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	Safety IONIZING RADIATION PROTECTION	
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CESO

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

ER 385-1-80

Regulation
No. 385-1-80

30 June 2010

Safety
IONIZING RADIATION PROTECTION

1. Purpose. This regulation assigns safety and health responsibilities to:
 - a. Safely and effectively, use radioactive materials and radiation generating devices.
 - b. Ensure compliance with all applicable federal, Department of Army (DA), USACE, state and local regulations concerning the safe use of radioactive materials or radiation generating devices. Guidance concerning the safe use of non-ionizing radiation sources (such as lasers and radio frequency radiation) can be found in EM 385-1-80 (USACE Radiation Protection Manual).
 - c. Obtain, renew, amend, and terminate U.S. Nuclear Regulatory Commission (NRC) licenses, Army Radiation Authorizations (ARAs), and Army Radiation Permits (ARPs) for possession and use of radioactive materials and radiation generating devices not requiring a specific license from the NRC.
 - d. Transfer or dispose radioactive materials and radioactive wastes.
 - e. Oversee contractors using radioactive materials or radiation generating devices that require NRC or Agreement State licensing or registration, ARAs, or ARPs for possession or use of radioactive materials or radiation generating devices.
 - f. Oversee contractors performing remediation of sites contaminated with radioactive material or radioactive waste.
2. Applicability. This regulation applies to the entire USACE Direct Reporting Unit (DRU) including Divisions, Districts, Labs, and Centers, which procure, use, possess, transport, transfer, or dispose radioactive materials or radiation generating devices. The USACE Safety and Health Requirements Manual, EM 385-1-1, contains contractor requirements concerning radiation safety issues.
3. Distribution Statement. Approved for public release, distribution is unlimited.
4. References. References are listed in Appendix A.
5. Definitions. Definitions are listed in Appendix B.
6. Responsibilities.

a. The Chief, Safety and Occupational Health Office (CESO), Headquarters, USACE, is responsible for program management and oversight for licensing, permitting, accountability, possession, use, storage, transfer and disposal of all radioactive material and radiation generating devices within USACE. This responsibility shall be discharged by:

(1) Appointing in writing and maintaining on staff a qualified Radiation Safety Staff Officer (RSSO).

(2) Assuring USACE DRU implementation of Department of Army (DA) and USACE radiation protection policy.

b. On behalf of USACE, the RSSO is responsible for:

(1) Serving as a primary focal point for coordination with other Federal Agencies, Department of Defense, and DA officials concerning radiation safety issues and providing radiation safety consultation, in coordination with the Environmental and Munitions Center of Expertise, to USACE Divisions, Districts, Labs, and Centers.

(2) Providing coordination, administration and technical review of all USACE applications, renewals, amendments and terminations of all NRC licenses and ARAs for the possession, use, transportation, transfer or disposal radioactive material and radiation generating devices, and maintaining liaison with the NRC.

(3) Providing recordkeeping for all paperwork and correspondence regarding applications, renewals, amendments, and terminations of authorization for the possession, use, transportation, transfer or disposal of licensed and or permitted radioactive material and radiation generating devices.

(4) Providing (may be through a designee) Radiation Protection Audits to all locations possessing an NRC license or ARA for radioactive material or radiation generating devices, at least on a triennial basis.

c. The Commander of any USACE District, Lab or Center which procures, uses, possesses, transports, transfers, or disposes NRC general or specifically licensed, or ARA listed radioactive materials or radiation generating devices, or has personnel occupationally exposed to radiation, or oversees contractors working with radioactive materials or radiation generating devices, is responsible for:

(1) Appointing, funding and maintaining a qualified Radiation Safety Officer (RSO) (may be designated as a Radiation Protection Officer (RPO) in other documents) upon recommendation from the RSSO, and supporting decisions of the RSO.

(2) Establishing written policies and a formal radiation protection program ensuring compliance with this and all applicable regulations, license or permit conditions.

(3) Maintaining adequate resources to ₂ assure the safety of personnel, property

and the environment, and to cope with emergencies.

(4) Ensuring that all personnel who may be exposed to ionizing radiation receive appropriate radiation protection training. The adequacy of the training shall be determined by the RSO with concurrence of the RSSO.

(5) Establishing, funding, maintaining, and supporting a Radiation Safety Committee (RSC) if warranted by a specific NRC license or ARA condition.

