

SECTION 6

HAZARDOUS SUBSTANCES, AGENTS, AND ENVIRONMENTS

06.A GENERAL

06.A.01 Exposure standards.

- a. Exposure, through inhalation, ingestion, skin absorption, or physical contact, to any chemical, biological, or physical agent in excess of the acceptable limits specified in the most recently published American Conference of Governmental Industrial Hygienist (ACGIH), "Threshold Limit Values and Biological Exposure Indices," or by OSHA, whichever is more stringent, shall be prohibited.
- b. In case of conflicts between ACGIH and other standards or regulations referenced in this manual, the more stringent shall prevail.
- c. The employer shall comply with all applicable standards and regulations to reduce contaminant concentration levels as low as is reasonably achievable (ALARA).

06.A.02 Hazard evaluation.

- a. All operations, materials, and equipment shall be evaluated to determine the presence of hazardous environments or if hazardous or toxic agents could be released into the work environment.
- b. AHA and/or PHA shall be used for the evaluation. The analyses shall identify all substances, agents, and environments that present a hazard and recommend hazard control measures. Engineering and administrative controls shall be used to control hazards; in cases where engineering or administrative controls are not feasible, PPE may be used.

EM 385-1-1

3 Nov 03

c. The analyses shall identify: that it serves as certification of hazard assessment; the workplace and activity evaluated; the name of the person certifying that the evaluation has been performed; and the date of the evaluation.

d. Operations, materials, and equipment involving potential exposure to hazardous substances, agents, or environments shall be evaluated by a qualified industrial hygienist, or other competent person, to formulate a hazard control program. This program must be accepted by the GDA before the start of operations. **> This evaluation shall be performed at least annually for USACE operations.**

06.A.03 Testing and monitoring.

a. Approved and calibrated testing devices shall be provided to measure hazardous substances, agents, and environments. (Devices shall be labeled indicating the name of the individual performing the calibration and date of the current calibration.)

b. Individuals performing testing and monitoring shall be trained in testing and monitoring procedures and hazards: testing devices shall be used, inspected, and maintained in accordance with the manufacturer's instructions, a copy of which shall be maintained with the devices.

c. NIOSH sampling and analytical methods, OSHA required, or other approved sampling and analytical methods shall be used; laboratories used for analysis shall be accredited by nationally recognized bodies, such as the American Industrial Hygiene Association (AIHA), for the type of analysis performed.

d. Determinations of the concentrations of, and hazards from, hazardous substances, agents, and environments shall be made by a qualified industrial hygienist or other competent person during initial startup and as frequently as necessary to ensure the safety and health of the work environment.

- e. Records of testing/monitoring shall be maintained on site and shall be available to the GDA upon request.

06.A.04 The following precedence shall be in the control of exposure to hazardous substances, agents, and environments:

- a. Engineering controls (such as local/general ventilation) shall be instituted to limit exposure to hazardous substances, agents, and environments within acceptable limits;
- b. When engineering controls are not feasible or are not sufficient to limit exposure to hazardous substances, agents, and environments within acceptable limits, work practice controls (such as the wetting of hazardous dusts) shall be instituted;
- c. When engineering or work practice controls are not feasible or are not sufficient to limit exposure to hazardous substances, agents, and environments within acceptable limits, PPE programs (such as the use of respirators or gloves) shall be instituted.

06.B HAZARDOUS SUBSTANCES

06.B.01 When any hazardous substance is procured, used, stored, or disposed, MSDS for the substances shall be available at the worksite. > **See 01.B.06.**

- a. Information contained in the MSDS shall be incorporated in the AHA/PHAs for the activities in which the material will be used and will be followed in the use, storage, and disposal of the material and the selection of hazard control and emergency response measures.
- b. All employees using, storing, or disposing of hazardous substances shall receive training in the information contained in the MSDS for the substance and any general safety and health instruction required to understand this information.

EM 385-1-1

3 Nov 03

06.B.02 When engineering and work practice controls are either infeasible or insufficient, appropriate PPE and sanitary facilities shall be provided and used for the transportation, use, and storage of hazardous substances.

a. When irritants or hazardous substances may contact skin or clothing, sanitary facilities and PPE shall be provided. PPE may include suitable gloves, face/eye protection and chemical protective suits. The qualified industrial hygienist or other competent personnel shall determine the scope and type of protective gear. Special attention should be given to selecting proper chemical protection when working with materials designated with a "skin" notation by OSHA standards or by ACGIH in the latest edition of their *Threshold Limit Values and Biological Exposure Indices* booklet. Such materials may produce systemic toxic effects through absorption through unbroken skin. **> See also 02.D and Section 5.**

b. When the eyes or body of any person may be exposed to harmful substances, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. **> Reference ANSI Z358.1.**

(1) Emergency eyewash equipment must be provided where there is the potential for an employee's eyes to be exposed to corrosives, strong irritants, or toxic chemicals. **>See Appendix Q for definitions.**

(2) The emergency eyewash equipment must irrigate and flush both eyes simultaneously while the operator holds the eyes open.

(3) The emergency eyewash equipment must deliver at least 0.4 gallons (gal) (1.5 liters (L)) of water per minute for 15 minutes or more.

(4) Personal eyewash units are portable, supplementary units that support plumbed units or self-contained units,

or both, by delivering immediate flushing for less than 15 minutes. Personal eyewash equipment may be used to supplement emergency washing facilities, however, they must not be used as a substitute.

(5) All plumbed emergency eyewash facilities and hand-held drench hoses must be activated weekly and inspected annually to ensure that they function correctly and that the quality and quantity of water is satisfactory for emergency washing purposes.

06.B.03 Transportation, use, storage, and disposal of hazardous substances shall be under the supervision of a qualified person.

- a. Transportation, use, and storage of hazardous substances shall be planned and controlled to prevent contamination of people, animals, food, water, equipment, materials, and environment.
- b. All storage of hazardous substances shall be in accordance with the recommendations of the manufacturer and accessible only to authorized persons.
- c. Disposal of surplus or excess materials and containers shall occur in a manner that will not contaminate or pollute any water supply, ground water, or streams; and will comply with Federal, State, and local regulations and guidelines.
- d. Containers that have been used for hazardous substances shall not be used for any other material until they have been cleaned in accordance with the hazardous substance manufacturer's recommendations.
- e. Every hazardous substance being transported for disposal shall be transported with a copy of the substance's MSDS.

06.B.04 Process safety management of highly hazardous chemicals shall be employed in accordance with 29 CFR 1910.119 or 29 CFR 1926.64 whenever a work activity involves:

EM 385-1-1

3 Nov 03

- a. A process that involves a chemical at or above the threshold quantities listed in Appendix A of the above-cited CFRs, or
- b. A process that involves a flammable liquid or gas as defined in 29 CFR 1926.59(c) on site in one location in a quantity of 10,000 lb (4535.9 kg) or more, except:
 - (1) Hydrocarbon fuels used solely for workplace consumption as a fuel if such fuels are not part of a process containing another highly hazardous chemical covered by the standards cited above, or
 - (2) Flammable liquids stored in atmospheric tanks or transferred that are kept below their normal boiling point without benefit of chilling or refrigeration.

