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PAGE CHANGE

DOE 5480.1 Chg 5

8-13-81

SUBJECT: ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH
PROTECTION PROGRAM FOR DOE OPERATIONS

1. PURPOSE. To transmit revised chapters to the subject Order.
2. EXPLANATION OF CHANGE. The following chapters, revised by the Acting Under Secretary's Task Force, supersede previously published chapters as indicated:
 - a. Chapter I "Environmental Protection, Safety, and Health Protection Standards."
 - b. Chapter V, "Safety of Nuclear Facilities", which now includes former Chapter IV, also superseded.
 - c. Chapter VI, "Safety of Department of Energy Owned Reactors."
3. FILING INSTRUCTIONS.
 - a.

<u>Remove Page</u>	<u>Dated</u>	<u>Insert Page</u>	<u>Dated</u>
I-1 thru I-18 and Attachment I-1	5-22-81	I-1 thru I-18 and Attachment I-1	8-13-81
IV-1 thru IV-16	12-18-80		
V-1 thru V-6	12-18-80	V-1 thru I-26	8-13-81
VI-1 thru VI-18 and Attachment VI-1	12-18-80	VI-1 thru VI-23 and Attachment VI-1	8-13-81
 - b. After filing the attached pages, this transmittal may be discarded.



William S. Heffelfinger
Assistant Secretary
Management and Administration

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INITIATED BY:
Assistant Secretary, Environmental
Protection, Safety, and
Emergency Preparedness

CHAPTER I

ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION STANDARDS

1. PURPOSE. This chapter sets forth the environmental protection, safety, and health protection standards applicable to all operations of the Department of Energy, hereafter referred to as the Department.
2. GENERAL REQUIREMENTS.
 - a. Provisions of this chapter shall be followed during facility design, construction, operation, modification, and decommissioning. Existing facilities need not be changed arbitrarily to comply with the specified standards except as required by law. As part of the normal facility design effort for each new facility the applicable codes, standards, and guides to be used in the design and operation are to be identified and documented.
 - b. This chapter covers the prescribed standards to be used by the Department and its contractors. In addition, DOE and its contractors shall comply with all legally applicable Federal and State standards. Where a Department contractor is also a Nuclear Regulatory Commission licensee, the contract relationship will not exempt the contractor from compliance with Nuclear Regulatory Commission regulations and the terms of the license. Where Department of Energy contractors are tenants on a military installation and a Host-Tenant Agreement has been executed, the standards established by the host shall be observed unless the Department prescribed standards provide for greater protection, in which case Department standards shall be observed. Facilities covered by this chapter include those owned, leased or otherwise controlled by the Department or leased by contractors for use in work, and include those of either a permanent or temporary nature (e.g., trailers, rented spaces, field sites).
 - c. In addition to the prescribed and recommended standards set forth by this chapter, the user should also consult the other chapters of this Order. The sources for the standards and a glossary of abbreviations are contained in Attachment 1.
 - d. If there are conflicts between prescribed standards in this chapter, or between this chapter and other chapters of this Order, the standards providing the greater protection shall govern.
 - e. Those DOE-owned reactor plants which are prototype reactor plants for design and development of Naval reactor plants, and which are concomitantly used for training of operators for Naval nuclear propulsion plants, have certain unique requirements because of their military application. All of these plants and supporting laboratory facilities are under the cognizance of the Deputy Assistant Secretary for Naval

Reactors who jointly serves as the Director of the Naval Nuclear Program. Accordingly, the Deputy Assistant Secretary for Naval Reactors is responsible for assuring that adequate standards are applied for emergency preparedness, environmental protection, nuclear safety, and health protection for Naval reactor prototype plants and supporting laboratory facilities owned by DOE."

3. RESPONSIBILITIES AND AUTHORITIES.

a. Program Secretarial Officers shall:

- (1) Assure compliance with the standards of this chapter on a site-wide basis by organizations under their jurisdiction by review and approval of the summary type implementation plans for DOE Orders submitted by field organizations.
- (2) Prescribe, as appropriate, additional or more stringent standards for individual facilities after appropriate consultation with field organization management and other affected Program Secretarial Offices.

b. Heads of Field Organizations and the Assistant Secretary, Management and Administration shall:

- (1) Apply the prescribed standards contained herein.
- (2) Assure that the level of performance of health and safety are maintained consistent with the intent of these standards, for those activities under their direction.
- (3) Prescribe, as appropriate, additional or more stringent standards, based on the determination that such standards are essential to safety and proper performance of their function.
- (4) Grant exemptions as set forth in paragraph 4, where such action will best serve the interest of DOE, providing that the safety of employees, the public, and Government and private property can be maintained.
- (5) Identify needs to Deputy Assistant Secretary for Environmental Safety and Health (EP-30) for new standards to address environment, safety, and health concerns.

c. Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness (EP-1) shall:

- (1) Review nationally recognized health and safety requirements, guides, codes, and standards and prescribe those applicable to DOE activities,

following appropriate review and comment by affected Departmental elements.

- (2) Determine the need for and develop or promote the development of new or revised standards applicable to environmental safety and health.
- (3) Act as liaison with voluntary standards bodies and other Federal agencies on ES&H standards to reflect DOE needs and requirements.
- (4) Develop and maintain appropriate mechanisms for maintaining the standards listing comprehensive, up-to-date, and revising the standards listing, as necessary.

4. PROCEDURE FOR GRANTING EXEMPTIONS.

- a. Heads of Field Organizations are authorized to grant exemptions from the prescribed standards of this chapter for specific facilities or activities, except as noted in subparagraph 4b. Specific exemptions to the prescribed standards identified in this chapter, which are dependent on specific facility designs, shall be identified in the facility design documentation and safety analysis, which will be reviewed and approved in the normal process of facility design and operation and assessed as part of the Environmental, Safety, Quality Assurance, and Health Appraisal Programs.
- b. Exemptions from standards established pursuant to the Federal regulations listed herein, unless allowed by the procedure identified in subparagraph 4c, are to be submitted with suitable justification to EP-1.
- c. Those Department contractor operations subject to DOE 5483.1, OCCUPATIONAL SAFETY AND HEALTH PROGRAM FOR GOVERNMENT-OWNED CONTRACTOR-OPERATED FACILITIES, must follow the procedures of that Order to obtain variances from the Occupational Safety and Health Administration standards listed herein. Those Department operations directly subject to the Occupational Safety and Health Administration's regulations must follow the procedures of 29 CFR 1960, Subpart C, or 29 CFR 1905, as appropriate, to obtain relief from standards listed herein (which are also listed in 29 CFR 1910, 1915-1918, and 1926). Requests are to be forwarded to the appropriate Department of Energy official as defined in DOE 5483.1 or DOE 3790.1.

5. EMERGENCY PREPAREDNESS. The following standards, in addition to those listed in the other chapters, shall be used as applicable.

- a. Prescribed Standards. To be identified.
- b. Recommended Standards. "Immediate Evacuation Signal for Use in Industrial Installations Where Radiation Exposure May Occur," ANSI N2.3-1979 (ANSI).

6. ENVIRONMENTAL PROTECTION. The following standards, in addition to those listed in the other chapters, shall be used as applicable.

a. Prescribed Standards.

(1) Executive Order 12088 "Federal Compliance with Pollution Control Standards."

(2) The following standards, regulations, and guidelines promulgated pursuant to Federal environmental legislation:

(a) Air.

1 New Source Performance Standards (40 CFR 60).

2 National Hazardous Air Pollutant Standards (40 CFR 61).

3 Regulations Designating Air Quality Control Regions (40 CFR 81).

(b) Water.

1 Discharge of Oil (40 CFR 110).

2 Oil Pollution Prevention (40 CFR 112).

3 National Oil and Hazardous Substances Contingency Plan (40 CFR 1510).

4 Water Quality Standards Approved by the Federal Government (40 CFR 120).

5 National Pollutant Discharge Elimination System (40 CFR 122).

6 Policies and Procedures for the National Pollutant Discharge Elimination System (40 CFR 125).

7 General Pretreatment Regulations for Existing and New Sources of Pollution (40 CFR 403).

8 Secondary Treatment Information (40 CFR 133).

9 Transportation for Dumping, and Dumping of Material into Ocean Waters (40 CFR 220-230).

10 Cooling Water Intake Structures (40 CFR 401.14) (General Provisions for Effluent Guidelines and Standards - 40 CFR 401).

(c) Drinking Water.

- 1 National Interim Primary Drinking Water Regulations (40 CFR 141).
- 2 National Interim Primary Drinking Water Regulations Implementation (40 CFR 142).

(d) Solid Waste.

- 1 Guidelines for the Thermal Processing of Solid Wastes and for the Land Disposal of Solid Wastes (40 CFR 240 and 241).
- 2 Solid Waste Storage and Collection (40 CFR 243).

(e) Radiation. "Performance Testing and Procedural Specifications for Thermoluminescence Dosimetry (Environmental Applications)," ANSI N 545-1975 (ANSI).

(f) Pesticides.

- 1 Executive Order 11870, "Environmental Safeguards on Activities for Animal Damage Control on Federal Lands."
- 2 Regulations for Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act (40 CFR 162).
- 3 Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticide Containers (40 CFR 165).
- 4 Exemption of Federal and State Agencies for Use of Pesticides Under Emergency Conditions (40 CFR 166).
- 5 Worker Protection Standards for Agricultural Pesticides (40 CFR 170)
- 6 Certification of Pesticide Applicators (40 CFR 171).

b. Recommended Standards.

- (1) Standard Methods for the Examination of Water and Wastewater (AWWA).
- (2) Guide for Use of Insecticides, Handbook 290 (USDA).
- (3) Manual of Septic Tank Practice, Publication No. 526 (USPHS).

- (4) Sanitary Landfill Design and Operation Publication No. SW-65ts. (EPA).
 - (5) Interim Guide of Good Practice for Incineration at Federal Facilities, Publication No. AP-46 (USPHS).
 - (6) Incinerator Guidelines, Publication No. 2012 (USPHS).
 - (7) Air Pollution Engineering Manual, Publication No. AP-40 (USPHS).
 - (8) Compilation of Air Pollutant Emission Factors (EPA).
7. FIRE PROTECTION. The following standards, in addition to those listed in the other chapters, shall be used as applicable.
- a. Prescribed Standards.
 - (1) National Fire Codes (NFPA).
 - (2) Standard for Fire Protection of AEC Electronic Computer Data Processing Systems, WASH 1245-1. (Compliance with this standard satisfies the requirements for NFPA-75).
 - (3) Product Directories of Underwriters Laboratories together with the periodic supplements (UL).
 - (4) Factory Mutual Approval Guide (FM).
 - (5) TP20-11 General Fire Fighting Guidance for Nuclear Weapons (this document is confidential restricted data).
 - (6) Standard on Fire Protection for portable structures, DOE/EV-0043, August 1979.
 - b. Recommended Standards.
 - (1) Handbook of Fire Protection (NFPA).
 - (2) Loss Prevention Data Sheets (FM).
8. HEALTH PROTECTION. The following standards, in addition to those listed in the other chapters, shall be used as applicable.

a. Radiation Protection.

(1) Prescribed Standards.