(6) Obtaining all required licenses, authorizations and permits (NRC and Army) prior to procurement, use, transfer, or disposal of radioactive materials or radiation generating devices.

(7) Ensuring annual audits are conducted to determine compliance with all applicable regulations and license or ARA conditions.

(8) Establishing procedures to assure that the local Safety and Occupational Health Office is advised prior to any change in the use of radioactive materials or radiation generating devices and that the RSO evaluates the procedures and hazards prior to utilization of radioactive materials or radiation generating devices.

d. The Chief, Safety and Occupational Health Office (SOHO) of any USACE Command, which procures, uses, possesses, transports, transfers, or disposes radioactive materials or radiation generating devices, or has personnel occupationally exposed to radiation, or oversees contractors working with radioactive materials or radiation generating devices, including non-ionizing radiation sources, is responsible for:

(1) Assuring the radiation protection component of the Command's Safety and Occupational Health Program complies with all applicable safety regulations.

(2) Providing coordination, administration, review, and approval of all USACE applications, renewals, amendments and terminations of NRC licenses and ARA's.

(3) Assuring that USACE personnel including the RSO, Authorized Users and Authorized User's Assistants are adequately instructed in the safe use of radiation and their duties and responsibilities under this regulation.

(4) Reviewing Command audit reports and advising the Commander of any unsafe practices, defects or non-compliance with applicable regulations.

(5) Providing, upon request from contractors, the proper procedures for obtaining service permits or authorizations for use of radioactive materials or radiation generating devices on DOD installations.

e. The Command Radiation Safety Officer for each license and/or ARA is responsible for:

(1) Preparing and submitting to the RSSO, through USACE channels (see paragraph 8) within assigned time frames, all applications, amendments or submittals

necessary for compliance with all applicable regulations concerning radioactive materials or radiation generating devices.

(2) Ensuring that all exposures of workers and the general public to ionizing radiation are kept as low as is reasonably achievable (ALARA), with technical and socioeconomic factors being taken into account. This shall be accomplished by ensuring compliance with all applicable regulations concerning radioactive materials or radiation generating devices by all users of radioactive materials or radiation generating equipment.

(3) Providing competent technical guidance for all users of radioactive material or radiation generating devices.

(4) Determining the appropriate training for all personnel who may be exposed to ionizing radiation.

(5) Ensuring that all personnel who may be exposed to ionizing radiation, receive appropriate training.

(6) Maintaining all documents, correspondence, reports, and records required by this regulation and other applicable Federal and Army regulations, licenses, and authorizations.

(7) Disseminating all guidance and providing services as described in this regulation.

(8) Auditing activities involving radioactive materials or radiation generating devices within their USACE Command on an annual basis.

(9) Providing timely reports to the Commander or Director of his or her USACE Command, of both routine activities and non-routine events as required by this regulation and other applicable Federal and Army regulations, licenses, ARAs, and ARPs, or as directed by higher headquarters.

(10) Providing external and internal dosimetry to USACE personnel as needed, and as described in paragraph 10 of this ER.

f. All USACE personnel, who procure, use, possess, transport, transfer or dispose of radioactive materials or radiation generating devices, or oversee contractors working with radioactive materials or radiation generating devices, are responsible for:

(1) Having knowledge of and complying with all applicable regulations concerning radioactive materials or radiation generating devices with which they work.

(2) Performing their duties involving radioactive materials and radiation generating devices in a safe manner, in compliance with all applicable regulations, and in such a way as to promote maintaining doses ALARA.

(3) Ensuring that others performing work with radioactive materials or radiation generating devices, under their supervision, do so in a safe manner and in compliance

with all applicable regulations, and in such a way as to promote maintaining doses ALARA.

(4) Informing the RSO, in a timely manner, of all procurement, possession, use, transfer, disposal, loss, theft, or other reportable occurrence involving radioactive materials or radiation generating equipment.

7. Authorized Users and Authorized Users' Assistants.

a. Authorized Users (AUs) are individuals allowed to work unsupervised with radioactive materials or radiation generating devices. AUs will receive training commensurate with the hazard presented by their work. The RSO in conjunction with the RSSO will determine the content and extent of the training (details concerning training requirements are contained in EM 385-1-80).

b. Authorized Users' Assistants (AUAs) are individuals allowed to work with radioactive materials or radiation generating devices under the direct supervision (that is, within the physical presence) of an AU. AUAs will receive training commensurate with the hazard presented by their work. The RSO, in conjunction with the RSSO, will determine the appropriate training requirements (details concerning training requirements are contained in EM 385-1-80).