06.B.05 Lead and Asbestos Hazard Control Activities.

a. General. Prior to beginning work that will impact lead-containing materials, to include protective and decorative coatings or asbestos-containing materials, a written lead compliance plan and/or asbestos hazard abatement plan shall be developed. The lead compliance plan shall be in accordance with 29 CFR 1910.1025 and 29 CFR 1926.62. The asbestos hazard abatement plan shall be in accordance with 29 CFR 1910.1001; 29 CFR 1926.1101; and 40 CFR 61, Subpart M. The plan(s) shall be developed as an appendix to the contract APP or, for USACE operations, the Project Safety Plan. The written plan(s) shall be submitted for acceptance by the GDA before beginning work. Unified Facility Guide Specifications (UFGS) for lead, asbestos and general safety and health requirements have been published and should be used in developing contract specifications.

b. Lead Compliance Plan. A lead compliance plan shall describe the procedures to be followed in order to protect workers from lead hazards while performing lead hazard control activities. The Plan shall address the following:

- (1) A description of each work activity in which lead is emitted. The description shall include such topics as equipment and materials used, controls in place, crew size, job responsibilities, operating procedures, and maintenance practices; and shall also include work activity locations and lead-containing components keyed to the project drawings.
- (2) Description of means to be used to achieve exposure compliance, including any engineering controls.
- (3) Worker exposure assessment procedures to monitor and document worker lead exposure. Exposure monitoring shall include two types:

 - (a) Initial determination (monitoring for the initial determination may be omitted if there is sufficient objective or historical data showing action level compliance according to the requirements), and
 - (b) Continued exposure monitoring required as a result of initial exposure determinations.
- (4) Protective clothing to protect workers from lead exposure, housekeeping procedures to prevent the spread of lead contamination both in and beyond the lead hazard control area, and hygiene facilities and practices to prevent workers from inadvertent ingestion of lead.
- (5) Administrative controls to limit worker exposure to lead, including worker rotation schedule to be employed, if engineering controls or PPE precautions fail to eliminate exposures exceeding the permissible exposure limit (PEL).
- (6) Medical surveillance procedures to monitor worker lead exposures and assure fitness for wearing respiratory protection devices.
- (7) Competent person and worker training required to assure workers understand the significance of the lead

hazards and how to protect themselves.

(8) Detailed sketches identifying lead hazard control areas, including decontamination areas and facilities, critical barriers, and physical and air distribution boundaries.

(9) Perimeter or other area air monitoring outside or adjacent to the regulated area.

(10) Any security required for each lead hazard control area.

(11) Waste generation, characterization, transportation, and disposal (including recordkeeping).

c. Asbestos Hazard Abatement Plan. An asbestos hazard abatement plan shall describe the procedures to be followed to protect workers from asbestos hazards while performing work that will disturb asbestos-containing materials. The Plan shall address the following:

(1) A description of each activity where asbestos will be disturbed. The description shall include the OSHA class of work, equipment required, controls to be used, crew size, job responsibilities, maintenance practices, and locations keyed to the project drawings.

(2) Method of notification of other employers at the worksite

(3) Description of regulated areas, including types of containment, decontamination unit plan, and engineering controls.

(4) Air monitoring: personal, environmental, and clearance. Worker exposure assessment procedures shall address monitoring and documenting worker exposures. An initial determination shall be performed to meet the OSHA requirements. Monitoring for the initial determination may be omitted if there is sufficient objective or historical data showing compliance with the requirements. Continued

exposure monitoring may be required as a result of initial exposure determinations. Environmental monitoring shall demonstrate the absence of asbestos fiber migration outside the regulated area. Clearance monitoring shall document that the area has met specified clearance criteria.

(5) PPE, including respirators and clothing.

(6) Housekeeping procedures addressing the prevention of the spread of contamination both in and beyond the regulated area.

(7) Hygiene facilities and practices to prevent workers from inadvertently spreading contamination.

(8) Competent person and worker training required that assures workers understand the significance of the hazards and how to protect themselves.

(9) Medical surveillance, as required, to assess exposure and to monitor worker fitness to perform work tasks while wearing PPE to include respiratory protection devices.

(10) Waste generation, containerization, transportation, and disposal (including recordkeeping).

(11) Security, fire, and medical emergency response procedures.

06.C HOT SUBSTANCES

06.C.01 Heating devices and melting kettles.

- a. Heating devices and melting kettles shall be placed on firm, level foundations and shall be protected against traffic, accidental tipping, or similar hazards and, whenever possible, shall be placed downwind from workers or occupied buildings..

EM 385-1-1

3 Nov 03

b. A fire extinguisher, rated not less than 2-A:20-B:C, shall be available at all locations where heating devices and melting kettles are in use. > **Hot work permits shall be required on Government installations unless otherwise indicated by the GDA.**

c. Heating devices and melting kettles shall not be left unattended when in use. > **See 09.J.03**

d. Bituminous-material melting kettles shall be provided with an effective lid or hood and a thermometer in operating condition.

e. Bituminous-material melting kettles shall not be used or operated inside, atop, or within 25 ft (7.6 m) of buildings or combustible material.

06.C.02 Enclosed areas in which hot substances are heated or applied shall be ventilated.

06.C.03 Ladles, equipment, and material shall be moisture-free before being used or placed in heated material.

06.C.04 Transporting and handling hot substances.

a. Runways or passageways, clear of obstructions, shall be provided for all persons carrying hot substances.

b. Hot substances shall not be carried up or down ladders.

c. When hoists are used to raise or lower hot substances, attention shall be given to assuring that the hoisting mechanism is adequate for the loads imposed and is securely braced and anchored.

d. All persons handling hot substances shall be provided protection against contact with, or exposure to radiant heat, glare, fumes, and vapors of the substances. > **See Section 5.**

- e. Containers for handling and transporting hot substances shall be of substantial construction, free from any soldered joints or attachments, and shall not be filled higher than 4 in (10.1 cm) from the top.

06.D HARMFUL PLANTS, ANIMALS, AND INSECTS

06.D.01 Protection against hazards from animals and insects shall include, as applicable, the following:

- a. PPE such as boots, hoods, netting, gloves, and masks;
- b. Repellents;
- c. Drainage or spraying of breeding areas;
- d. Burning or destruction of nests;
- e. Smudge pots and aerosols for protecting small areas;
- f. Elimination of conditions that propagate insects or vermin;
- g. Extermination measures;
- h. Inoculation;
- i. Approved first-aid remedies for employees; and
- j. Instruction in recognition of the animals and insects.

06.D.02 In areas where employees are exposed to poisonous plants (e.g., poison ivy, oak, or sumac), the following protective measures, as applicable, shall be provided:

- a. Removal or destruction of plants, where practical;
- b. Appropriate protective clothing such as gloves;

EM 385-1-1

3 Nov 03

- c. Protective ointments;
- d. Soap and water for washing exposed parts;
- e. Approved first-aid remedies; and
- f. Instruction in recognition and identification of the plants.

06.D.03 When burning poisonous plants, controls shall be instituted to prevent contact with or inhalation of toxic elements contained in the smoke.

06.E IONIZING RADIATION

06.E.01 Anyone who procures, uses, possesses, transports, transfers, or disposes of radioactive materials or radiation generating devices shall:

- a. Notify, in writing, the GDA of the nature of the material or device, a description of the intended use, the location of use and storage, and all transportation and disposal requirements.
- b. Secure appropriate authorization or permit if a licensed or DOD regulated radiological device or radioactive material is to be used on a DOD installation (a lead time of at least 45 days should be allowed for obtaining a DOD authorization or permit).
- c. Provide to the GDA a copy of all Nuclear Regulatory Commission (NRC) or Agreement State licenses, the Army Radiation Authorization (ARA), and reciprocity forms (to include NRC Form 241), as applicable.

06.E.02 Qualified Personnel.