- (a) Performance Specifications for Direct Reading and Indirect Reading Pocket Dosimeters for X and Gamma Radiation, ANSI N13.5-1972 (ANSI).
- (b) Radiation Symbol, ANSI N2.1-1969 (ANSI).
- (c) Radiological Safety in the Design and Operation of Particle Accelerators, ANSI N43.1-1978 (ANSI).
- (d) Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents, ANSI N13.10-1974 (ANSI).
- (e) Personnel Neutron Dosimeters (Neutron Energies Less Than 20 MeV), ANSI N319-1976 (ANSI).
- (f) Performance Criteria for Instrumentation Used for Inplant Plutonium Monitoring, ANSI N317-1978 (ANSI).
- (g) "Inspection and Test Specifications for Direct and Indirect Reading Quartz Fiber Pocket Dosimeters," ANSI N322-1975. (ANSI).
- (h) A Guide to Reducing Radiation Exposure to As Low As Reasonably Achievable (ALARA), DOE/EV/1830-TS, April 1980 (to be used until issued as formal standard).

(2) Recommended Standards.

- (a) Applicable (FRC) Reports (#1-1960, #2-1962, #5-1964, #7-1965, #8 (Revised) (EPA).
- (b) Handbooks, NCRP Recommendations (NBS).
- (c) Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, ANSI N13.1-1969 (ANSI).
- (d) Criteria for Film Badge Performance, ANSI N13.7-1972 (ANSI).
- (e) Radiation Protection Instrumentation Test and Calibration, ANSI N323-1978 (ANSI).
- (f) Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications, ANSI N545-1975 (ANSI).

- (g) Standards for Protection Against Radiation (10 CFR 20).
- (h) Radiation Protection Standards Reports (ICRP).
- (i) Reports (ICRU)
 - 1 Report 20, 1971, Radiation Protection Instrumentation and Its Application.
 - 2 Report 19, 1968, Radiation Quantities and Units.
 - 3 Report 14, 1969, Radiation Dosimetry.
- (j) Safety Series (IAEA).
- (k) Electronic Product Radiation Control, Subpart 3 of P.L. 90-602, as amended on 10-18-68.
- (l) Technical Considerations in Emergency Instrumentation Preparedness, BNWL-1742, 1974 (DOE).
 - 1 Phase II-C - Emergency Radiological and Meteorological Instrumentation for Fuel Reprocessing Facilities, BNWL-1857, 1976.
 - 2 Phase II-D - Evaluation Testing and Calibration Methodology for Emergency Radiological Instrumentation, BNWL -1991, 1976.
 - 3 Phase II-B - Emergency Radiological and Meteorological Instrumentation for Mixed Fuel Fabrication Facilities, BNWL-1742, 1974.
 - 4 Phase II-A - Emergency Radiological and Meteorological Instrumentation Criteria for Reactors, BNWL-1635, 1972.

b. Occupational Medicine.

- (1) Prescribed Standards. To be identified.
- (2) Recommended Standards.
 - (a) Scope, Objectives, and Functions of Occupational Health Programs, OUCH-213 (AMA).
 - (b) Occupational Health Services for Employees, U.S. Department of Health, Education, and Welfare. Public Health Service Publication No. 1041 (May 1963)(USPHS).

- (c) An Administrative Guide for Federal Occupational Health Units, HEW, Public Health Service Publication No. 1325-A (March 1966), (USPHS).
- (d) Epidemiology in Occupational Disease and Injury, OOOH-290 (AMA).
- (e) Medical Aspects of Radiation Accidents Handbook, Eugene Saenger, M.D., Editor (GPO).

c. Industrial Hygiene.

(1) Prescribed Standards.

- (a) Current Threshold Limit Values (ACGIH).
- (b) Practices for Respiratory Protection, ANSI Z88.2-1980 (ANSI).

(2) Recommended Standards.

- (a) Hygienic Guide Series (AIHA).
- (b) Heating and Cooling for Man in Industry (AIHA).
- (c) Respirator Manual, LA-6370-M (DOE).
- (d) Industrial Ventilation Manual (ACGIH).
- (e) Industrial Noise Manual (AIHA).
- (f) Guide for Conservation of Hearing and Noise (AAO0).
- (g) NIOSH Criteria Documents (NIOSH).

d. Public Health and Sanitation.

(1) Prescribed Standards.

(a) Food.

- 1 Food Service Sanitation Manual, DHEW Publication No. 78-2081 (FDA).
- 2 The Vending of Food and Beverages, USPHS Publication No. 546 (1965).

(b) Water.

- 1 National Interim Primary Drinking Water Regulations, Publication No. EPA-570/9-76-003 (EPA).

- 2 Manual for Evaluating Public Drinking Water Supplies, Publication No. 1820 (EPA).
 - 3 Manual of Individual Water Supply Systems, Publication No. 430 9/73-003 (EPA).
 - 4 Quality Standards for Bottled Water (21 CFR 11).
 - 5 Sanitary Standard for Manufactured Ice, USPHS 1183 (1964).
 - 6 GSA Handbooks on Performance Standards for Cleaning Public Buildings (GSA).
9. OCCUPATIONAL SAFETY. The following standards, in addition to those listed in the other chapters, shall be used as applicable.
- a. General Safety.
 - (1) Prescribed Standards.
 - (a) Forest Service Safety Standards (USDA).
 - (b) Boiler and Pressure Vessel Code; Sections I-XI (ASME).
 - (c) Occupational Safety and Health Standards, 29 CFR 1910.
 - (d) Safety and Health Regulations for Construction, 29 CFR 1926.
 - (e) Safety and Health Regulations for Ship Repairing, 29 CFR 1915.
 - (f) Safety and Health Regulations for Shipbuilding, 29 CFR 1916.
 - (g) Safety and Health Regulations for Shipbreaking, 29 CFR 1917.
 - (h) Safety and Health Regulations for Longshoring, 29 CFR 1918.
 - (i) Department of Defense Explosive Safety Board Standards (Ordnance Operations).
 - (j) Department of Navy Standards (for Naval Reactors program applications) (NAV).
 - (2) Recommended Standards.
 - (a) Chemical Rocket Propellant Hazards, JANNAF Propulsion Committee, Volume I - General Safety Engineering Design Criteria, NTIS-AD 889763, May 1970. Volume II - Solid Rocket Propellant Processing, Handling, Storage, and Transportation, NTIS-AD

870258, May 1970. Volume III - Liquid Propellant Handling, Storage, and Transportation, N.T.I.S.-AD 870259, May 1970. (Quantity distance tables are expected-OSHA/NFPA QD tables apply where appropriate).

- (b) Manual Sheets (MCA).
- (c) Chemical Safety Data Sheets (MCA).
- (d) Accident Prevention Manual for Industrial Operations (NSC).
- (e) Supervisor's Safety Manual (NSC).
- (f) Handbook of Laboratory Safety (CRC).
- (g) Handbook of Rigging, W.E. Rossnagel, McGraw-Hill Book Co., Inc., publishers. (McGraw).
- (h) Data Sheet Series (NSC).
- (i) Matheson Gas Data Book (MPD).
- (j) Handling Hazardous Materials, NASA SP-5032 (NASA).
- (k) Testing Materials Standards (those applicable to safety) (ASTM).
- (l) Handbook of Compressed Gases (CGA).
- (m) Service Station Safety, Accident Prevention Manual 5 (API).
- (n) Operating Personnel Training Program on Oxygen Deficient Atmospheres, UC-240-002, September 1978.

b. Construction Safety.

(1) Prescribed Standards.

- (a) Pipeline Safety Standards (49 CFR 192).
- (b) Safety and Health Regulations for Construction (29 CFR 1926).

(2) Recommended Standards.

- (a) Manual of Accident Prevention in Construction (AGCA).
- (b) Guidelines for Minimizing Soil Erosion and Water and Air Pollution During Construction, Soil Conservation Service Engineering Memorandum 66, 6-19-68 (USDA).

c. Crane Safety.(1) Prescribed Standards.

- (a) ANSI Series B 30.
- (b) Crane Manufacturers Association of America, Specification No. 70 (CMAA).

(2) Recommended Standard.

- (a) Requirements for Hoisting and Rigging of Special Components and Equipment, RDT F8-6 (DOE).
- (b) DOE Hoisting and Rigging Manual, May 1980.

d. Drilling Safety.(1) Prescribed Standards.

- (a) Petroleum Safety Orders, Administrative Code, Title 8, Chapter 4, Subchapter 14, State of California (except the requirement of paragraph (b) Section 6640, of article 41 of the 1959 orders is permanently waived-API PR 9B applies). (CALIF)
- (b) Applicable Division of Production Specifications and Recommended Practices on Oil Field Equipment (API).
- (c) Safe Practices in Drilling Operations, Third Edition, 1967, RP 2010 (API).

(2) Recommended Standards.

- (a) Rotary Drilling Handbook on Accident Prevention and Safe Operating Practices (IAODC).
- (b) Applicable Division of Production Bulletins (API).

e. Electrical Safety.(1) Prescribed Standards.

- (a) National Electrical Code, ANSI/NFPA No. 70-1978.
- (b) National Electrical Safety Code (ANSI-C2-1977).

(2) Recommended Standards.

- (a) Electrical Engineering Regulations, CG-259, U.S. Coast Guard (DOT).
- (b) Miscellaneous Electrical Equipment List, CG-293, U.S. Coast Guard (DOT).
- (c) Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines, NBS No. 81.
- (d) Electrical Safety Guides for Research, Safety, and Fire Protection, Bulletin No. 13 (DOE).
- (e) Safety Guidelines for High Energy Accelerator Facilities, TID 23992 (DOE).
- (f) IEEE Standards.
- (g) Electrical Safety Criteria for Research and Development Activities, DOE/EV-0051/1.

f. Explosives Safety.

(1) Prescribed Standards.

- (a) Development and Readiness Command Safety Manual, DARCOM 385-100, U.S. Army Materiel Development and Readiness Command. (AMC)
- (b) DOD Ammunition and Explosives Safety Standards, DOD 5154.4S (DOD).
- (c) Blaster's Handbook (DuPont).

(2) Recommended Standards.

- (a) Rules for Storing, Transporting, and Shipping Explosives, Pamphlet 5 (IME).
- (b) Safety in the Transportation, Storage, Handling, and Use of Explosives, Pamphlet 17 (IME).
- (c) Structures to Resist the Effects of Accidental Explosions, Department of the Army Technical Manual TM5-1300 (AMC).
- (d) Safety Guide for the Prevention of Radio Frequency Radiation Hazards, Pamphlet 20 (IME).

- (e) Evaluation of Explosive Storage Safety Criteria, May 1970, AD 871 194 (NTIS).

g. Firearm Safety.

(1) Prescribed Standards.

- (a) GSA Handbook HB, Federal Protective Service Uniformed Force Operations, PBS P5930.17.
- (b) Pistols and Revolvers, FM 23-35, 7-60 (AMC).
- (c) Safety with Firearms Handbook (NRA).

(2) Recommended Standards.

- (a) Education and Training Security Police, Training Course AMCP 621-1 (AMC).
- (b) Military Police Preservation of Order Activities, AMCR 190-3, 12-71 (AMC).

h. Mine and Tunnel Safety.