8. Information Flow through Applicable USACE Channels.

a. All NRC license or ARA applications, amendment requests, renewals, and terminations requests must be routed to the HQUSACE RSSO. For example, a request to obtain an NRC license amendment would be coordinated with the Chief, SOHO. Following coordination, it would flow from the local RSO, to the HQUSACE RSSO for review and approval followed by CESO action.

b. Failure to follow the information flow process is a violation of the USACE delegation requirements specified by DA. Technical consultations between NRC offices and license holders at USACE Commands may take place, though notification of the RSSO of such communications is recommended.

9. Notices, Instructions and Reports to Workers.

a. The RSO will maintain in his or her office, current copies of the following:

(1) 10 CFR 19 Notices Instructions and Reports to Workers: Instructions and Investigations.

(2) 10 CFR 20 Standards for Protection Against Radiation.

(3) AR 385-10.

(4) DA PAM 385-24.

(5) ER 385-1-80 Ionizing Radiation Protection.

(6) EM 385-1-80 Radiation Protection Manual.

(7) EM 385-1-1, Safety and Health Requirements Manual.

(8) All NRC licenses and Army Radiation Authorizations (ARAs) with all attachments, all amendments to licenses or ARAs, and all associated correspondence.

(9) The Command's radiation protection program.

(10) All Standing Operating Procedures (SOPs) applicable to working with radiation within their Command.

(11) Any notice of violation of license or ARA requirements.

b. The RSO will post the following documents in an area that is common to the workplace (e.g., break room, safety board, etc):

(1) A notice with contact information for the RSO, including phone number, which indicates the location where all documents listed in Paragraph 8.a. are located for review.

(2) A current NRC Form 3, Notice to Employees.

(3) Notice(s) of Violation of a license as required by federal regulations.

10. Dose Limits.

a. USACE has established a three-tiered approach to worker dose limits. Tiered dose limits and implementation of the three-tiered approach is further explained in EM 385-1-80. Each user of radioactive material or radiation generating devices shall keep his/her occupational dose below the limits in Table 4-1 of EM 385-1-80.

b. Planned special exposures (see definitions, Appendix B) shall not be performed.

c. Persons under the age of 18 shall not be allowed occupational exposure to radiation on USACE sites.

d. Activities with radiation shall be conducted so that USACE personnel who are not working with radiation and members of the public cannot receive a TEDE exceeding 100 millirem per year.

e. The dose in any unrestricted area will not exceed 2 millirem in any one hour.

11. Surveys and Monitoring.

a. The RSO will ensure that adequate surveys and monitoring are performed to ensure compliance with the above dose limits in an accurate and timely manner, and are properly recorded and filed.

b. The RSO will ensure that all instruments and equipment used for quantitative radiation measurements are calibrated at least annually or as directed by

regulations, license or ARA conditions, or manufacturer's recommendations.

12. Personnel Dosimetry.

a. The RSO will provide external and/or internal dosimetry (bioassay) to all USACE personnel who may exceed a Tier 2 radiation dose and to all personnel who enter a High or Very High Radiation Area.

b. All personnel issued dosimetry will provide the RSO with a completed DD Form 1952 (Dosimeter Application and Record of Occupational Radiation Exposure).

c. External dosimetry will be provided to USACE personnel by the RSO using dosimeters provided by the U.S. Army Ionizing Radiation Dosimetry Center (ADC). ADC will also provide dosimetry reading and reporting services. ADC maintains accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP).

d. Exposure of personnel to ionizing radiation shall be reported annually by the RSO to each USACE person assigned dosimetry. Exposures shall be recorded using NRC Form 5 or equivalent. Exposures measured using other than ADC dosimetry shall be reported to ADC.

e. Dosimetry results will be reported and explained by the RSO to all USACE personnel annually and within 30 days of the request of any individual presently or previously monitored under the dosimetry program.

f. Employee exposure records will be maintained in accordance with the requirements in 10 CFR 19 and 20, 29 CFR 1910.1020 and 5 CFR Part 339.

g. The RSO will review all exposure records at least once in each three-month period to ensure that exposures are being kept ALARA.

h. Occupationally exposed personnel receiving exposure from other employers shall inform the RSO of this employment and shall coordinate with the RSP to ensure program/legal limits are not exceeded.