- a. Operations involving radiation hazards or use of radioactive material or radiation generating devices shall be performed under the direct supervision of a person, designated in writing by the Radiation Safety Officer (RSO), who is qualified and

responsible for radiological safety. This person shall conduct surveys, evaluate and secure any specialized assistance to assure compliance with radiation protection standards.

b. The RSO will be technically qualified, meeting the experience, training, and education requirements listed below:

(1) Formally trained in radiation protection that includes the following topics: physics of radiation; radiation's interaction with matter; mathematics necessary for the subject matter; biological effects of radiation; type and use of instruments for detection, monitoring and surveying radiation; radiation safety techniques and procedures; and use of time, distance, shielding, engineering controls, and PPE to reduce radiation exposure.

(2) Hands-on training in the uses all of the equipment, instrumentation, procedures, and theory used in their unit.

(3) Knowledge of regulations (NRC, U.S. Environmental Protection Agency (USEPA), Department of Energy (DOE), DOT and DOD, to include all applicable DOD Components) pertaining to radioactive materials, radiation generating devices, and radioactive and mixed waste; and

(4) Knowledge of the USACE Radiation Safety Program, and recordkeeping requirements for work with radioactive materials and radiation generating devices.

06.E.03 Radiation Safety Program.

a. Operations involving regulated radiation hazards, and users of radioactive material or radiation generating devices, shall develop and implement a Radiation Safety Program. The program shall be managed by the RSO and based on sound radiation safety principles that shall keep occupational doses and doses to the public ALARA. A RSO and Ionizing Radiation Safety Committee (IRSC) shall be established in accordance

EM 385-1-1
3 Nov 03

with 10 CFR 20 and DOD requirements as part of the Radiation Program. The program shall be reviewed annually.

b. All personnel entering an area where radioactive material or radiation generating devices are used, and where there is a potential for an individual to receive a Total Effective Dose Equivalent (TEDE) of 100 milliRems (mrem) or more in 1 year, shall receive instruction in:

- (1) The presence of the material or device;
- (2) Health and safety problems associated with exposure to radiation, including the potential effects of radiation on a pregnant female, the fetus, or embryo;
- (3) Precautions and controls used to control exposure;
- (4) Proper use of instrumentation and dosimetry in the area;
- (5) The Radiation Safety Program required in 06.E.03a; and
- (6) Their rights and responsibilities.

c. The Radiation Safety Program will include plans and procedures for handling credible emergencies involving radiation and radioactive materials. This will include coordination with civilian and/or military emergency response organizations as necessary.

06.E.04 Dose Limits.

a. Occupational dose limits shall be based on the TEDE.
> **See Table 6-1.**

- (1) An annual limit that is the more limiting of: 5 rems (0.05 sieverts (Sv)) TEDE, or the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue of 50 rems (0.5 Sv), or 15 rems (0.15 Sv) to the lens

TABLE 6-1

OCCUPATIONAL DOSE RATES

Body part	Annual limits (NRC) per RSO	Annual limits (NRC) without RSO	Suggested ALARA limits
Whole body	5 rem (0.05 Sv)	0.5 rem (0.005 Sv)	0.1 rem (0.001 Sv)
Individual organ	50 rem (0.5 Sv)	5 rem (0.05 Sv)	0.5 rem (0.005 Sv)
Lens of eye	15 rem (0.15 Sv)	1.5 rem (0.015 Sv)	0.15 rem (0.15 Sv)
Skin	50 rem (0.5 Sv)	5 rem (0.05 Sv)	0.5 rem (0.005 Sv)

of the eye, or 50 rems (0.5 Sv) shallow dose equivalent to the skin or any extremity.

(2) Without the written approval of the RSO, the annual occupational dose shall not exceed the more limiting of: 0.5 rems (0.005 Sv) TEDE, or the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue of 5 rems (0.05 Sv), or 1.5 rems (0.015 Sv) to the lens of the eye, or 5 rems (0.05 Sv) shallow dose equivalent to the skin, or any extremity.

(3) To keep doses ALARA, the user shall set administrative action levels below the annual dose limits. These action levels shall be realistic and attainable. Suggested action levels are the more limiting of: 0.1 rems (0.001 Sv) TEDE, or the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue of 0.5 rems (0.005 Sv), or 0.15 rems (0.0015 Sv) to the lens of the eye, or 0.5 rems (0.005 Sv) shallow dose equivalent to the skin or any extremity.

EM 385-1-1

3 Nov 03

b. Planned special exposures shall not be used without the written consent of the RSO and the IRSC.

c. No employee under 18 years of age shall receive occupational exposure to ionizing radiation.

d. The dose to a declared pregnant worker shall not exceed 0.5 rem (0.005 Sv) during the entire gestation period and efforts shall be made to avoid variations in a uniform monthly exposure rate. If the dose to the embryo/fetus exceeds or is within 0.05 rem of 0.5 rem at the time of declaration, then dose to the embryo/fetus is limited to 0.05 rem for the remainder of gestation.

06.E.05 Radiation Monitoring, Surveys, and Dosimetry.

a. Users of radioactive material or radiation generating devices shall conduct surveys and monitoring to ensure occupational dose limits are not exceeded.

b. Instruments used for radiation monitoring and surveying shall be:

(1) Available and used whenever radioactive material or radiation generating devices are used;

(2) Properly calibrated to a National Institute of Standards and Technology (NIST) traceable source;

(3) Appropriate for the type and intensity of the radiation surveyed; and

(4) Operationally checked against a dedicated check source before each use.

c. Users of radioactive material or radiation generating devices and visitors or personnel performing work tasks in the area shall

coordinate with the RSO for appropriate dosimetry use whenever any of the following situations exist:

- (1) An individual enters a Radiation Area (>5 mrem (50 microsieverts (μSv)) in any 1 hour), or a High Radiation Area (>100 mrem (1 millisieverts (mSv)) in any 1 hour), or a Very High Radiation Area (>500 rad (5 Gray (Gy)) in 1 hour),
- (2) An individual has the potential to receive greater than 0.5 rem (0.005 Sv) in 1 year.

d. All external dosimetry shall be processed by a National Voluntary Laboratory Accreditation Program (NVLAP) certified laboratory. USACE personnel shall use the designated Department of Army (DA) dosimetry center.

e. Users of unsealed radioactive material sources shall institute an internal dosimetry program:

- (1) When there is a potential for a worker to receive an internal dose of greater than 0.5 rem (5 mSv) per year;
- (2) That is reviewed and approved by a qualified health physicist, and
- (3) That contains provisions for a pre-exposure bioassay, a bioassay method capable of detecting internal radioactive materials, at a level below 10% of the annual limits of intake (ALI) listed in Appendix B of 10 CFR 20 for each radionuclide used, appropriate action levels for requiring additional bioassay, actions for individuals found to have internally deposited radioactive materials, and provisions for post-exposure bioassay.

06.E.06 Access, Storage, and Control.

a. All radiological devices and radioactive materials shall be designed, constructed, installed, used, stored, transported, and

EM 385-1-1

3 Nov 03

disposed of in such a manner to assure personnel exposures are kept ALARA.

b. Users of radioactive materials or radiation generating devices shall post signs and control access to radiation areas in accordance with 06.E.08.

c. Where radiation levels exceed 2 mrem (20 μ Sv) in any 1 hour, users shall use engineering controls, shielding, access time limitation, and/or physical separation to keep doses to the public ALARA.

d. Users shall secure radioactive material and radiation generating devices against theft or unauthorized use.

e. Storage shall be in accordance with any license or permit requirements.

f. Radioactive material and radiation generating devices, not in storage, shall be under constant control and surveillance.

g. Operations involving regulated radiation hazards or users of regulated radioactive material or radiation generating devices shall conduct surveys to ensure that the public dose limit of 0.01 rem (0.0001 Sv) is not exceeded.