(1) Prescribed Standards.

- (a) P.L. 91-173 88 Stat. 742-804 as amended by P.L. 95-164, Federal Mine Safety and Health Act of 1977.
- (b) Tunnel Safety Orders, Administrative Code, Title 8, Chapter 4, Subchapter 20, State of California (CALIF).
- (c) Mine Safety Orders, Administrative Code, Title 8, Chapter 4, Subchapter 12, State of California (CALIF).

(2) Recommended Standard. Tunneling: Recommended Safety Rules, Bulletin 644, Bureau of Mines. (BUMINES)

10. NUCLEAR SAFETY. The following standards, in addition to those listed in the other chapters, shall be used as applicable.

a. Reactor Safety.

(1) Prescribed Standards.

- (a) Criteria for Protection Systems for Nuclear Power Generating Stations, ANSI/IEEE 279-1971.

- (b) Boiler and Pressure Vessel Code, ASME.
- (c) Selection, Qualification, and Training of Personnel for Nuclear Power Plants, ANS 3.1, October 1980 (for Category A reactors).

(2) Recommended Standards.

- (a) Applicable Nuclear Energy (RDT) Standards (See index of NE (RDT) Standards) (DOE).
- (b) Licensing of Production and Utilization Facilities, 10 CFR 50 and appendices, including regulatory guides issued to describe methods of implementing these regulations.
- (c) Operators' Licenses, 10 CFR 55.
- (d) Reactor Site Criteria, 10 CFR 100.
- (e) Safe Operation of Critical Assemblies and Research Reactors, 1971 Edition, Safety Series No. 35 (IAEA).
- (f) Safe Operation of Nuclear Power Plants, Safety Series 31 (IAEA).
- (g) IEEE Standards.
- (h) ANS Series 15 Standards.
- (i) Design Guide; Critical Facilities, BNL-50831-I.
- (j) Design Guide; Light and Heavy Water Cooled Reactors, BNL-50831-II.
- (k) Design Guide; Pool Type Reactors, BNL-50831-III.
- (l) Design Guide; Liquid Metal Reactors, BNL-50831-IV.
- (m) Design Guide; Transient Reactors, BNL-50831-V.
- (n) Design Guide; Air Cooled Graphite Reactors, BNL-50831-VI.

b. Nuclear Facility Safety.

(1) Prescribed Standards.

- (a) Criticality Accident Alarm System, ANSI/ANS-8.3-1979 (ANSI).
- (b) Safety Standards for Operations with Fissionable Materials Outside Reactors, ANSI N16.1-1975 (ANSI).

(c) Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Materials, (ANSI/ANS 8.5-1979) (ANSI).

(2) Recommended Standards.

(a) Nuclear Safety Guide, TID-7016 (DOE).

(b) Critical Dimensions of Systems Containing uranium-235, plutonium-239, and uranium-233, TID-7028 (DOE).

(c) Critical and Safe Masses and Dimensions of Lattices of U and UO₂ in Water, DuPont-1014 (DUPONT).

(d) United Kingdom Atomic Energy Authority Handbook of Criticality Data, AHSB(S), Handbook 1 (1st Revision).

(e) Criticality Handbook, ARH-600, (3 volumes).

(f) ANSI N16 Series Standards.

(g) Licensing of Production and Utilization Facilities, (10 CFR 50).

(h) Special Nuclear Material (10 CFR 70).

(i) Rules of General Applicability to Licensing of Byproduct Material (10 CFR 30).

(j) Licensing of Source Material (10 CFR 40).

(k) Operators' Licenses (10 CFR 55).

(l) Appropriate Portions of Reactor Site Criteria (10 CFR 100).

(m) Nuclear Air Cleaning Handbook ERDA 76-21, (DOE).

11. TRANSPORTATION SAFETY. The following standards, in addition to those listed in the other chapters, shall be used as applicable.

a. Aircraft Safety.

(1) Prescribed Standards. Federal Aviation Regulations (DOT).

(2) Recommended Standard. Aviation Ground Operation Safety Handbook (NSC).

b. Motor Vehicle and Traffic Safety.

(1) Prescribed Standards.

- (a) Motor Carrier Safety Regulations, Federal Highway Administration (DOT).
- (b) Hazardous Materials Regulations (49 CFR 397) (DOT).
- (c) Manual on Uniform Traffic Control Devices for Streets and Highways, Bureau of Public Roads (DOT).
- (d) Inspection Requirements for Motor Vehicles, Trailers and Semi-trailers Operated on Public Highways, ANSI D7.1-1973 (ANSI).
- (e) Uniform Vehicle Code (NCUTLO).
- (f) A Policy on Geometric Design on Rural Highways (AASHTO).

(2) Recommended Standards.

- (a) Traffic Engineer's Handbook (ITE and NSC).
- (b) Traffic Engineering, Matson, Smith and Hurd. McGraw-Hill Book Company, Inc., publishers (McGraw).
- (c) Motor Fleet Safety Manual (NSC).
- (d) Traffic Accident Investigator's Manual for Police, The Traffic Institute, Northwestern University (NWU).
- (e) Handbook of Highway Safety Design and Operating Practices (DOT).

c. Vessels (Marine) Safety Prescribed Standards.

- (1) Rules and Regulations for Uninspected Vessels, Booklet 258, U.S. Coast Guard (DOT).
- (2) Rules and Regulations for Numbering of Undocumented Vessels and the Reporting of Boating Accidents, Booklet 267, U.S. Coast Guard (DOT).
- (3) Equipment Lists, Booklet 190, U.S. Coast Guard (DOT).
- (4) Marine Engineering Regulations and Material Specifications, Booklet 115, U.S. Coast Guard (DOT).

- (5) Ventilation System for Small Craft, Booklet 395, U.S. Coast Guard (DOT).
- d. Transportation of Radioactive Material.
 - (1) Prescribed Standards.
 - (a) Department of Transportation Hazardous Materials Regulations (49 CFR 100-179).
 - (b) Packaging of Radioactive Materials for Transport (10 CFR 71).
 - (2) Recommended Standards.
 - (a) Cask Designers Guide ORNL-NSIC-68, 1970 (DOE).
 - (b) Structural Analysis of Shipping Casks, ORNL-TM-1312, Volumes I through X (DOE).
 - (c) Packaging of Uranium Hexafluoride for Transport, ANSI N14.1-1971 (ANSI).
- e. Railroad Safety. Prescribed Standard. Federal Railroad Administration, (49 CFR 211-240).

SOURCES OF STANDARDS

1. AAOO American Academy of Ophthalmology and Otolaryngology
15 Second Street, SW.
Rochester, Minnesota 55901
2. AASHTO American Association of State Highway and Transportation
Officials
444 North Capitol Street, NW.
Washington, D.C. 20001
3. ACGIH American Conference of Governmental Industrial Hygienists
2205 South Road
Cincinnati, Ohio 45238
4. AGCA Associated General Contractors of America, Inc.
1957 E Street, N.W.
Washington, D.C. 20006
5. AIHA American Industrial Hygiene Association
475 Wolf Ledges Parkway
Akron, Ohio 44311
6. AMC United States Department of the Army
Headquarters, U.S. Army Material Development and
Readiness Command
Pentagon
Washington, D.C. 20310
7. ANSI American National Standards Institute
1430 Broadway
New York, New York 10018
8. API American Petroleum Institute
2101 L Street N.W.
Washington, D.C. 20037
9. ASME American Society of Mechanical Engineers, Inc.
345 East 47th Street
New York, New York 10017
10. ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, Pennsylvania 19103

11. AWWA American Water Works Association, Inc.
666 Quincy Street
Denver, Colorado 80235
12. BUMINES Publications Section
U.S. Bureau of Mines
4800 Forbes Avenue
Pittsburgh, Pennsylvania 15213
13. CALIF State of California
General Services Publications
P.O. Box 1015
North Highland, California 95660
14. CGA Compressed Gas Association, Inc.
500 Fifth Avenue
New York, New York 10036
15. CMAA Crane Manufacturers Association of America, Inc.
1326 Freeport Road
Pittsburgh, Pennsylvania 15238
16. CRC C. R. C. Press, Inc.
2000 N.W. 24th Street
Boco Raton, Florida 33431
17. DOD Department of Defense
The Pentagon
Washington, D.C. 20301
18. DNA Field Command
Defense Nuclear Agency
Albuquerque, New Mexico
19. DOT Department of Transportation
400 7th Street, S.W.
Washington, D.C. 20590
20. DOT Coast Guard
Department of Transportation
400 7th Street, SW.
Washington, D.C. 20590
21. DUPONT E.I. duPont de Nemours and Company
Petrochemicals Department
Wilmington, Delaware 19898

22. EPA Environmental Protection Agency
401 M Street, SW.
Washington, D.C. 20460
23. FDA Food and Drug Administration
5600 Fishers Lane
Rockville, Maryland 20857
24. FEMA Federal Emergency Management Agency
Administrative Services Division
Printing and Publications Branch
Room 404
Washington, D.C. 20472
25. FM Factory Mutual Engineering Division
1151 Boston-Providence Turnpike
Norwood, Massachusetts 02062
26. GPO Superintendent of Documents
United States Government Printing Office
Washington, D.C. 20402
27. GSA General Services Administration
General Services Building
18 and F Street, NW.
Washington, D.C. 20405
28. IAEA UNIPUB
P.O. Box 433, Murray Hill Station
New York, New York 10016
29. ICRP International Committee on Radiation Protection
4201 Lexington Avenue
New York, New York 10017
30. ICRU International Commission on Radiation Units
and Measurements
7910 Woodmont Avenue
Washington, D.C. 20014
31. IEEE Institute of Electrical and Electronic
Engineers, Inc.
345 East 47th Street
New York, New York 10017
32. IME Institute of Makers of Explosives
420 Lexington Avenue
New York, New York 10017

33. IRI Industrial Risk Insurers
85 Woodland Street
Hartford, Connecticut 06102
34. ISO International Standards Organization
c/o American National Standards Institute
1430 Broadway
New York, New York 10018
35. ITE Institute of Transportation Engineers, Inc.
Suite 905, 1815 North Fort Myer Drive
Arlington, Virginia 22209
36. MCA Chemical Manufacturers Association
1825 Connecticut Avenue, NW.
Washington, D.C. 20009
37. MCGRAW McGraw-Hill Book Company, Inc.
1221 Avenue of Americas
New York, New York 10020
38. MPD G. D. Searle and Company
Will Ross, Inc./Matties or Products Division
P.O. Box 85
East Rutherford, New Jersey 07073
39. NASA National Aeronautics and Space Administration
400 Maryland Avenue, SW.
Washington, D.C. 20546
40. NAV Commanding Officer
(Code 512) Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, Pennsylvania 19120
41. NBS National Bureau of Standards
Department of Commerce
Washington, D.C. 20234
42. NCRP National Council on Radiation Protection and
Measurement
7910 Woodmont Avenue, Suite 1016
Bethesda, Maryland 20014
43. NCUTLO National Committee on Uniform Traffic Laws
and Ordinances
1776 Massachusetts Avenue, NW.
Washington, D.C. 20036

