNTIL EXHAUSTED

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PROFILE OF IONIZING RADIATION WORKER

1. Name:	2. SSN:	3. Phone:
4. Position Title:	5. Office: (Bldg. & Room No.)	6. Ofc Symbol:

7. EDUCATION AND SAFETY INSTRUCTION

a. School Degree(s), Award(s)	b. Courses/Date	c. Location

8. PREVIOUS EXPERIENCE

a. Electronic X-Ray Devices/R'Nuclides Types	b. Professional Service	c. Duration	d. Location Of Service

9. ASSIGNMENT

a. Electronic X-Ray Devices Or R'Nuclides Types	b. Location Of Devices (Bldg. No. & Room No.)	c. Professional Service

10. SIGNED STATEMENT

As a radiation worker assigned duties with radiological sources which are licensed by the Nuclear Regulatory Commission (NRC) or authorized by applicable Department of the Army (DA) Radioactive Materials Authorization, DA Form 3337, and managed by the BRADC Radiation Research Group, I have been informed of the relevant requirements at Title 10 Code of Federal Regulations (CFR).

(1) 10 CFR 19, "Notices, Instructions, and Reports to Workers; Inspections."
(2) 10 CFR 20, "Standards for Protection against Radiation."
(3) 10 CFR 21, "Reporting of Defects and Noncompliance."
(4) AR 40-14, Medical Services: Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Material.
(5) Belvoir R&D Ctr Reg 385-11, Safety: Radiation Protection Program.

11. Applicant: (Signature)	12. Supervisor: (Signature)	
13. Medical Exam Date:	14. Local RPO: (Signature)	15. Local RCC Approval Date:

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1 Dec 83

NONIONIZING INVENTORY

1. Device Location:	2. Division:	3. Team Leader:

4. Ofc Symbol:	5. Bldg. No.:	6. Room No.:	7. Supervisor:	8. Phone No.:

9. Device Identification:	10. Manufacturer:	11. Model No.:
___ Laser ___ Microwave ___ Optical		

12. Serial Number:	13. Property No./HRA Acct. No.:	14. Local RCC/Microwave/ Laser Permit No.:

OPERATING CHARACTERISTICS (Complete as applicable)

15. Medium:

___ Ar	___ Ga-As	___ N2	___ Pb-Se	___ Other
___ CO2	___ He-Ne	___ Nd	___ Ruby	
___ Dye	___ KLYSTRON	___ Nd:YAG	___ Semiconductor	
___ Freon	___ Kr	___ Ne	___ Ultraviolet	

16. Frequency/Wavelength:	17.	18. Energy Output: (W or J; mW or mJ)
_____ Hz _____ um	___ Q-Switched ___ Non-Q-Switched ___ Pulsed ___ Continuous	Maximum Power _____ Operating Power _____

19. Emergent Beam Diameter(cm)	20. Limiting Aperture (cm):	21. Maximum Exposure: (W/cm2, mW/cm2; or J/cm2, mJ/cm2)
		Irradiance _____ Radiant _____

22. Maximum Appliable Radiance (W/cm2/sr, mW/cm2/sr; or J/cm2/sr, mJ/cm2/sr)	23. Pulse:	24. Emergent Beam Divergence (mrad)
___ Integrated ___ Pulsed	Duration (sec) _____ Repetition (Hz) _____	

25. LASER HAZARD CLASSIFICATION (CHECK ONE)

___ I	___ IIIa	___ IV
___ II	___ IIIb	___ Enclosed

26. TYPE OF APPLICATION

___ Alignment	___ Military	___ Repair/Maintenance
___ Industrial	___ Development	___ Research
	___ NOT-IN-USE	___ Military Except

(2-4)

PROFILE OF NONIONIZING RADIATION WORKER		
1. Name:	2. SSN:	3. Phone:
4. Position Title:	5. Office: (Bldg. & Room No.)	6. Ofc Symbol:

7. EDUCATION AND SAFETY INSTRUCTION

a. School Degree(s), Award(s)	b. Courses/Date	c. Location

8. PREVIOUS EXPERIENCE

a. Types Nonionizing Devices	b. Professional Service	c. Duration	d. Location Of Service

9. ASSIGNMENT

a. Types Nonionizing Devices	b. Location Of Devices (Bldg. No. & Room No.)	c. Professional Service

10. SIGNED STATEMENT

I have read and understood the REQUIRED LASER PPOTECTION STANDARDS AND MICROWAVE or HIGH INTENSITY OPTICAL STANDARDS and exposure limits against high intensity nonionizing radiation as specified and entitled at Chapter 3, Section II, BELVOIR R&D CTR REGULATION NUMBER 385-11.

11. Applicant: (Signature)	12. Supervisor: (Signature)	
13. Medical Exam Date:	14. LOCAL LSO: (Signature)	15. LOCAL RCC Approval Date:

STRBE FM 6-20(Rev) 1 Dec 83 PREVIOUS EDITIONS OF THIS FORM WILL BE USED UNTIL EXHAUSTED