06.E.07 Respiratory Protection and other Controls.

a. Users of radioactive material shall, to the extent practicable, institute process or engineering controls to limit concentrations of radioactive materials in air.

b. Where process or engineering controls are unable to control airborne radioactive material concentrations, users shall increase monitoring and limit intakes of radioactive materials through control of access, limitation of exposure times, use of respiratory protection equipment, or other controls.

c. The use of respiratory protection equipment shall be in compliance with 05.E., of this manual, and shall be limited by the protection factors listed in Appendix A of 10 CFR 20.

06.E.08 Signs, Labels, and Posting Requirements.

a. The RSO shall post in a conspicuous location a sign or signs bearing the standard radiation symbol shown in Figure 8-5 and the following words:

(1) "**Caution, Radiation Area**" - areas where radiation field is equal to or greater than 5 mrem (0.05 mSv) in any 1 hour and less than 100 mrem (1 mSv) in any 1 hour;

(2) "**Caution, High Radiation Area**" - areas where radiation field is equal to or greater than 100 mrem in any 1 hour (0.1 mSv) and less than 500 rads (5 Gy) in any 1 hour;

(3) "**Grave Danger, Very High Radiation Area**" - areas where the radiation field is equal to or greater than 500 rads (5 Gy) in any 1 hour;

(4) "**Caution, Airborne Radioactivity Area**" - areas where airborne radioactive material concentrations are greater than the derived air concentration (DAC) limits listed in 10 CFR 20, Appendix B; or

(5) "**Caution, Radioactive Material**" - rooms where quantities of radioactive materials in excess of ten times the 10 CFR 20, Appendix C quantities are used or stored.

b. Users who receive or expect to receive a package containing radioactive material shall follow the package receipt procedures listed in 10 CFR 20.1906.

c. When a site has an NRC license, the RSO shall post an NRC Form 3 in a location visible to all employees who work with or around radioactive materials.

EM 385-1-1

3 Nov 03

06.E.09 Radioactive Waste Disposal.

a. Radioactive sealed sources (and gauges) when no longer needed may be returned (transferred) to the manufacturer. The local USACE Command RSO must be notified and any applicable licenses or permits amended or terminated.

b. Radioactive waste disposal shall be coordinated with the GDA. For disposal actions specific to USACE operations and activities the GDA shall coordinate with the USACE Command RSO and the USACE Hazardous, Toxic, and Radioactive Waste Center of Expertise.

c. Tritium (H-3) and Carbon-14 used in liquid scintillation counting, at concentrations below 0.05 microcuries per gram ($\mu\text{Ci/g}$), may be disposed without regard to its radioactivity. (Note: Many liquid scintillation fluids are hazardous wastes and must be disposed of as such.)

06.E.10 Records.

a. All users of radioactive material or radiation generating devices shall prepare and maintain records of the Radiation Safety Program for 3 years after termination of the license or permit.

b. For any individual who frequents a restricted or controlled area, and may potentially be exposed to 100 mrem (1 mSv) per year or more, the licensee shall prepare and maintain records to determine that person's:

(1) Occupational dose during the current year,

(2) Attempt to obtain records of cumulative occupational radiation exposure, and

(3) Dose received, both internal and external.

c. All users of radioactive material or radiation generating devices shall prepare and maintain records of all calculated or monitored radiation dose to individual members of the public so as to document compliance with 06.E.05.

06.E.11 Reports.

a. Any loss, theft, damage, or overexposure shall immediately upon discovery be reported to the RSO who will then file a report with NRC in accordance with the requirements of 10 CFR 20.

b. Annual reports shall be issued by the RSO for each individual USACE radiation worker with the recorded or calculated dose assigned to the USACE individual for the year or specific work project. These shall be maintained in such a manner that accumulated exposure can be determined at a future date.

06.E.12 Transportation, interstate or intrastate, shall comply with the requirements of the DOT for transportation of radioactive materials contained in 49 CFR.

06.E.13 Medical surveillance. **> See Section 28 for requirements specific to work conducted under the provisions of 29 CFR 1910.120 and 29 CFR 1926.65.**

a. Medical examinations are not routinely required before occupational exposure to ionizing radiation. For USACE personnel, a medical examination shall be conducted in accordance with AR 40-5, when deemed necessary, by a physician the RSO or other regulations. The RSO will coordinate with supporting medical personnel to help assure that personnel receive appropriate occupational health surveillance.

b. All cases of overexposure and suspected ingestion or inhalation of radioactive materials shall be referred to a physician for examination.

EM 385-1-1

3 Nov 03

06.E.14 Radon.

a. Any structure, building or tunnel, wherein workers may be reasonably expected to be exposed to radon concentrations exceeding 7.5 picocuries per liter (pCi/L), shall be tested for radon. Where the radon concentration exceeds 7.5 pCi/L, the provisions of 29 CFR 1910.1096 for exposure, SOPs, posting, training, medical records, record keeping and reporting shall apply. 29 CFR 1910.1096(c)(1) refers to Table 1 of Appendix B to 10 CFR 20. The Table 1 value for radon is 30 pCi/L.

b. USACE workers and USACE and DA facilities will comply with testing, exposure, and mitigation guidance provided in AR 200-1.

06.F NONIONIZING RADIATION AND MAGNETIC AND ELECTRIC FIELDS

06.F.01 Lasers.

a. Only qualified and trained employees may be assigned to install, adjust, and operate laser equipment. Proof of qualification of the laser equipment operator shall be in the operator's possession during operation.

b. Laser equipment shall bear a label to indicate make, maximum output, and beam spread.

c. Areas in which lasers are used shall be posted with standard laser warning signs. > **See 08.A.05k.**

d. Employees whose work requires exposure to laser beams shall be provided with appropriate laser safety goggles that will protect for the specific wavelength of the laser and be of optical density adequate for the energy involved, as specified in Table 6-2.

TABLE 6-2

**LASER SAFETY GOGGLE OPTICAL DENSITY
REQUIREMENTS**

Intensity, continuous wave maximum power density (watts/cm ²)	Attenuation	
	Optical density	Attenuation factor
0.01	5	10,000
0.1	6	100,000
1.0	7	1,000,000
10.0	8	10,000,000

Protective goggles shall bear a label identifying the following data: the laser wavelengths for which use is intended, the optical density of those wavelengths, and the visible light transmission.

e. Beam shutters or caps shall be used, or the laser turned off, when laser transmission is not required. When the laser is left unattended for a period of time (e.g., during lunch hour, overnight, or at change of shifts) the laser shall be turned off.

f. Only mechanical or electronic means shall be used as a detector for guiding the internal alignment of the laser.

g. The laser beam shall not be directed at employees: whenever possible, laser units in operation shall be set above the heads of employees.

h. When it is raining or snowing or when there is dust or fog in the air, the operation of laser systems shall be prohibited (as practical); during such weather conditions employees shall be kept out of range of the areas of source and target.

EM 385-1-1

3 Nov 03

i. Employee exposure to laser power densities shall be within the threshold limit values (TLVs) as specified by the ACGIH in "Threshold Limit Values and Biological Exposure Indices."

j. Only Class I, II, or IIIa lasers may be used as hand-held pointing devices. Lasers used as pointing devices (e.g., during briefings) shall not be directed toward employees and shall be handled and stored in accordance with the manufacturer's recommendations.