44. NFPA National Fire Protection Association
470 Atlantic Avenue
Boston, Massachusetts 02210
45. NIOSH Publications
NIOSH (MSR6)
4676 Columbia Parkway
Cincinnati, Ohio 45226
46. NRA National Rifle Association
1600 Rhode Island Avenue, NW.
Washington, D.C. 20036
47. NSC National Safety Council
444 North Michigan Avenue
Chicago, Illinois 60611
48. NTIS National Technical Information Service
Department of Commerce
Springfield, Virginia 22151
49. NWU Traffic Institute
Northwestern University
405 Church Street
Evanston, Illinois 60201
50. OMB Office of Management and Budget
Old Executive Office Building
17th and Pennsylvania Avenue, NW.
Washington, D.C. 20503
51. OSHA OSHA Publications Office
U.S. Department of Labor
Room S1212
3rd Street and Constitution Avenue, NW.
Washington, D.C. 20210
52. UL Underwriters' Laboratories, Inc.
207 East Ohio Street
Chicago, Illinois 60611
53. USDA Department of Agriculture
Washington, D.C. 20250
54. USPHS Public Health Service
Office of Public Affairs
100 Independence Avenue, SW.
Room 7406
Washington, D.C. 20201

CHAPTER V

SAFETY OF NUCLEAR FACILITIES

1. PURPOSE. This chapter establishes safety procedures and requirements for nuclear facilities to assure:
 - a. That nuclear facilities are sited, designed, constructed, modified, operated, maintained, and decommissioned in accordance with generally uniform standards, guides, and codes which are consistent with those applied to comparable licensed nuclear facilities.
 - b. That radioactive and fissionable materials are produced, processed, stored, transferred, or handled in such a manner that the probability of an accident is acceptably low.
 - c. That an environmental protection, safety, and health protection program is established in accordance with the requirements stipulated in paragraphs 6 through 11 of this chapter.
 - d. That environmental protection, safety, and health protection matters are comprehensively addressed and receive an objective review with all identifiable risks reduced to acceptably low levels, and that management authorization of the operation is documented.
 - e. That consideration is given to all potential criticality hazards associated with fissionable material operations outside nuclear reactors.
 - f. The protection of Government property and essential operations from the effects of potential accidents.
2. SCOPE. This chapter applies to Headquarters and field organizations, Department of Energy contractors, and Government-owned laboratories and non-reactor nuclear facilities. The requirements of this chapter shall be applied to the design, construction, maintenance, operation, and decommissioning of a given facility with due consideration to the degree of risk that facility presents to employees, the public, and the environment. Accelerator and nuclear reactor facilities and their operation are not included in this chapter, but are covered by other Environmental, Safety, and Health Orders, as appropriate.
3. REFERENCES.
 - a. DOE 5480.1, Chapter XI, "Requirements for Radiation Protection."
 - b. Code of Federal Regulations, Title 10, Part 30, "Rules of General Applicability to Licensing of Byproduct Material."

- c. Code of Federal Regulations, Title 10, Part 40, "Licensing of Source Material."
- d. Code of Federal Regulations, Title 10, Part 50, "Licensing of Production and Utilization Facilities."
- e. Code of Federal Regulations, Title 10, Part 55, "Operators' Licenses."
- f. Code of Federal Regulations, Title 10, Part 70, "Special Nuclear Material."
- g. "Handbook of Nuclear Safety," Clark, H.K., 1-61 (DP-532).
- h. "Los Alamos Critical Mass Data," Paxton, H.C., 5-64 (LAMS-3067).
- i. "Criticality Control in Chemical and Metallurgical Plants," Karlsruhe Symposium, Organization for Economic Cooperation and Development, European Nuclear Energy Agency, 1961.
- j. "Criticality Control of Fissile Materials," Proceedings of Symposium, Stockholm, Sweden, International Atomic Energy Agency, 1966.
- k. ANSI N16 Series, N16.1 thru N16.5 inclusive, N16.8, and N16.9.
- l. The Criticality Data Center Report Series.
- m. "Criticality Control in Operations With Fissile Materials," 11-72 (LA-3366, Rev.), Paxton, H.C.
- n. "Criticality Problems of Actinide Elements," Clayton, E.D., and Bierman, S.R., Actinides Reviews 1 (1971), 409-432.
- o. "Nuclear Safety Guide" (TID-7016, Revision 2, 1978, available as NUREG/CR-0095).
- p. DOE 5484.1, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION INFORMATION REPORTING REQUIREMENTS, of 2-24-81.
- q. DOE 5484.2, UNUSUAL OCCURRENCE REPORTING SYSTEM.
- r. DOE 5482.1A, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION APPRAISAL PROGRAM.
- s. DOE 5700.6A, QUALITY ASSURANCE.
- t. DOE 6430., GENERAL DESIGN CRITERIA FOR DEPARTMENT OF ENERGY FACILITIES.
- u. DOE 5481.1A, SAFETY ANALYSIS AND REVIEW SYSTEM.

- v. "Critical Dimensions of Systems Containing U-235, PU-239, and U-233," TID-7028.

4. DEFINITIONS.

- a. Critical Mass. The smallest mass of fissionable material that will support a self-sustaining chain reaction under specified conditions.
- b. Fissionable Materials. Nuclides capable of sustaining a neutron induced fission chain reaction, e.g., uranium 233, uranium 235, plutonium 239, plutonium 238, plutonium 241, neptunium 237, americium 241 and curium 244. (Additional fissionable nuclides shall be included as significant quantities become available.)
- c. Fissionable Materials Handler. An individual officially designated by management to manipulate or handle significant quantities of materials; or manipulate the controls of equipment used to produce, process, transfer, store, or package significant quantities of such materials.
- d. Supervisor. An individual officially designated by management to direct the activities of operators or fissionable materials handlers and to supervise the operation of equipment that handles, produces, processes, stores, packages, or uses radioactive material or significant quantities of fissionable materials.
- e. Nuclear Criticality. A self-sustaining chain reaction, i.e., the state in which the effective neutron multiplication constant of a system of fissionable material equals or exceeds unity.
- f. Nuclear Criticality Safety. Prevention or termination of inadvertent nuclear criticality, mitigation of consequences, and protection against injury or damage due to an accidental nuclear criticality.
- g. Nuclear Facility. A facility whose operations involve radioactive materials in such form and quantity that a significant nuclear hazard potentially exists to the employees and the general public. Included, are facilities that (1) produce, process, or store radioactive liquid or solid waste, fissionable materials, or tritium; (2) conduct separations operations; (3) conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations; (4) conduct fuel enrichment operations. Incidental use of radioactive materials in a facility operation (e.g., check sources, radioactive sources, and X-ray machines) does not necessarily require the facility to be included in this definition. Accelerators and reactors and their operations are not included.
- h. Operational Safety Requirements. Those requirements which define the conditions, safe boundaries, and bases thereof, and management control required to assure the safe operation of a nuclear facility.

- i. Operator. An individual designated by management to perform operations or conduct activities with radioactive materials at a nuclear facility.
- j. Safety Analysis. A documented process to systematically identify the hazards of a Department of Energy operation, to describe and analyze the adequacy of the measures taken to eliminate, control, or mitigate identified hazards, and to analyze and evaluate potential accidents and their associated risks.
- k. Safety Guides. Documents designated or recognized as an acceptable basis for nuclear criticality safety evaluations. The guides are used as aids by Department of Energy field organizations when suggesting acceptable safety practices, and include material developed by Department of Energy contractors, professional societies, industrial organizations, and foreign atomic energy industries.
- l. Safe Mass. That mass of fissionable materials which is subcritical for all conditions to which it could reasonably be expected to be exposed, including processing, handling, storing, and procedural uncertainties.
- m. Significant Modification. A change to the nuclear facility that involves an unreviewed safety question, as defined below.
- n. Significant Quantities. A mass of fissionable materials greater than a safe mass, as defined above.
- o. Risk. A quantitative or qualitative expression of possible loss which considers both the probability that a hazard will cause harm and the consequences of that event.
- p. Undue Risk. A level of identifiable risk which is unacceptable to the Department.
- q. Unreviewed Safety Question. A proposed change, test, or experiment is an unreviewed safety question if:
 - (1) The probability of occurrence or the consequence of an accident or malfunction of equipment important to safety, previously reviewed by the Department will be significantly increased, or
 - (2) A possibility for an accident or malfunction of a different type than previously reviewed by the Department will be created which could result in significant safety consequences.
- r. Unusual Occurrence. See DOE 5484.2, UNUSUAL OCCURRENCE REPORTING SYSTEM.

- s. Verification of Training and Retraining. The confirmation by an auditable record of the experience, education, medical conditions, training, and testing pertinent to the candidate's specific job assignment and responsibilities. This record should show that all applicable requirements of paragraph 8, are met.

5. RESPONSIBILITIES AND AUTHORITIES.

- a. Program Secretarial Officers, or their designees, perform the following functions for nuclear facilities under their program responsibility:
 - (1) Assume line management responsibility for nuclear facility safety.
 - (2) Provide for independent review and assessment of nuclear facility activities in their program organizations and the field offices to assure that they are accomplished in consonance with the need for protecting the environment, safety, and health of DOE and DOE contractor employees, and the public.
 - (3) Assure that the construction and initial startup of high hazard (as defined in DOE 5481.1A) facilities and any subsequent modifications involving a high hazard to a facility will not create undue environmental protection, safety, or health protection risks by:
 - (a) Assuring that an acceptable safety review has been made and documented by the appropriate field organization.
 - (b) Determining that such independent safety reviews indicate that an adequate degree of protection of health and safety exist.
 - (4) Transmit the results of the actions taken under subparagraphs (2) and (3), above, to the responsible field organizations with any necessary or appropriate instructions as to subsequent action to be taken with a copy to the Office of Nuclear Safety.
 - (5) Submit to higher management for action, any disagreement with recommendations made during safety reviews that cannot be resolved.
 - (6) Provide assistance and guidance to field organizations in the performance of safety reviews, appraisals, and the preparation of safety analysis reports.
 - (7) Recommend additions or revisions to nuclear safety standards, guides, and codes to the Office of Nuclear Safety.