13. Control of Exposure from External Sources in Restricted Areas. Authorized Users and the RSO will ensure that all entrances to High and Very High Radiation Areas are locked when access is not required, and that individuals document all entries.

14. Storage and Control.

a. Radioactive materials will be secured by the authorized user to prevent unauthorized access or removal when not in use.

b. Radioactive materials not in secure storage will be under the constant surveillance and control of the authorized user.

c. The RSO shall physically inventory all radioactive materials and radiation generating devices within his or her Command annually. The physical inventory will be

performed more frequently if required by regulations, license or ARA conditions. The inventory will be documented and retained by the RSO, and reported to the District/Lab/Center Commander annually.

d. Unless specifically exempted, the RSO shall ensure that all sealed radioactive sources are leak tested every six months, or as required by NRC regulations, the NRC license, ARA conditions, or in the Sealed Source and Device Registry.

e. If leak test results exceed 0.005 microcuries, the source will be removed from service and the RSSO notified as soon as possible.

15. Transfer of USACE Radioactive Material and Radiation Generating Devices.

a. The RSSO must approve any transfer of any radioactive material or radiation generating device listed on a license or an ARA.

b. The request for authorization to transfer radioactive materials will be submitted through channels to the RSSO on ENG Form 4790-R (Request for Authorization to Transfer Radioactive Materials).

c. For transfer of all NRC licensed materials, a Certificate of Disposition of Materials NRC Form 314 will be prepared in accordance with paragraph 16c of this regulation.

16. Transportation of Radioactive Materials. All radioactive materials will be transported in accordance with 49 CFR 171-179 and other federal/international regulations as applicable. Additionally, all NRC licensed radioactive material will be transported in accordance with 10 CFR 71. USACE training requirements pertaining to transportation are in EM 385-1-80.

17. Waste Disposal.

a. All DOD low level radioactive waste (LLRW) disposal not associated with environmental remediation will be coordinated with the Environmental and Munitions Center of Expertise and the DOD Executive Agent for low-level radioactive waste disposal (U.S. Joint Munitions Command (JMC), AMSIO-DMW, Rock Island, IL 61299-6000).

b. All releases of radioactive effluents will be in accordance with 10 CFR 20. A record of all effluent releases containing the date, radionuclide, activity and chemical form will be maintained.

c. An NRC Certificate of Disposition of Materials, NRC Form 314, will be prepared for all NRC licensed materials prior to disposal or transfer. The certificate will be forwarded to the RSSO who will review and forward it to the NRC via CESO.

18. Records.

a. The RSO will maintain records of the provisions and implementation of their Command's radiation protection program and all audits and reviews of the program for the time required by any NRC regulation or license condition, ARA or as listed in AR 25-400-2, The Army Records Information Management System (ARIMS).

b. In accordance with applicable federal and DA regulations, the RSO will maintain records of the monitoring and surveys required in paragraph 10 above, all instrument calibration records, all internal and external personnel dosimetry records, all waste disposal, all effluent release records, and all decommissioning records. Employee exposure records, and decommissioning records will be maintained in accordance with 10 CFR 20 and 29 CFR 1910.1020. The RSO will maintain these records for the time required by any NRC regulation or license condition, ARA or as listed in AR 25-400-2. Employee training records will be maintained in accordance with Human Resources Management Office policies.

19. Reports.

a. The RSO will immediately report the loss or theft of NRC licensed radioactive materials to the RSSO and the NRC within the time frames listed in 10 CFR 20.

b. The RSO will notify the RSSO of any exposure exceeding Tier 2 USACE Dose Limits and any release of radioactive materials that could potentially cause a dose to an individual to exceed the Tier 2 USACE dose limits, or an event that could lead to a member of the public receiving a significant portion of the 100 millirem/yr dose limit. The RSO will notify the RSSO and the NRC of overexposures and releases as defined by NRC as per 10 CFR 20.

20. Army Radiation Authorizations.

a. All radioactive materials that are not specifically licensed by NRC, and all radiation generating devices for possession or use by USACE personnel must be covered by an Army Radiation Authorization (ARA) issued by USACE. An ARA is required for all such sources except:

(1) Byproduct, source, or special material which the NRC has declared to be license-exempt (10 CFR 30, sections 30.14 through 30.20; 10 CFR 40, sections 40.13 and 40.14; and 10 CFR 70, section 70.14).

(2) Less than 0.1 microcurie (μCi) [3.7 kilobecquerels (kBq)] of radium.