06.F.02 Radio frequency and electromagnetic fields.

a. Ensure that no employee is exposed to electric or magnetic fields, radio frequency (RF) including infrared, ultraviolet, and microwave radiation levels exceeding the values listed in the ACGIH Threshold Limit Values and Biological Exposure Indices.

b. Protective clothing to minimize RF exposure will not be used as a routine method of protecting personnel.

c. All personnel routinely working with RF emitting equipment where exposures may exceed TLVs will receive training in RF hazards, procedures for minimizing these hazards, and their responsibility to limit potential overexposures. Operator's manuals, Training Orders, Equipment SOPs, etc. will be available for all RF generating equipment and safety guidance will be followed.

d. Whenever personnel are potentially exposed to RF fields exceeding PELs, the fields will be measured and evaluated using Institute of Electrical and Electronics Engineers (IEEE) guidance. District and/or project safety personnel will use this information and document RF environments.

06.G VENTILATION AND EXHAUST SYSTEMS

06.G.01 Design.

- a. Ventilation systems shall be designed to prevent dispersion into the air, or drawing through the work area, of dusts, fumes, mists, vapors, and gases in concentrations causing harmful exposure.
- b. The design of proposed engineering controls shall be approved by the GDA before acquisition or installation of the equipment; design data and drawings shall accompany the request for approval.
- c. Airborne contaminants created by portable equipment (such as drills, saws, and grinding machines) in concentrations exceeding acceptable safe limits shall be effectively controlled at the source. > **See 06.A.04.**

06.G.02 Ventilation systems shall be designed, installed, operated, and maintained in such a manner to ensure the maintenance of a volume and velocity of exhaust air sufficient to gather contaminants and safely transport them to suitable points for removal.

06.G.03 Duration of operation.

- a. Ventilation systems shall be operated continuously during operations when persons are exposed to airborne contaminants or explosive gases at or above acceptable safe limits as defined in 06.A.01 or as otherwise specified by this manual, referenced standards, or regulations.
- b. Ventilation systems shall remain in operation for a time after the work process or equipment has ceased to ensure the removal of any contaminants in suspension in or vaporizing into the air.

EM 385-1-1
3 Nov 03

06.G.04 The efficiency of engineering control systems and methods shall be periodically verified as specified by the designated authority.

06.G.05 Dusts and refuse materials removed by exhaust systems or other methods shall be disposed of in a manner that will not create a hazard to employees or the public and in accordance with Federal, State, and local requirements.

06.H ABRASIVE BLASTING

06.H.01 Written operating procedures shall be developed and implemented for abrasive blasting operations, including pressurized pot procedures (filling, pressurizing, depressurizing, and maintenance and inspection).

- a. The written operating procedures will be developed, maintained, and provided as stated in Appendix C.
- b. No employee will be allowed to work in abrasive blasting operations unless he/she has met the medical surveillance and training and experience, and has been provided the PPE specified in Appendix C.
- c. Pressurized systems and components shall be inspected, tested, certified, and maintained in accordance with the requirements of Section 20.

06.H.02 Abrasive blasting operations shall be evaluated to determine composition and toxicity of the abrasive and the dust or fume generated by the blasted material, including surface coatings. This determination shall be documented on the AHA developed for the abrasive blasting activity.

06.H.03 The concentration of respirable dust and fume in the breathing zone or persons exposed to the blasting operation shall be maintained in accordance with 06.A.01.

06.H.04 When silica sand or other substances containing more than 1% crystalline silica are used for abrasive blasting, the silica control program stated in Appendix C shall be implemented.

06.H.05 Blast cleaning enclosures shall be exhaust ventilated in such a way that a continuous inward flow of air will be maintained at all openings in the enclosure during the blasting operation.

- a. All air inlets and access openings shall be baffled or so arranged that by the combination of inward air flow and baffling the escape of abrasive or dust particles into an adjacent work area will be minimized and visible spurts of dust will not be observed.
- b. The rate of exhaust shall be sufficient to provide prompt clearance of the dust-laden air within the enclosure after cessation of the blasting.

06.I CONFINED SPACE

06.I.01 Confined space work covered by OSHA's General Industry (29 CFR 1910) and Construction (29 CFR 1926) standards shall be performed in accordance with 29 CFR 1910.146 and as provided herein. Confined space work covered by OSHA's Shipyard (29 CFR 1915) standard or USCG regulations shall be performed in accordance with those regulations. > ***For USACE conducted confined space work activities associated with ship and vessel repair and maintenance operations covered by 29 CFR 1915, consult the OSHA regional authority to determine if the requirements of 29 CFR 1910.146 and those provided herein are sufficient to be considered compliant for the specific confined space work tasks to be performed.***

- a. At each facility or activity, the Contractor, or the GDA for USACE operations, shall assign in writing, a competent person for confined space (see Appendix Q for definition) to evaluate the potential for permit-required confined spaces (PRCSs).

EM 385-1-1
3 Nov 03

- b. The evaluation shall use the procedures and decision logic presented in Figure 6-1.
- c. A list of confined spaces (permit-required and non-permit required) shall be maintained on site and shall be updated as new confined spaces are discovered.
- d. All PRCs shall be identified with a sign reading “DANGER-PERMIT-REQUIRED CONFINED SPACE-DO NOT ENTER” to inform personnel of the existence and location of, and danger posed by, the PRC.
- e. Facilities shall be reevaluated at least once annually for the presence of confined spaces. In addition, confined spaces shall be reevaluated whenever they or their characteristics change in a way that could lead to reclassification as a PRC.

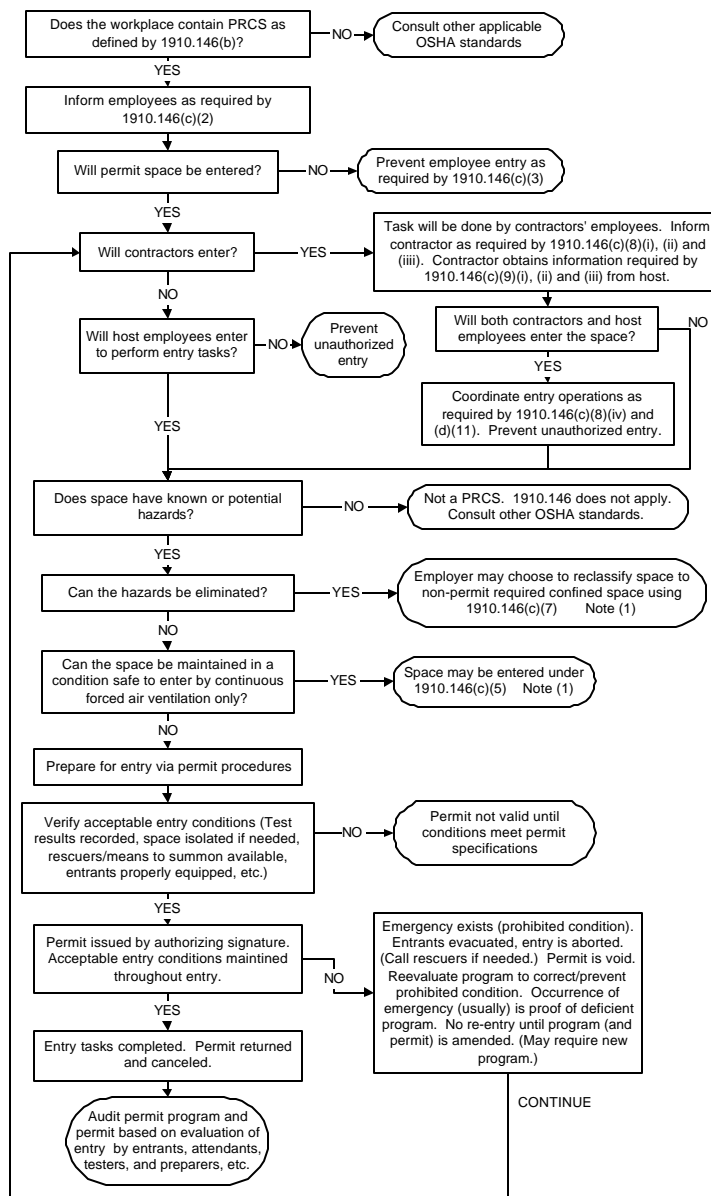
06.I.02 All employees with potential entry into a PRC shall be notified of the existence, location, and hazards of the space. The Contractor, or the GDA for USACE operations, shall ensure all authorized entrants, attendants, and entry supervisors know the hazards that may be faced during entry, including information on the mode, signs or symptoms, behavioral effects, and consequences of the exposure.