- (8) Perform program reviews and assessments to assure compliance of field organizations with subparagraph 5(e) below. In the execution of this responsibility, maximum use should be made of the appraisals performed by the Office of Nuclear Safety.
 - (9) Assure the safe operation of nuclear facilities by:
 - (a) Directing the responsible field organization to require modification of equipment, procedures, or practices to assure safe operation.
 - (b) Taking other actions to assure the implementation of this chapter, including directing the field organization to curtail or suspend the operation of their nuclear facilities when necessary.
 - (c) Taking other actions as deemed appropriate.
 - (10) Provide to the Deputy Assistant Secretary for Environment, Safety, and Health (EP-30) a copy of directions given under subparagraph (9), above.
 - (11) Include, in long-range program objectives and plans, the requirements to assure safe operation.
 - (12) Assure that program budgets provide adequate funds for health and safety requirements during all phases of facility life.
 - (13) Consider nuclear facility safety factors in connection with review and approval of designs, program and project proposals, and other proposals requiring Headquarters action.
 - (14) Obtain special technical assistance as needed in performance of assigned functions when the expertise is not available in the office in need of assistance.
 - (15) Transmit to cognizant field organizations proposed new safety requirements. Upon consideration of field organization assessments of such requirements and EP-30 comments, provide final approval.
 - (16) Review and approve the field office designation of nuclear facilities after considering comments received from the Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness (EP-1).
- b. Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness, through the Deputy Assistant Secretary for Environment, Safety, and Health:

- (1) Provides the Secretary with an independent safety overview and assessment of the operation at DOE-owned nuclear facilities.
- (2) Establishes priorities for conducting safety appraisals of programs in conjunction with program Secretarial Officers and Operations Office Managers.
- (3) Assures that nuclear facilities projects are consistent with DOE nuclear safety policy.
- (4) Overviews and appraises both the line and independent nuclear safety activities of the cognizant Secretarial Officers and the Operations Office Managers to assure that DOE nuclear projects are accomplished in consonance with a need for protecting the safety and health of DOE and DOE contractor employees, and the public. Specific emphasis will be placed on training programs to assure that they include requirements necessary to achieve the goal of well-trained operators.
- (5) Conducts appraisal with teams which are augmented with experts from other DOE organizations.
- (6) Provides nuclear safety expertise to assist other Headquarters and field organizations.
- (7) Develops and maintains generic qualification and training standards for operators.
- (8) Assures that responsible EP personnel are proficient in the operations personnel training area, including diverse expertise so that important areas related to nuclear safety are covered.
- (9) Collects new safety requirements applicable to licensed nuclear facilities and consults with the cognizant program Secretarial Officer to make a preliminary evaluation to determine their potential applicability to DOE nuclear facilities and:
 - (a) Evaluates field office assessments and program Secretarial Office disposition of newly proposed requirements and considers the requirements for inclusion in DOE Orders, as appropriate.
 - (b) Maintains a summary of the consideration and disposition given by the Department to each of the newly proposed requirements for nuclear facilities.

NOTE: The above process for implementing newly proposed environmental protection, safety, and health requirements into DOE orders, policies, or directives does not relieve the line

program organization from its responsibility to assure that new environmental protection, safety, and health requirements are considered and applied as necessary to their facilities.

c. The Deputy Assistant Secretary for Naval Reactors.

- (1) Directs a program for assuring environmental protection, safety, and health protection at supporting contractor facilities for the Naval Reactors program and fulfills the responsibilities described for Heads of Field Organizations under subparagraph 5d, below, for the Schenectady and Pittsburgh Naval Reactors Offices.
- (2) Fulfills the responsibilities of this chapter and DOE 5482.1A, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION APPRAISAL PROGRAM, for criticality control and nuclear facility safety overview, assessments, and appraisals for nuclear facilities under the cognizance of the Deputy Assistant Secretary for Naval Reactors.
- (3) Shall be exempt from the requirement to submit copies of correspondence, reports, and documents, as provided elsewhere in this chapter, to the Deputy Assistant Secretary for Environment, Safety, and Health.

d. Heads of Field Organizations shall, for nuclear facilities and operations under their jurisdiction:

- (1) Assume line management responsibility for the safety of assigned nuclear facilities.
- (2) Assure adequate consideration for, and take action on, environmental protection, safety, and health protection matters during siting, design, construction, operation, maintenance, modification, deactivation, decontamination, and decommissioning.
- (3) Require preparation of safety analyses including nuclear criticality safety evaluation. In preparing safety analyses for facilities under this chapter, consideration should be given to the appropriate NRC Division 3 Regulatory Guides (e.g., 3.5, 3.15, 3.25, 3.26, 3.33, 3.34, 3.35, 3.39, 3.44).
- (4) Require preparation of, and approve, facility Operational Safety Requirements and changes thereto.
- (5) Authorize operation of a new nuclear facility after assuring that adequate consideration has been given to all hazards including nuclear criticality safety, and determining by reviewing safety analyses and Operational Safety Requirements that its operation

will not create undue environmental protection, safety, and health protection risks.

- (6) Authorize activities, operations, and modifications that change the Operational Safety Requirements or involve an unreviewed safety question only after assuring that:
 - (a) The contractor has performed and documented a safety review of each proposed change or each unreviewed safety question.
 - (b) An independent safety review has been performed and documented to assure that continued operation is acceptable for environmental protection, safety, and health protection.
- (7) Take such action as may be appropriate to assure implementation of this chapter, including curtailment and suspension of operations when, in their opinion, such operation would result in an undue environmental protection, safety, and health protection risk.
- (8) Assure implementation by Department of Energy contractors and subcontractors of the requirements set forth in paragraph 6 through 11 of this chapter, and provide advisory services to Department of Energy contractor and subcontractors on matters dealing with nuclear facilities, environmental protection, safety, and health protection policies; standards, codes, guides and procedures, including the requirements of this chapter.
- (9) Require that contractors having significant quantities of material:
 - (a) Prepare and utilize written procedures for the handling of fissionable materials, including storage, transfer, and processing.
 - (b) Establish and maintain suitable management review and audit systems and clear lines of responsibility for nuclear criticality safety within their organizations. These systems shall include provisions for contractor internal review of operations for nuclear criticality safety.
 - (c) Develop, establish, and maintain training programs and employee indoctrination or instruction which will promote an awareness of the risks involved and a level of proficiency consistent with assigned tasks.
 - (d) Develop emergency plans to handle potential accidents, including complete medical support of irradiated or contaminated people.

- (10) Assume the establishment of an unusual occurrence investigation and reporting system in accordance with DOE 5484.1 and DOE 5484.2.
- (11) Assist in the review and development of environmental protection, safety, and health protection codes, standards, and guides.
- (12) Conduct appraisals in accordance with DOE 5482.1A.
- (13) Review newly proposed safety requirements and determine applicability to specific facilities and submit assessments of such proposed requirements to the cognizant program Secretarial Officer.
- (14) Identify those facilities on his or her site(s) which are designated to be nuclear facilities and submit to the cognizant program Secretarial Officer for approval.

5. BASIC REQUIREMENTS. The environmental protection, safety, and health protection program for nuclear facilities shall include the following:
- a. An independent safety analysis review process which includes a formal documented system for the identification and control of risks through preparation, independent review, and approval of safety analyses.
 - b. Administrative and procedural controls that delineate (1) responsibilities and methods for safe operation under normal and emergency conditions, and (2) a system of configuration control that requires independent safety review and approval of all changes to components, equipment, procedures and systems required for facility safety.
 - c. A documented training program for personnel involved in operating nuclear facilities which meets the requirements specified on page V-13, paragraph 8.
 - d. Operational Safety Requirements setting forth, in a concise manner, the approved limitations of safe operation. The requirements shall be commensurate with the potential risks involved.
 - e. Development and implementation of quality assurance programs that fulfill the requirements of DOE 5700.6A.
 - f. Application of environmental protection, safety, and health protection codes, standards, and guides covering siting, design, construction, modification, operation, maintenance, deactivation, decontamination, and decommissioning. Where established standards are determined to be inadequate or not available, suitable operating standards shall be

developed, using contractor expertise as necessary, so that a defined and agreed upon basis for conducting and assessing operations is established and used. The Safety Analysis or other design documentation shall identify, on a facility specific basis, the standards applied.

- g. Notification, investigation, and reporting of occurrences and the followup system to assure remedial action has been implemented. (See DOE 5484.1 and 5484.2).
- h. For new nuclear facilities and for significant modifications to existing nuclear facilities, review of safety analyses design criteria, environmental assessments and environmental impact statements, and other design documents to assure adequate environmental protection, safety, and health protection consideration.
- i. For new nuclear facilities and for significant modifications to existing nuclear facilities, reviews and inspections during construction, acceptance of systems and preoperational phases to assure compliance with the appropriate environmental protection, safety, and health protection standards and requirements.
- j. A formal documented system for the control and traceability of records and documentation specified herein.
- k. A program of nuclear criticality safety which meets the requirements of paragraphs 9 and 10 of this chapter.
- l. A contractor independent safety review and appraisal system which meets the requirements of paragraph 7 of this chapter.
- m. The safe storage criteria for unirradiated fissionable material meeting the requirements of paragraph 11 of this chapter.

7. CONTRACTOR INDEPENDENT OF REVIEW AND APPRAISAL SYSTEM. The field office shall require each contractor to establish and maintain an internal safety review system for nuclear facilities which:

- a. Functions primarily in an advisory capacity to the line organization, reporting to a designated position or authority at a level of management sufficiently high to take any necessary corrective action. (Safety is a line responsibility; neither review nor subsequent approval releases line management from its responsibility for safety of people and equipment.)
- b. Is clearly defined and delineated in writing (e.g., purposes, objectives, functions, authority, responsibility, composition, quorum, meeting frequency, and reporting requirements).

- c. Can be audited by contractor management and by the Department. The performance of the system shall be recorded in sufficient detail to permit contractor management and the Department to evaluate its effectiveness. Actions taken on any recommendations resulting from reviews, audits, inspections, appraisals, and surveillance shall be included in these records.
- d. Provides technical competence in the areas being reviewed. Each review, except subparagraph i, below, shall be carried out by persons whose technical disciplines cover the range of technical fields encountered in performing a safety review. Safety considerations are to be treated in such breadth and depth as is necessary to identify the potential hazards and to evaluate the risks.
- e. Provides for group interaction and discussions between reviewers on all but the more routine matters.
- f. Provides an independent determination of whether a proposed activity involves an unreviewed safety question, violation of a Criticality Safety Limit, Operational Safety Requirement, or any matter for which approval is required.
- g. Provides an appraisal of the overall operation of each facility at least annually. This appraisal shall be made by individuals, the majority of whom are independent of the operation being appraised. It shall include, but not be limited to, applicable areas listed in subparagraph h, below.
- h. Provides for objective and independent review of:
 - (1) Proposed modifications to nuclear facilities and equipment having safety significance, and safety analysis thereof.
 - (2) Proposed experiments and operations having safety significance.
 - (3) Procedures, i.e., administrative, operating (normal and abnormal), maintenance, repair, testing, quality assurance, and emergency, and significant changes thereto.
 - (4) Organization and staffing.
 - (5) Standards, Nuclear Criticality Safety Limits, Operational Safety Requirements, and changes thereto.
 - (6) Nuclear facility safety training programs, including the initial and subsequent qualification and verification requirements and procedures for criticality safety.