(3) Less than 1 μCi (37 kBq) of any naturally occurring or accelerator produced radioactive material (NARM) other than radium.

(4) Electron tubes containing less than 10 μCi (370 kBq) of any NARM radioisotope.

(5) Machine-produced ionizing radiation sources not capable of producing a high radiation area or very high radiation area. (For example, medical and dental diagnostic x-ray systems do not require an ARA.)

(6) Army nuclear reactors and Army reactor-produced radioactive material (RAM) that remains at the reactor site. The Army Reactor Office issues Army reactor permits for these sources per AR 50-7, Army Reactor Program.

b. All ARA applications, amendments, termination requests, and correspondence will be forwarded to the RSSO. The RSSO will review these documents, and when they are in compliance, issue on behalf of the Commanding General, USACE, the ARA and any required conditions via CESO.

c. Application for an ARA, amendment to an ARA, or termination of an ARA including all enclosures, will be submitted using DA Form 3337, to the RSSO not later than 30 days prior to the date the action is needed.

d. ARA conditions will specify the time period for which the ARA is valid, and any special procedures applicable to the possession and use of the radioactive materials or radiation generating devices.

e. Radioactive materials and radiation generating devices will not be procured until the required ARAs have been received.

21. Army Radiation Permits.

a. USACE contractors wishing to use, store, or possess radioactive materials or radiation generating devices on any DA installation must obtain an Army Radiation Permit (ARP). For purposes of this paragraph, "ionizing radiation source" means any source that, if held or owned by an Army agency, would require a specific NRC license or ARA. The non-Army applicant will apply by letter with supporting documentation (paragraph 21.b, below) to the District/Lab/Center Commander.

b. The ARP application will specify start and stop dates for the ARP and describe for what uses the applicant needs the ARP. The District/Lab/Center Commander will approve the application only if the applicant provides evidence to show that one of the following is true:

(1) The applicant possesses a valid NRC license or Department of Energy (DOE) radiological work permit that allows the applicant to use the source as specified in the ARP application.

(2) The applicant possesses a valid Agreement State license that allows the applicant to use radioactive material as specified in the ARP application, and the applicant has filed NRC Form-241, Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters with the NRC in accordance with 10 CFR 150.20. An ARP issued under these circumstances will be valid for no more than 180 days in any calendar year.

(3) For machine-produced ionizing radiation sources, the applicant has an appropriate State authorization that allows the applicant to use the source as specified in the ARP application or has in place a radiation protection program that complies with Army regulations.

(4) For overseas installations, the applicant has an appropriate host-nation authorization as necessary that allows the applicant to use the source as specified in the ARP application and has in place a radiation protection program that complies with Army regulations.

c. All ARPs will require applicants to remove all permitted sources from Army property by the end of the permitted time.

d. Disposal of radioactive material by non-Army agencies on Army property is prohibited. However, the installation Commander may authorize radioactive releases to the atmosphere or to the sanitary sewerage system that are in compliance with all applicable Federal, DOD, and Army regulations.

22. Air Force and Navy Radiation Permits.


a. USACE personnel and USACE contractors wishing to use radioactive materials or radiation generating devices on any Air Force installation must obtain permission from the installation. On Air Force property, contact the installation Environmental Health Section for instructions.

b. USACE personnel and USACE contractors wishing to use radioactive materials or radiation generating devices on any Navy installation must obtain permission from the installation. On Navy property, contact the installation Safety Office for instructions.

23. EM 385-1-80, USACE Radiation Protection Manual, provides more in-depth guidance and explanation of methods to meet the requirements of this regulation. It provides information to ensure a greater level of radiation protection (ionizing and non-ionizing) to USACE personnel, the public and the environment. It also provides guidance for compliance.

FOR THE COMMANDER:

2 Appendices
Appendix A-References
Appendix B-Definitions


STEPHEN L. HILL
Colonel, Corps of Engineers
Chief of Staff

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30 Jun 10

APPENDIX A

References

A.1. Required Publications.

10 CFR
Energy

29 CFR 1910
Labor

49 CFR 171-179
Transportation

AR 50-7
The Army Reactor Program

AR 385-10
The Army Safety Program

DA PAM 385-10
The Army Safety Program

DA PAM 385-24
The Army Radiation Safety Program

EM 385-1-1
Safety and Health Requirements Manual

EM 385-1-80
Radiation Protection Manual

A.2. Related Publications.