06.I.03 Responsibilities.

- a. Authorized entrants shall:
 - (1) Know the hazards that may be encountered during entry, including information on the mode, signs or symptoms, behavioral effects and consequences of hazardous exposure;
 - (2) Properly use equipment as required;
 - (3) Communicate with the attendant as necessary so the attendant can monitor entrant status and alert entrants of any need to evacuate the PRC, and

FIGURE 6-1

PRCS PROCEDURES AND DECISION LOGIC



Note (1): spaces may have to be evacuated and re-evaluated if hazards arise during entry

FIGURE 6-1 (CONTINUED)

Test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin. If isolation of the space is feasible because the space is large or is part of a continuous system (e.g., sewer system), pre-entry testing shall be performed to the extent feasible before entry is authorized. If entry is authorized, entry conditions shall be continuously monitored in the areas where authorized entrants are working. Test or monitor the permit space as necessary to determine if acceptable entry conditions are maintained during entry operations. The space will be tested first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors.

(4) Evacuate the PRCS and alert the attendant whenever they recognize any warning sign or symptom of exposure to a dangerous situation or they detect a prohibited condition, or whenever the attendant or entry supervisor orders evacuation or an evacuation alarm is activated.

b. Attendants shall:

(1) Know the hazards that may be encountered during entry, including information on the mode, signs or symptoms, behavioral effects, and consequences of hazardous exposure in authorized entrants;

(2) Remain outside the PRCS during entry operations until relieved by another attendant;

(3) Take action when unauthorized persons approach or enter a PRCS while entries are underway (warn that they must stay away from the PRCS or that they must immediately exit if they have entered the PRCS; inform authorized persons and the entry supervisor if unauthorized persons have entered the PRCS);

- (4) Continuously maintain an accurate count of authorized entrants in the PRCS. Ensure that the means used to identify authorized entrants is accurate.
- (5) Communicate with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the PRCS;
- (6) Monitor activities inside and outside the PRCS to determine if it is safe for entrants to remain in the PRCS;
- (7) Immediately order evacuation of the PRCS if they detect a prohibited condition, the behavioral effects of hazard exposure in an authorized entrant, or a situation outside the PRCS that could endanger the authorized entrants, or if the attendant cannot effectively and safely perform any of his or her duties and responsibilities;
- (8) Perform non-entry rescues, as specified by the confined space entry permit; summon rescue and other emergency services as soon as it is determined that authorized entrants may need assistance to escape from PRCS hazards, and
- (9) Not, under any circumstance, monitor more than one occupied PRCS at any given time; not perform any duty that might interfere with their primary duty to monitor and protect the authorized entrants.

c. Entry supervisors shall:

- (1) Know the hazards that may be encountered during entry, including information on the mode, signs or symptoms, behavioral effects, and consequences of hazardous exposure in authorized entrants and attendants;
- (2) Verify, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and

EM 385-1-1
3 Nov 03

equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(3) Terminate the entry and cancel the permit when the entry operations covered by the entry permit have been completed or whenever a condition that is not allowed under the entry permit arises in or near the PRCS;

(4) Verify that rescue services are available and that the means for summoning them are operable;

(5) Remove unauthorized individuals who enter or who attempt to enter the PRCS during entry operations;

(6) Determine (at intervals dictated by the hazards and operations performed within the PRCS and whenever responsibility for a PRCS entry operation is transferred) that entry operations are consistent with terms of the entry permit and that acceptable entry conditions are maintained.

d. Contractors who perform work in, or who may be required to enter, a PRCS on a USACE-controlled facility shall:

(1) Request and obtain (from USACE) information on the location and hazards of PRCS that his or her employees will be entering or working near, before start of work;

(2) Request and obtain any pertinent information on USACE or previous contractor experience with PRCS that his/her employees will be entering or working near, before start of work;

(3) Be apprised of any precautions or procedures that the USACE installation has implemented for the protection of employees in or near PRCSs;

(4) Submit a copy of their written PRCS program, which meets the requirements of this section and 29 CFR

1910.146 without respect to 1910.146(a), that will be followed;

(5) Coordinate PRCS entry operations with USACE; and

(6) Debrief USACE personnel at the conclusion of entry operations on any matters concerning the entry program or any hazards created or confronted in the PRCS during entry operations.

06.I.05 Written PRCS program.

a. Each facility and each activity that has a PRCS shall maintain a written PRCS program.

b. PRCS programs shall cover the elements in Table 6-3.

c. The activity or facility, as part of its PRCS program, will provide, maintain, and assure the proper use of:

(1) Testing and monitoring equipment;

(2) Ventilating equipment needed to obtain acceptable entry conditions;

(3) Communications equipment;

(4) PPE used where engineering controls and work practices do not adequately protect USACE personnel;

(5) Lighting equipment;

(6) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;

(7) Rescue and emergency equipment; and

TABLE 6-3

PRCS PROGRAM ELEMENTS

- Hazard identification: identification of the PRCS hazards.
- Hazard control: procedures, practices, and controls developed and implemented to eliminate or control PRCS hazards.
- Permit system: written system for preparing, issuing, implementing, and canceling entry permits, including provisions for closing permit-required spaces and returning them to service after work is completed.
- Specialized equipment: specialized equipment (e.g., monitoring instruments, ventilation equipment, PPE, communication equipment, rescue equipment) that shall be provided and used.
- Personnel: designation and responsibilities of employees who have a role in the PRCS entry.
- Testing and monitoring: provisions for testing and monitoring the PRCS to determine if it is safe for entry and that conditions remain acceptable for the duration of the entry.
- Emergency procedures: emergency procedures and provisions, including personnel and equipment, which will be implemented.
- Outside contractors: coordination of activities of any contractors who will be required to work in or around PRCSs.
- Information and training: procedures and requirements for informing/training employees on PRCS responsibilities and hazards.
- Program review: requirements for noting on the permit any problems encountered during the entry; procedures for reviewing canceled permits at least once a year to determine if there are needs to modify existing procedures to ensure continued employee protection.

(8) Any other equipment necessary for safe entry into and rescue from permit spaces.

06.I.06 PRCS entry procedures.

a. The Contractor, or the GDA for USACE operations, shall develop and implement a system for the preparation, issuance, use, and cancellation of PRCS entry permits (ENG Form 5044-R or equivalent shall be used).