- (7) Unusual occurrences, including those referred to as incidents, operating anomalies and violations of Criticality Safety Limits or Operational Safety Requirements.
 - (8) The physical condition of the nuclear facilities.
 - (9) The accuracy and completeness of recordkeeping and documentation.
- i. Is reviewed by contractor management for adequacy of performance at least every 3 years.
8. PERSONNEL SELECTION AND TRAINING. A program shall be established for the selection, training, and retraining of all individuals who operate, maintain, or supervise activities in nuclear facilities. The program will promote an awareness of the risks involved and a level of proficiency consistent with assigned tasks. The purpose of this program is to assure that the nuclear facility is operated and maintained by personnel who are qualified to carry out their assigned responsibilities. It includes the following:
- a. Operating Personnel.
 - (1) The elements of the training program shall be documented.
 - (2) Documentation shall provide a means to ascertain that the candidate has achieved the necessary qualification status, both initially and on a continuous basis, to perform his or her assigned tasks in a safe and proficient manner.
 - (3) Sufficient time shall be provided for training and retraining on a continuing basis.
 - (4) For each type of nuclear operation, management shall determine the physical demands imposed upon the operating personnel by the job tasks that are required to perform both routine and emergency duties. A medical examination shall be given to prospective employees and a reexamination shall be given to requalifying operators and supervisors to verify health and physical fitness to safely perform their defined tasks. Operators and supervisors must be cleared by medical examination prior to returning to work following any serious injury or illness.
 - (5) On-the-job training shall be provided to assure that personnel are familiar with all aspects of their positions. Such training shall include but not be limited to:
 - (a) Normal procedures.

- (b) Emergency actions.
 - (c) Radiation control practices.
 - (d) Location and functions of the pertinent safety systems.
 - (e) Configuration control procedures.
 - (f) Procedures for making changes or alterations in the operations.
- (6) Verification of training shall be made by a cognizant management or supervisory official following a finding that the candidate's proficiency is satisfactory after completion of the training program and receipt of a satisfactory statement of the candidate's medical condition and other pertinent information. Verification of training for fissionable material handlers, operators, or supervisors may not be made by his or her immediate supervisor.
- (7) Retraining and reexamination shall be required at least annually on all procedures for handling abnormal nuclear facility conditions and emergency situations relative to the employee's assigned responsibilities, and at least every 2 years on all other subjects in which the fissionable materials handler, operator, or supervisor is expected to be proficient.
- (8) Verification of training shall be documented by contractor management at least every 2 years.
- (9) The program shall be auditable by contractor management and by the Department.
- (10) In addition to the above, a program shall be established for those fissionable materials handlers, operators, and supervisor candidates who process, store, transfer, or handle significant quantities of fissionable materials, which includes the following elements:
- (a) Fissionable materials handlers, operators, and supervisor candidates shall possess either formal training or pertinent experience or both, commensurate with the stated degree of responsibility and complexity of the prospective position.
 - (b) The training program shall provide for evaluating the progress of each trainee periodically during training. Each evaluation shall require the demonstration of a satisfactory knowledge of all required subjects and procedures covered in the training program. This demonstration may include written, oral, and operational examinations as appropriate to the position,

experience, and educational level of the employee. Upon completion of the program, the final evaluation of the candidate's proficiency shall be made by the examining official. A file record of the employee's training, including a record of the subjects covered in oral and operating tests along with the written examinations, shall be maintained.

- (c) Retraining for fissionable materials handlers, operators, and supervisors following extended absence from the nuclear facility shall be required. The extent of retraining will depend upon the length of absence and the type of work and operational routine in the event of changes. For absences of 3 months or less, if retraining is deemed necessary, informal retraining and oral testing may be sufficient. For absences of 3 to 12 months, selected retraining as appears necessary, including training in the use of, and familiarization with, any new devices or changes in the process, with appropriate demonstrations of knowledge and proficiency, is required. For absences greater than 1 year, a written reexamination shall be required and where indicated by the results of that examination, retraining shall be mandatory.
- (d) The program shall provide for training, retraining, examination, and reexamination in the following areas to the extent that they are pertinent to the position in question (supervisor training shall require an understanding in greater depth than fissionable materials handler and operator training):
 - 1 Standard and Emergency Operating Procedures. Normal operating procedures, abnormal and emergency actions, and administrative controls and responsibilities.
 - 2 Radiological Safety and Control. Radiation hazards, monitoring, safety practices, control procedures, and terminology.
 - 3 Safety and Emergency Systems. The kind of equipment, operating characteristics and procedures, and testing requirements of safety systems.
 - 4 Instrumentation and Control. Types of instruments and control systems, including principles of operation and consequences of malfunctions.
 - 5 Facility Operating Characteristics. Principal features, operating parameters, and operating limits of the facility, including the auxiliary systems.

- 6 Principles of Nuclear Facility Operation. The processes involved and technical terminology for the chemical, physical, and metallurgical reactions.
- (e) In the case of initial startup of a new nuclear facility or operation precluding prior on-the-job training, practical experience at similar facilities, training on simulators, training with inert materials, or other appropriate training shall be considered.
- (f) The supervisor training program, in addition to the above, shall include the following material to the extent that it is pertinent:
- 1 Design, control, and operating limitations for the facility, including instrumentation characteristics, adjustment, operation, facility console control mechanisms, and control room manipulations.
 - 2 Procedures for making design and operating changes, including changes in operating procedures.
 - 3 Radiation hazards which may arise during the performance of experiments other than those in critical assemblies.
 - 4 Nuclear and radiation theory, including details of fission process, neutron multiplication, source effects, neutron poison effects, and reactor kinetics.
 - 5 Specific operating characteristics of the facility, such as causes and effects of temperature, pressure, and reactivity changes.
 - 6 Procedures and limitations involved in initial equipment loading, alterations in fissionable material configuration, and determination of various internal and external effects on reactivity.
 - 7 Procedures, equipment, and facilities available for handling and disposing of radioactive materials and effluents.
- (g) Any waiver from the requirements set forth in subparagraph 8a shall be obtained from the field office manager. (The name of the fissionable materials handler, operator, or supervisor and the specific subject for which the waiver is requested,

along with the justification for the waiver shall be submitted.)
Waivers may be requested only in specific areas for those fissionable materials handlers, operators, and supervisors who are exceptionally well qualified by past experience and education, and who have been continuously employed in the same type position.

- b. Maintenance Personnel. The training requirements for maintenance personnel shall be determined by the class of maintenance which the personnel are to perform, the degree of supervision required, and the required knowledge of the nuclear facility.
 - (1) All maintenance operations shall be performed by personnel who are properly trained in their respective discipline or under direct supervision of trained personnel.
 - (2) A written policy shall be established that describes functions, assignments, and responsibilities of the maintenance organization as it relates to nuclear safety.
 - (3) The successful completion of the training and qualification effort shall be documented.

- 9. NUCLEAR CRITICALITY SAFETY ELEMENTS. The following basic elements of nuclear criticality safety shall be provided in contractors' programs involving significant quantities of fissionable materials:
 - a. Process Analysis. Before beginning an operation with significant quantities of fissionable materials, or changing an existing operation, a preoperational audit shall be made to determine that the entire process will be subcritical under both normal and abnormal operating conditions that could reasonably be expected to occur. Distinction may be made between shielded and unshielded facilities, and the criteria may be less stringent when adequate shielding assures the protection of personnel.
 - b. Identification of the Parameters on which Prevention of Accidental Nuclear Criticality will Depend. The basis for establishing subcriticality shall be noted for all significant conditions at each step in the process. This may, in the case of established facilities or operations, consist of references to existing nuclear criticality safety evaluations.
 - c. Written Plans and Procedures. Operations shall be governed by written plans and procedures. These plans and procedures shall be an integral part of the initial proposal for the nuclear facility, its operations, and subsequent modifications that may affect the nuclear reactivity. The plans and procedures shall include the following, where applicable:

- (1) Plans for receiving fissionable material into the facility and for inspecting the shipment on receipt, including procedures for:
 - (a) Determining, verifying, or noting the contents of each package, including the net weight of fissionable material therein.
 - (b) The placing of materials in the receiving area and the storage facility.
 - (c) Handling wet or damaged packages.
- (2) Plans and procedures for storing fissionable material, including:
 - (a) Limitations on total quantity of material, quantity of each individual unit, container dimensions, and spacing between units.
 - (b) Description of containers in which fissionable materials are stored.
 - (c) Description of the storage facility, including dimension and materials used in construction of the enclosure and shelving, cubicles, cages, and other equipment within the storage area.
 - (d) Precautions to avoid entry of water or other material into a storage area where moderating and reflecting effects would be unsafe.
 - (e) Administrative controls over the distribution of fissionable material from storage and its return to storage, including means of verifying the weight, isotopic content, chemical composition, and degree of moderation.
- (3) Plans and procedures for processing the fissionable material, including:
 - (a) A description, using appropriate sketches or drawings, of equipment and facilities in which the hazard of criticality exists, and showing dimensions in sufficient detail to permit evaluation of the information mentioned in subparagraphs (c) and (f), below.
 - (b) A statement of the chemical and physical form of fissionable material in each step of the operation, including isotopic content, the nature of any material, and the resulting concentrations, densities, and degrees of moderation throughout the steps of the process.

- (c) A statement of the maximum quantities of fissionable material allowed at any one time in each step of the process.
- (d) Spacing of masses of fissionable material within each process area, and separation from fissionable material in adjoining areas.
- (e) Methods of collecting, handling, and transporting fissionable material from each process area or individual operation, and evaluation of the nuclear safety of these methods.
- (f) Description of procedures which are intended to prevent criticality resulting from accumulation of fissionable material in scrap or waste, lathe turnings, crucible slag, pickling solutions, choppings, sumps, filters.
- (g) Installed or proposed criticality alarm system and emergency procedures, including alarm levels, fail-safe features, response time of devices, and frequency of evacuation drills. Pertinent documents shall show the location of all detectors, their distance to possible sources of criticality, and intervening shielding. The criticality alarm system shall be installed in all locations wherein the quantities of fissionable material may exceed 700 grams of uranium 235, 520 grams of uranium 233, 450 grams of plutonium, or 450 grams of any combination of these three nuclides. (Limits for other fissionable materials shall be as indicated in American National Standard Institute Standard ANS 8.15, "Nuclear Criticality Control of Special Actinide Elements," when issued.) These limits may be exceeded when justified by consideration of the physical form and isotopic distribution of the fissionable material. This justification must be based upon a documented analysis demonstrating that, in such cases, the alarm system is not required. Special attention shall be given to all processes in which reflectors and moderators more effective than hydrogen are present and, as appropriate, the above limits reduced so that nuclear reactivity is not increased.
- (h) A monitoring system, using gamma- or neutron-sensitive radiation detectors which will initiate a clearly audible alarm, distinctive in tone, if accidental criticality occurs, is required. The detectors shall be capable of detecting a criticality condition that produces an absorbed dose in free air of 20 rads of combined neutron and gamma radiation at an unshielded distance of 2 meters from the fissionable material within 60 seconds. Provisions shall be made to minimize false alarms. These provisions may include concurrent response of

two or more detectors or single, highly reliable detectors to initiate an alarm. In redundant systems, failure of any single channel shall be into the alarm state. Warning of malfunctions within the alarm system without activation of the alarm shall be provided. Evacuation for such warning may not be required. This paragraph is not intended to require underwater monitoring when special nuclear material is handled or stored beneath water shielding adequate to protect the personnel. Also, such alarm systems are not required for material during shipment or material packaged in approved shipping containers awaiting transport, provided no other operation involving fissionable material not so packaged is permitted on the dock or in the shipment area. Such an area or dock shall be located so that the interaction between fissionable material positioned thereon, and any other arrays of fissionable material is essentially zero. (See Chapter III of this Order for details regarding the safe shipment of fissionable materials.)