42 U.S.C. 2021-2121d
National Low Level Radioactive Waste Policy Act of 1980, Pub.L. No. 96-573

AR 25-400-2
Army Records Information Management System

AR 25-1
Army Knowledge Management and Information Technology

AR 40-5
Preventive Medicine

DA PAM 40-18/DLAI 1000.30
Personnel Dosimetry Guidance & Dose Recording Procedures for Personnel
Occupationally Exposed to Ionizing Radiation

APPENDIX B

Definitions

ACTIVITY – The number of nuclear disintegrations occurring in a given quantity of material per unit time. (See Curie)

CONTAMINATION, RADIOACTIVE – Deposition of radioactive material in any place where it is not desired, and particularly in any place where the presence may be harmful.

CURIE – The quantity of any radioactive material in which the number of disintegrations is 3.7×10^{10} per second. Abbreviated Ci.

Millicurie – One-thousandth of a curie (3.7×10^7 disintegrations per second).
Abbreviated mCi.

Microcurie – One-millionth of a curie (3.7×10^4 disintegrations per second).
Abbreviated μ Ci.

Picocurie – One-millionth of a microcurie (3.7×10^{-2} disintegrations per second or 2.22 disintegrations per minute). Abbreviated pCi.

DOSE – A general term denoting the quantity of radiation or energy absorbed in a specified mass. For special purposes, it must be appropriately qualified (e.g., absorbed dose).

DOSE, ABSORBED – The energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest. The unit of absorbed dose is the rad or the gray (1 rad = 0.01 gray = 100 ergs/gram).

EXPOSURE – Means being exposed to ionizing radiation or to radioactive material. The special unit of exposure is the roentgen.

EXTERNAL DOSIMETRY – The use of thermoluminescent dosimeters, film badges or other exposure measuring devices to determine the radiation dose a person receives from sources outside the body.

HIGH RADIATION AREA – Means an area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

INTERNAL DOSIMETRY – Also called bioassay. The use of instruments to measure radiation coming from inside the body or the analysis of urine, or fecal samples to determine the radiation dose a person receives from radiation sources inside the body.

IONIZING RADIATION – Any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter.

MONITORING – Means the measurement of radiation levels, concentrations, surface area concentrations, or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

OCCUPATIONAL DOSE – The radiation dose a person receives as a result of activities related to their employment, but excluding doses resulting from background and medical radiation.

PLANNED SPECIAL EXPOSURE (PSE) – Means an infrequent exposure to radiation, separate from and in addition to the annual NRC (Tier 3) dose limit.

RADIATION – Means alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this regulation, does not include non-ionizing radiation such as radio- or microwaves, or visible, infrared, or ultraviolet light.

RADIATION AREA – Means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters.

RADIATION GENERATING DEVICE – Any device that generates ionizing radiation. Examples include x-ray machines, x-ray diffraction units, and neutron generators. Radiation from reactors, accelerators, gas chromatographs and x-ray fluorescence devices come from radioactive materials generated or enclosed in the items.

RADIATION SURVEY – Evaluation of the radiation hazards incident to the production, use, or existence of radioactive materials or other sources of radiation under a specific set of conditions. Such evaluation customarily includes a physical survey of the disposition of materials and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes using or affecting these materials to predict hazards resulting from expected or possible changes in materials or equipment.

RADIONUCLIDE OR RADIOACTIVE MATERIAL – A nuclide with an unstable ratio of neutrons to protons placing the nucleus in a state of stress. In an attempts to reorganize to a more stable state, it may undergo various types of rearrangement that involve the release of radiation.

REM – The special unit of dose equivalent. The dose equivalent in rems is numerically equal to the absorbed dose in rads multiplied by the quality factor, distribution factor, and any other necessary modifying factors.

ROENTGEN (R) – A unit of exposure to ionizing radiation. It is the amount of gamma or x-rays required to produce ions resulting in a charge of 0.000258 coulombs/kilogram of air under standard conditions.

Milliroentgen (mR) – A submultiple of the roentgen equal to one one-thousandth (1/1000th) of a roentgen.

TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE) – Means the sum of the Deep Dose Equivalent (for external exposures) and the Committed Effective Dose Equivalent (for internal exposures). See EM 385-1-80 for additional information.

VERY HIGH RADIATION AREA – Means an area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at a meter from a radiation source or from any surface that the radiation penetrates.