(1) Before entry begins, the entry supervisor identified on the permit shall sign the permit to authorize entry.

(2) The completed permit shall be made available at the time of entry to all authorized entrants, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm the pre-entry preparations have been completed.

(3) The duration of the permit may not exceed the time required to complete the task or job identified on the permit.

b. Plans and procedures shall be developed and implemented or summoning rescue and emergency services, for rescuing entrants from PRCSs, and for preventing unauthorized personnel from attempting a rescue.

c. The entry supervisor shall designate at least one attendant who will remain, for the duration of entry operations, outside the PRCS into which entry is authorized.

d. The Contractor or GDA for USACE operations shall develop and implement procedures to coordinate entry operations when more than one work crew are authorized entry so that employees of one crew do not endanger the employees of other crews.

EM 385-1-1

3 Nov 03

e. The Contractor or GDA for USACE operations shall review entry operations when there is reason to believe that the measures taken under the PRCS program may not be sufficient to protect personnel and shall revise the program to correct any deficiencies before subsequent entries are authorized. Any problems encountered during an entry operation shall be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.

f. On at least a yearly basis, the designated official shall review the canceled permits for the past 12 months and revise the program as necessary to ensure that employees participating in entry operations are protected from PRCS hazards.

06.I.07 Training.

a. All employees shall be instructed not to enter PRCSs without the proper permit and without following the procedures and practices outlined in the permit.

b. Employees who are required to enter PRCSs or act as an attendant or entry supervisor shall be trained to acquire the understanding, knowledge, and skills necessary for the safe performance of their assigned responsibilities and duties. These employees must also be familiar with the kinds of hazards they might face during entry and understand the modes, signs, symptoms, and consequences of exposure.

c. Entrants, attendants, and supervisors shall receive training including but not limited to training in Table 6-4.

d. Training shall be conducted:

(1) To establish employee proficiency in the duties required,

(2) Before the employee is first assigned confined space duties (initial training),

(3) Before a change in assigned duties,

TABLE 6-4

PRCS TRAINING

Entrants shall receive training on:

- > the methods used to communicate with attendants and the means attendants will use to notify them of emergencies;
- > the operation of any specialized equipment they are expected to use, including monitoring and rescue equipment; and
- > evacuation signals and procedures and the need for entrants to notify the attendant and evacuate the PRCS if they detect any dangerous condition.

Attendants shall receive training on:

- > procedures for monitoring inside and outside the PRCS and in recognizing conditions that might be hazardous to entrants;
- > procedures for communicating with entrants;
- > procedures for evacuating entrants from the PRCS and under what conditions evacuation is required;
- > procedures for controlling access to the PRCS and to warn unauthorized people away from the space;
- > their responsibility to remain outside the PRCS during entry, unless they are relieved by another attendant; and
- > non-entry rescue procedures.

Supervisors shall receive training on:

- > verifying that the permit has been completed properly,
- > procedures for verifying that all tests specified by the permit have been conducted,
- > requirements for verifying that all procedures and equipment specified by the permit are in place before allowing entry to begin,
- > procedures for determining if conditions are acceptable for entry,
- > authorizing entry,
- > supervising entry operations, and
- > terminating entry.

EM 385-1-1

3 Nov 03

(4) Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained, and

(5) Whenever the Contractor or GDA for USACE operations has reason to believe that or that there are inadequacies in the employee's knowledge or use of these procedures.

e. The instructor shall verify the successful completion of training and provide written certification. The employer shall document employee training and develop a list of names of the trained employees and the dates of training.

06.1.08 On-site rescue/emergency teams.

a. Each member of the rescue/emergency team shall be provided with, and trained in the proper use of, PPE and equipment necessary for making rescues from PRCSs.

b. Each member of the rescue/emergency team shall practice making PRCS rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or persons from the actual PRCS or from representative PRCS. Representative PRCS shall, with respect to opening size and configuration, simulate the hazards and types of PRCS from which rescue is to be performed.

c. Each member of the rescue/emergency team shall receive the same level of training as authorized entrants and shall be trained in basic first aid and in CPR. Provisions shall be made so that whenever the team is on call, at least two members of the team shall have current certification in first aid and CPR.

d. If an injured entrant is exposed to a substance that requires that a MSDS or other similar written information is kept at the worksite, the MSDS or written information shall be made available to the medical facility treating the exposed entrant.

06.I.9 Off-site rescue and emergency services.

- a. The rescue/emergency service will be informed of the hazards they may confront when called on to perform rescues.
- b. The rescue/emergency service shall be provided access to all permit spaces from which rescue may be necessary so that the service can develop appropriate rescue plans and practice rescue operations.

06.I.10 To facilitate non-entry rescues, retrieval systems or methods shall be used whenever an authorized entrant enters a PRCS, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.

- a. Each authorized entrant shall use a chest or full-body harness, with a retrieval line attached at the center of the entrant's back near the shoulder level or above the entrant's head (wristlets may be used in lieu of the chest or full-body harness if the employer can demonstrate that the use of a chest or full-body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative).
- b. Retrieval lines shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescues can begin as soon as the rescuer becomes aware that rescue is necessary.
- c. A mechanical device shall be ready to retrieve personnel from vertical PRCSs more than 5 ft (1.5 m) deep.
- d. If an injured entrant is exposed to a substance that requires that a MSDS or other similar written information is kept at the worksite, the MSDS or written information shall be made available to the medical facility treating the exposed entrant.

EM 385-1-1

3 Nov 03

06.J INCLEMENT WEATHER AND ENVIRONMENTAL HAZARDS

06.J.01 When there are warnings or indications of impending severe weather (heavy rains, damaging winds, tornados, hurricanes, floods, lightning, etc.), weather conditions shall be monitored and appropriate precautions taken to protect personnel and property from the effects of the severe weather.

06.J.02 Employers shall develop a comprehensive written site-specific heat/cold stress monitoring plan, in accordance with this Section, the ACGIH "Threshold Limit Values and Biological Exposure Indices" and other references the employer determines applicable to protect employees exposed to temperature extremes. The plan shall be incorporated in the employer's APP or project safety and health plan and shall follow the guidelines of 06.J.04 of this manual.

06.J.03 In hot environments, drinking water shall be made available to workers and workers shall be encouraged to frequently drink small amounts, e.g., one cup every 15-20 minutes: the water shall be kept reasonably cool. **>See Section 02.B.**

06.J.04 In situations where heat stress may impact worker safety and health, worker acclimatization and workloads shall be assessed and work/rest regimens shall be established.

a. For workers in permeable work clothing, Wet Bulb Globe Temperature (WBGT) Index or physiological monitoring shall be conducted and work/rest regimens established as specified in the ACGIH's "Threshold Limit Values and Biological Exposure Indices."

b. For workers in impermeable work clothing, only physiological monitoring shall be conducted, and work/rest regimens and fluid replacement schedules shall be established as specified in the ACGIH's "Threshold Limit Values and Biological Exposure Indices."

06.J.05 Employees working in air temperatures of -15°F (-26°C) or less shall use the work-/warm-up regimen specified in the ACGIH "Threshold Limit Values and Biological Exposure Indices."

06.J.06 At air temperatures of 36°F (2°C) or less, workers who become immersed in water or whose clothing becomes wet shall immediately be provided a change of clothing and treated for hypothermia.

06.J.07 When manual dexterity is not required of a worker, he or she shall be provided thermally protective gloves when exposed to the following temperatures.

- a. For light work, 40°F (4°C) and below, and
- b. For moderate and heavy work, 20°F (-6.6°C) and below.