- (i) Where the function of the facility is to store radioactive waste packaged elsewhere, the plans and procedures required in subparagraph 9c(3), may be appropriately combined with those required for storage in subparagraph 9c(2).
- (j) The plans described in paragraphs 9c(1) and (2), may make suitable allowance for situations where fissionable contents are repetitive or known from the work of others; e.g., the cases of mass-produced fuel elements and waste containers for which the fissionable content has previously been determined by a method known to be reliable.

d. Records. Operations shall provide for control, sign-off, and traceability of records, such as plans, procedures, inspections, monitoring systems, regarding the collection, handling, transportation, inspection, receipt, and monitoring of fissionable material.

10. NUCLEAR CRITICALITY SAFETY CONTROL PARAMETERS. Nuclear criticality safety of fissionable materials may be provided by maintaining any one of the single parameter limits set forth in the latest revision of American National Standards Institute Standard N16-1. Although the single parameter limits are adequate for many purposes they are inconveniently and uneconomically small for many others. In many cases, simultaneous limitation of two or more parameters may allow more flexible operational control. General guidance for multiparameter limits may be found in subparagraphs 3f, 3j, 3n, and paragraph 6 of this chapter. The following basic control parameters for nuclear criticality safety shall be considered:

a. Controlling Factors. Nuclear criticality safety is achieved by exercising control over:

(1) The Mass and Distribution of All Fissionable Materials.

- (a) Mass Controls. For operations where nuclear criticality safety depends upon mass control, the allowable mass shall be no greater than the safe mass for the associated conditions. The safe mass in all cases shall be based upon current published or available nuclear safety guides and handbooks. These guides and handbooks may include values which, in the absence of directly applicable experimental measurements, are derived from calculations made by a method shown to be valid by comparison with experimental data, provided allowances are made for uncertainties in the data and in the calculations. For operations depending upon mass control where the contained volume does not automatically limit the contents to the safe mass or less, the possibility of multiple batching shall be considered. If a batch of fissionable materials consists of different physical and chemical forms of a particular isotope, e.g., metallic uranium 235, compounds of uranium 235, the safe mass for the most reactive combinations under the associated conditions shall be the governing criterion. If a batch of fissionable materials consists of a mixture of fissionable nuclides, i.e., plutonium 239, uranium 235, uranium 233, neptunium 237, and curium 244, the allowable safe mass shall be determined experimentally or determined from calculations made by a method shown to be valid by comparison with experimental data.
- (b) Density Controls. Density (mass of fissionable nuclides per unit volume) is an accepted parameter for control of nuclear criticality safety. Systems that use density control shall meet established density criteria. These criteria may be found in safety guides, handbooks, and data compilations.
- (c) Spacing Controls. Individual items of equipment and containers holding fissionable materials, when arranged in a group, in storage, or when being transferred within a nuclear facility or between facilities onsite, shall be spaced so that the entire array is subcritical for all conditions that affect or might affect the nuclear facility or site. Movement of material under credible in-plant and onsite accident conditions shall be considered.

(2) The Mass, Distribution, and Use of the Nuclear Properties of All Other Materials With Which Fissionable Elements are Associated.

- (a) Neutron Absorbers. Neutron-absorbing materials, such as cadmium and boron, may be used to make equipment and processes safe, provided available data confirm their suitability and assure their presence and reliability. Care should be exercised in the use of solutions of neutron absorbers because of the controls required to assure their continued effectiveness.
 - (b) Moderation Controls. For operations in which nuclear criticality safety depends upon control of neutron moderation, there shall be assurance that the prescribed extent of moderation remains unchanged or that, if it does change, the reactivity of the system remains below acceptable subcritical limits. Such assurance shall include consideration of all credible accidents involving any moderator or combination of moderators.
 - (c) Neutron Reflection. Neutron reflection shall be considered for all systems of fissionable material. The extent of reflection shall be based upon the actual reflectors present or those to be expected during normal operations or as a result of a credible accident.
- b. Double Contingency Principle. Process designs shall incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before an accidental nuclear criticality is possible.
 - c. Geometry Control. Where practicable, reliance shall be placed on equipment design in which dimensions are limited, rather than on administrative controls. Full advantage may be taken of any nuclear characteristics of the process materials. Control shall be exercised to maintain all dimensions and nuclear properties on which reliance is placed.
 - d. Nuclear Criticality Safety Limits. Limits for nuclear criticality safety shall be established on bases derived from experiments. In the absence of directly applicable experimental measurements, the limits may be derived from calculations made by a method shown to be valid by comparison with experimental data, provided allowances are made for uncertainties in the data and in the calculations.
 - e. Margins of Safety. Safety margins used shall meet the control parameter requirements above. Further, a cumulative margin of safety shall provide allowance for experimental and computational uncertainties. Procedure violations also shall be a consideration.
 - f. Onsite Movement and Offsite Shipment of Fissionable Materials.
 - (1) Onsite movement includes all activities where fissionable materials are transferred from one operation to another within a facility and

from location to location onsite. For all such movements, the following requirements shall be met:

- (a) For the onsite movement of fissionable materials that do not present a radiation hazard, the pertinent requirements set forth in this chapter shall be met.
 - (b) For onsite movement of fissionable materials that presents a radiation hazard, as well as the possibility of an accidental chain reaction, the pertinent requirements of this chapter and Chapter XI of this Order shall be met.
 - (c) In addition to the physical controls specified above, administrative controls, including traffic controls, shall be exercised as deemed necessary by Heads of Field Organizations to minimize accident probabilities.
 - (d) Fire protection, security, health physics, and any other emergency personnel, when deemed appropriate by Heads of Field Organizations, shall be alerted and advised of movements and routings.
- (2) Safety standards for the packaging of fissionable materials for any offsite shipment are outlined in Chapter III of this Order. Further, such shipments shall meet the nuclear criticality safety requirements set forth in this chapter and the radiological safety standards outlined in Chapter XI of this Order.

11. SAFE STORAGE CRITERIA FOR UNIRRADIATED FISSIONABLE MATERIAL. These criteria are applicable to the storage of all forms and significant quantities of unirradiated fissionable material.

NOTE: These criteria are not applicable:

- (a) Where these materials are in-process as part of production, analytical and development procedures, or transport operations.
- (b) Where an assembly cell is used for assembly and/or storage of weapons components made with these materials.
- (c) For these materials packaged for shipment with number of packages limited in accordance with the requirements of Chapter III of this Order.
- (d) To radioactive waste storage or disposal facilities.

a. Operating Requirements for Storage.

- (1) Nonessential combustible materials shall not be stored in the storage area.
- (2) Process operations, storage of nonnuclear materials or equipment which is not directly required for storage operations, and all other functions not directly a part of normal storage operations shall be excluded from the storage area. Deviations from this requirement must be approved by the field office manager.
- (3) Documented periodic inspections, in situ tests, and preventive maintenance shall be performed at designated frequencies to assure that the safety systems and components necessary for criticality control, fire control, radiation detection, and environmental monitoring, as well as their alarm systems, are being properly maintained in readiness for use.
- (4) Limits for criticality safety shall be posted in conspicuous places near the storage area.
- (5) Signs or other appropriate devices shall be utilized at strategic locations to provide instructions regarding:
 - (a) Interpretations of and response to alarms.
 - (b) Evacuation routes.
 - (c) Combating fires.
- (6) In conjunction with site emergency planning, a fire fighting plan shall be developed, incorporated into the overall site fire plan, and exercised through periodic drills which include use of emergency equipment.
- (7) Auxiliary fire fighting equipment, self-contained breathing apparatus, and protective clothing shall be provided, as necessary, to facilitate manual fire suppression.
- (8) Excess fissionable material shall not be construed to be "In-Process" to circumvent the requirements of this paragraph.
- (9) Fissionable material shall not be stored in shipping containers for the purpose of negating the requirements of this paragraph.
- (10) All material shall be stored in racks or equivalent equipment (such as birdcages) capable of securely locating stored material to prevent displacement, to assure spacing control, and to meet designs

for safety under operational and credible accident conditions. Floor storage within the storage facility will be permitted only where control of location and other safety requirements (equivalent to those of racks) are inherently provided by the individual containers and their restraints.

- (11) All pyrophoric materials shall be put in a safe form prior to storage or stored in approved containers that will not permit spontaneous ignition or dispersal. Other dispersible materials must be stored in approved storage containers.
- (12) All containers shall be marked or coded to indicate the type or category of material, amount, degree of enrichment, and the radiation level at the outside surface of the vessel. Containers shall be securely closed and positioned so as to prevent significant displacement and maintain criticality prevention requirements.
- (13) Container design shall be appropriate to the form of stored material. Criteria for container integrity shall be developed in the course of the required safety analysis and the application of these criteria ascertained by periodic inspection. Containers involving any significant gas buildup or automatic pressure relief or other venting should be designed to assure that no personnel exposure to any released toxic material will occur under normal storage conditions or, insofar as practical, under accident conditions. Such venting must not permit spread of contamination.
- (14) Plutonium or U-233 bearing or contaminated material shall be packaged in a closed metal container. Combustibles within the container shall be minimized.
- (15) Plutonium storage facilities and containers shall be monitored and checked periodically to assure continued integrity of containment. When required by the form or hazard potential of the stored material, procedures shall be developed to detect contamination or loss of primary containment upon entering the plutonium storage facility.
- (16) Plutonium containers in which gas buildup can occur shall be designed to prevent leakage of gas over the maximum storage period or vented to prevent an accumulation of explosive gases; however, such venting must not permit spread of contamination.
- (17) Criteria, such as corrosion rate, external and internal, for determining suitability of the plutonium containers shall be developed and set forth in writing. All containers shall be periodically inspected against the criteria developed. The time between inspections may vary depending upon container quality and type.

- (18) Provisions shall be made in a plutonium storage facility to assure, in plutonium containers, necessary and adequate heat removal as established by the safety assessment.
- b. Multipurpose Facility (Storage and Processing) Criteria. In making the safety assessment for any building or area which includes both storage and processing functions, the operating contractor shall, with the approval of the field office manager, specify which manufacturing, production, or laboratory materials may be termed "in-process" and which may not. Materials in excess of in-process requirements shall be promptly placed in approved storage facilities. Definitions of in-process material shall be established and approved prior to start of the related operations and maintained thereafter unless approved changes are effected.
- c. Facility Functional Design Requirements for Storage. The design criteria shall meet the requirements of Chapter XXI, Plutonium Facilities, and Chapter XXIII, Unirradiated Enriched Uranium Storage Facilities of DOE 6430., FACILITIES GENERAL DESIGN CRITERIA, currently in coordination for use, by Assistant Secretary, Management and Administration memorandum of 6-10-81.