06.J.08 When fine work is required to be performed with bare hands for more than 10-20 minutes in an environment below 50°F (10°C), provisions shall be established for keeping workers' hands warm.

06.J.09 Metal handles and control bars shall be covered by thermal insulating material at temperatures below 30°F (-1°C).

06.J.10 Cold weather sheltering and clothing requirements.

- a. If wind chill is a factor at a work location, the cooling effect of the wind shall be reduced by shielding the work area or providing employees an outer windbreak layer garment. An AHA and/or PHA shall be prepared as an attachment to the site-specific, cold-stress monitoring plan and shall identify specific controls to minimize employee exposure to extreme cold.

- b. Extremities, ears, toes, and nose shall be protected from extreme cold by protective clothing.

EM 385-1-1

3 Nov 03

- c. Employees whose clothing may become wet shall wear an outer layer of clothing that is impermeable to water.
- d. Outer garments must provide for ventilation to prevent wetting of inner clothing by sweat.
- e. If clothing is wet, the employee shall change into dry clothes before entering a cold environment.
- f. Workers shall change socks and removable felt insoles at regular daily intervals or shall use vapor barrier boots.
- g. Due to the added danger of cold injury due to evaporative cooling, workers handling evaporative liquid (such as gasoline, alcohol, or cleaning fluids) at air temperatures below 40 °F (4 °C) shall take precautions to avoid soaking of clothing or contact with skin.
- h. Eyewear providing protection against ultraviolet light, glare, and blowing ice crystals shall be provided to workers employees in snow- and/or ice-covered terrain.

06.J.11 Environmental monitoring shall be conducted as follows:

- a. At air temperatures below 45 °F (7 °C) the temperature shall be monitored.
- b. At air temperatures below 30 °F (-1 °C) the temperature shall be measured and recorded at least every 4 hours. In indoor workplaces the wind speed should be measured and recorded at least every 4 hours when the rate of air movement exceeds 5 miles per hour (mph) (2.2 meters per second (m/s)); in outdoor work situations the wind speed should be measured and recorded with the air temperature.

c. The equivalent chill temperature and frost-bite precautions shall be determined by using Tables 6-5 and 6-6. **>To convert degrees Fahrenheit (°F) to degrees Celsius (°C) use formula: °C = (°F/9) x (°F-32). To convert wind speed in miles per hour (mph) to meters per second (m/s) use formula: m/s = mph x 0.447.)**

06.J.12 Workers shall be excluded from work in cold (30 °F (-1 °C) or below) if they are suffering from diseases or taking medication that interferes with normal body temperature regulation or reduces tolerance to work in cold environments.

06.J.13 Where employees are exposed to solar radiation for short periods and there is the potential for sunburn or are exposed for prolonged periods where long-term exposure could lead to health effects such as skin cancer, they shall be provided sun screen with a sun protection factor (SPF) appropriate for their skin type and exposure. Sunscreens shall be used only in accordance with the manufacturer's recommendations.

06.K CUMULATIVE TRAUMA PREVENTION

06.K.01 Work activities that require workers to conduct lifting, handling, or carrying; rapid and frequent application of high grasping forces; repetitive hand/arm manipulations; tasks that include continuous, intermittent, impulsive, or impact hand-arm vibration or whole body vibration; and other physical activities that stress the body's capabilities shall be evaluated by a competent person to ensure the activities are designed to match the capabilities of the workers.

06.K.02 When work activities that stress the body's capabilities are identified, the employer shall establish a cumulative trauma disorders prevention plan and incorporate it in the APP. The plan shall incorporate processes that recognize cumulative trauma hazards, isolate causative factors, inform and train workers, and implement controls.

TABLES 6-5 AND 6-6

Wind Chill Temperature Table

Wind Speed (mph)	Air Temperature (°F)																	
	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
0	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95

RISK OF FROSTBITE (see times on chart below)

GREEN LITTLE DANGER (frostbite occurs in >2 hours in dry, exposed skin)

YELLOW INCREASED DANGER (frostbite could occur in 45 minutes or less in dry, exposed skin)

RED GREAT DANGER (frostbite could occur in 5 minutes or less in dry, exposed skin)

Time to occurrence of frostbite in minutes or hours
(In the most susceptible 5% of personnel.)

Wind Speed (mph)	Air Temperature (°F)											
	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
0	>2h	>2h	>2h	>2h	>2h	>2h	40	22	20	13	11	9
5	>2h	>2h	>2h	>2h	31	22	17	14	12	11	9	8
10	>2h	>2h	>2h	28	19	15	12	10	9	7	7	6
15	>2h	>2h	33	20	15	12	9	8	7	6	5	4
20	>2h	>2h	23	16	12	9	8	8	6	5	4	4
25	>2h	42	19	13	10	8	7	6	5	4	4	3
30	>2h	28	16	12	9	7	6	5	4	4	3	3
35	>2h	23	14	10	8	6	5	4	4	3	3	2
40	>2h	20	13	9	7	6	5	4	3	3	2	2
45	>2h	18	12	8	7	5	4	4	3	3	2	2
50	>2h	16	11	8	6	5	4	3	3	2	2	2

WET SKIN COULD SIGNIFICANTLY DECREASE THE TIME FOR FROSTBITE TO OCCUR.

*Source: USARIEM Technical Note "SUSTAINING HEALTH & PERFORMANCE IN COLD WEATHER OPERATIONS," October 2001

06.K.03 Control measures to minimize hand-arm vibration shall include: adherence to the TLV guidelines as specified in the ACGIH in "Threshold Limit Values and Biological Exposure Indices"; the use of anti-vibration tools and/or gloves; implementation of work practices that keep the worker's hands and body warm and minimize the vibration coupling between the worker and the vibration tool; and application of specialized medical surveillance to identify personnel susceptible to vibration.

06.L INDOOR AIR QUALITY (IAQ) MANAGEMENT

06.L.01 IAQ Investigations. Supervisors will report employee concerns or complaints of IAQ problems to the facility manager/owner or other designated representative. That individual will be responsible for investigating and resolving the IAQ complaint in a timely manner and reporting back to the supervisor. For leased facilities, procedures for resolving IAQ issues should ultimately be investigated and resolved by the lessor. An industrial hygienist or other qualified and competent person will initiate an IAQ investigation using appropriate guidelines published by ACGIH; AIHA; ANSI; American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE); USEPA; OSHA; NIOSH; or other Federal, DOD, State, local, and host nation requirements.

a. Ensure building activities, such as painting, roof repairs, carpet installation and repair and other activities likely to involve usage of chemicals or solvents, are conducted after normal working hours where possible or in a manner that will prevent exposure to occupants.

b. Educate employees and supervisors concerning measures they can take to help maintain acceptable IAQ in their work areas. Employees shall be instructed not to make unauthorized modifications to the heating, ventilation, and air conditioning (HVAC) systems (i.e., blocking off vents, removing ceiling tiles).

06.L.02 Environmental tobacco smoke (ETS). Employees shall be protected from involuntary exposure to ETS in working and public living environments.

EM 385-1-1

3 Nov 03

a. Smoking shall be prohibited inside all DOD vehicles, aircraft, vessels, and work buildings.

b. Provide designated smoking areas only in outdoor locations that are not commonly used or accessed by nonsmokers. Receptacles will be provided in designated smoking areas for the containment of cigarette butts and other smoking by-products.

c. Locate designated smoking area away from supplied-air intakes and building entryways/egresses to prevent ETS from entering occupied buildings and structures.