CHAPTER VI

SAFETY OF DEPARTMENT OF ENERGY OWNED REACTORS

1. PURPOSE. The purpose of this chapter is to establish safety procedures and requirements for nuclear reactors to assure that:
 - a. The safety of each Department of Energy-owned reactor is properly analyzed, evaluated, documented, and approved by the Department.
 - b. Reactors are sited, designed, constructed, modified, operated, maintained, and decommissioned in a manner that gives adequate protection for health and safety and will be in accordance with uniform standards, guides, and codes which are consistent with those applied to comparable licensed reactors.
2. SCOPE. This chapter applies to Headquarters and field organizations, and Departmental contractors having responsibilities for Department reactor projects. This chapter applies to Department-owned reactors exempt from Nuclear Regulatory Commission licensing; additional guidance applicable to Department-owned licensed reactors will be provided as needed by future revision of the chapter.
3. REFERENCES.
 - a. Code of Federal Regulations, Title 10, Part 50, "Licensing of Production and Utilization Facilities."
 - b. Code of Federal Regulations, Title 10, Part 100, "Reactor Site Criteria."
 - c. DOE 5484.1, ENVIRONMENTAL PROTECTION, SAFETY AND HEALTH PROTECTION INFORMATION REPORTING REQUIREMENTS.
 - d. DOE 5700.6A, QUALITY ASSURANCE.
 - e. DOE 5482.1A, ENVIRONMENTAL SAFETY AND HEALTH APPRAISAL PROGRAM.
 - f. DOE 5500.2, EMERGENCY PLANNING, PREPAREDNESS, AND RESPONSE FOR OPERATIONS.
 - g. ANS 3.1, American Nuclear Society Standard 3.1, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants," October 1980.
 - h. ANSI N546-1976, "Medical Certification and Monitoring of Personnel Requiring Operator Licenses for Nuclear Power Plants."

- i. USNRC Regulatory Guide 1.134, Rev. 1, March 1979, "Medical Evaluation of Nuclear Power Plant Personnel Requiring Operator Licenses."
- j. DOE 5484.2, UNUSUAL OCCURRENCE REPORTING SYSTEM.

4. DEFINITIONS.

- a. Category A or B Reactor. Departmental designation as a Category A reactor is based on power level (e.g., 20 MW steady state), potential fission product inventory, and experimental capability. All other DOE-owned reactors (not including Naval Reactors) are designated Category B. Category A reactors are listed in Attachment VI-1, paragraph 3.
- b. Controls. When used with respect to nuclear reactors, means apparatus and mechanisms that, when manipulated, directly or indirectly affect the reactivity or power level of a reactor or engineered safety feature status.
- c. Health Examination. An examination by a licensed medical physician to cover medical and physical fitness for duty.
- d. Initial Startup. Those activities subsequent to preoperational testing, starting with the initial loading of fuel and involving all actions taken including tests to assure a safe, orderly, incremental approach to predefined conditions of reactor operation.
- e. Inspections. A deliberate and systematic examination at the reactor including, but not limited to, physical inspection of reactor systems, operating and maintenance procedures, logs, records, and reactor operations.
- f. Modification. Any change made to structures, systems, components, or procedures during any phase of the life of the reactor project.
- g. Operable. When the reactor is being operated or has the potential for being operated. A reactor that cannot be operated on a day-to-day basis because of refueling, extensive modifications, or technical problems is still considered to be operable.
- h. Reactor Operator. An individual certified by contractor management to operate a Department-owned reactor.
- i. Reactor Facility.
 - (1) The term reactor, unless it is modified by words such as containment, vessel, or core, means the entire reactor facility including the housing and equipment and associated areas devoted to the operation and maintenance of one or more reactor cores. Any apparatus that is designed or used to sustain nuclear chain reactions in a controlled

manner, including critical and pulsed assemblies and research, test and power reactors, is defined as a reactor. All assemblies designed to perform subcritical experiments which could potentially reach criticality are also to be considered reactors.

- (2) Critical assemblies are special nuclear devices designed and used to sustain nuclear reactions. Critical assemblies may be subject to frequent core and lattice configuration changes, and may be used frequently as mockups of reactor configurations. Therefore, requirements for modifications do not apply unless the overall assembly room is modified, a new assembly room is proposed, or a new configuration is not covered in previous safety evaluations (i.e., Safety Analysis Reports, Safety Analysis Report Addenda, or Technical Specifications).
- j. Reactor Operations. All those activities involved (or functions performed) in operating and using a reactor which, for purposes of this chapter, begins with the initial loading of fuel in the reactor vessel and ends with the removal of fuel to officially decommission or place the reactor in a standby status.
 - k. Reactor Project. Those activities which contribute to siting, designing, constructing, operating, or decommissioning a reactor, and those activities involving the operation or maintenance of operable and standby reactors, including shutdown reactors containing fuel.
 - l. Reactor Supervisor. An individual certified by contractor management to operate or to direct the operation of a Department-owned Category B reactor.
 - m. Risk. A quantitative or qualitative expression of possible loss which considers both the probability that a hazard will cause harm and the consequences of that event.
 - n. Safety Analysis Report. A safety document providing a concise but complete description and safety evaluation of the site, design, normal and emergency operation, potential accidents, and predicted consequences of such accidents, and the means proposed to prevent such accidents or mitigate the consequences of such accidents. A Safety Analysis Report is designated as final when it is based on final design information. Otherwise, it is designated as preliminary.
 - o. Safety Document. A document prepared specifically to assure that the safety aspects of part or all of the activities conducted at a reactor are formally and thoroughly analyzed, evaluated, and recorded; e.g., Technical Specifications, Safety Analysis Reports and addenda, and documented reports of special safety reviews and studies.

- p. Safety Review. A deliberate and critical examination of the safety impact of a proposed activity or an ongoing activity during the siting, designing, constructing, maintaining, modifying, or decommissioning of a reactor, which could affect health and safety. Documentation shall be considered part of the safety review, to provide management with adequate identification of the safety issues and their possible implications, and also to allow others not directly involved in the program or review process to independently evaluate the completeness or adequacy of the review.
- q. Senior Reactor Operator. An individual certified by contractor management to operate or to direct the operation of a Department-owned Category A reactor.
- r. Shutdown. That condition in which a reactor facility has ceased operation and the Department has declared officially that it does not intend to operate the reactor further.
- s. Standby. That condition in which a reactor facility is neither operable nor declared excess, and documentary authorization exists to maintain the reactor for possible future operation.
- t. Technical Specifications. A safety document approved by the Department which in a specified format defines the conditions, safety boundaries, and procedures under which activities are to be carried out at a reactor. See Code of Federal Regulations, title 10, part 50.36.
- u. Under Construction. When the authorization for construction has been issued and authorization for operation has not yet been issued.
- v. Unreviewed Safety Question. A proposed change, test, or experiment shall be deemed to involve an unreviewed safety question if:
 - (1) The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the Safety Analysis Report and addenda will be significantly increased.
 - (2) A possibility for an accident or malfunction of a different type than any evaluated previously in the Safety Analysis Report and addenda will be created which could result in significant safety consequences.
- w. Unusual Occurrence. See DOE 5484.2, UNUSUAL OCCURRENCE REPORTING SYSTEM.

5. RESPONSIBILITIES AND AUTHORITIES.

- a. Program Secretarial Officers, or their designees, perform the following functions for reactors under their program responsibility:
 - (1) Assume line management responsibility for reactor safety.

- (2) Provide for an independent review and assessment of the reactor program activities in their program organizations and the field offices to assure that they are accomplished in consonance with the need for protecting the safety and health of DOE and DOE contractor employees, and the public.
- (3) Assure that the construction, initial startup, and subsequent modifications of reactors involving an unreviewed safety question will not create undue environmental, safety, or health risks by:
 - (a) Assuring that an acceptable safety review has been made and documented by the appropriate field organization.
 - (b) Determining that such independent safety reviews indicate that an adequate degree of protection of health and safety exists.
- (4) Approve summary of training plans which define and describe the selective application of ANS 3.1 requirements to Category A reactors (see Attachment VI-1, paragraph 3), when assured that the summary provides for the requirements necessary to achieve the goal of well-trained personnel for the reactor(s) covered by the summary.
- (5) Transmit the results of the actions taken under subparagraph (2), (3), and (4), above, to the responsible field organizations with any necessary or appropriate instructions as to subsequent action to be taken, with a copy to EP-30.
- (6) Submit to higher management for action any disagreement with recommendations made during safety reviews that cannot be resolved.
- (7) Provide assistance and guidance to field organizations in the performance of safety reviews, appraisals, and the preparation of safety analysis reports.
- (8) Recommend additions or revisions to reactor safety standards, guides, and codes to EP-30.
- (9) Perform program reviews and assessments to assure that field organizations comply with subparagraph d, below. In the execution of this responsibility, maximum use should be made of the appraisals and other reviews performed by EP-30.
- (10) Assure the safe operation of reactors by:
 - (a) Directing the responsible field organization to require modification of equipment, procedures, or practices to assure safe operation.

- (b) Taking other actions to assure the implementation of this chapter, including directing the field organization to curtail or suspend the operation of their reactors when necessary.
 - (c) Taking other actions, as deemed necessary.
- (11) Provide to EP-30 a copy of directions given under subparagraph (10), above.
 - (12) Include, in long-range program objectives and plans, the requirements to assure safe reactor operation.
 - (13) Assure that program budgets provide adequate funds for health and safety requirements during all phases of reactor life.
 - (14) Consider reactor safety factors in connection with review and approval of designs, program and project proposals, and other proposals requiring Headquarters action.
 - (15) Obtain special technical assistance as needed in performance of assigned functions when the expertise is not available in the office in need of assistance.
 - (16) Transmit to cognizant field organizations proposed new safety requirements. Upon consideration of field organization assessments of such requirements and EP-30 comments, provide final approval.
- b. Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness (EP-1), through EP-30, performs the following:
- (1) Provides the Secretary with an independent safety overview and assessment of the operation at DOE-owned reactors.
 - (2) Establishes priorities for conducting appraisals of reactor programs in conjunction with program Secretarial Officers and field office managers.
 - (3) Assures that reactor projects are consistent with DOE reactor safety policy.
 - (4) Overviews and appraises both the line and independent reactor safety activities of the cognizant Secretarial Officers and the field office managers to assure that DOE reactor projects are accomplished in consonance with a need for protecting the safety and health of DOE and DOE contractor employees, and the public. Specific emphasis will be placed on training programs to assure that they include the requirements necessary to achieve the goal of well-trained operators.

- (5) Conducts appraisals with teams which are augmented with experts from other DOE organizations.
- (6) Provides reactor safety expertise to assist other Headquarters and field organizations.
- (7) Develops training fundamentals covering fields such as nuclear theory, heat transfer, fluid flow, and thermodynamics for DOE application.
- (8) Issues and keeps current Attachment VI-1, which identifies the officials having program safety responsibility for each DOE-owned reactor.
- (9) Assures that responsible EP personnel are proficient in the operations personnel training area, including diverse expertise so that important areas related to nuclear safety are covered.
- (10) Collects new safety requirements applicable to licensed nuclear reactors and consults with the cognizant program Secretarial Officer to make a preliminary evaluation to determine their potential applicability to specific DOE-owned reactors, and:
 - (a) Evaluates field office assessments and program Secretarial Officer disposition of newly proposed requirements and considers for inclusion in DOE Orders as appropriate.
 - (b) Maintains a summary of the consideration and disposition given by the Department to each of the newly proposed requirements for DOE-owned reactors.

NOTE: The above process for implementing newly proposed environmental protection, safety, and health requirements into DOE directives does not relieve the line program organization from its responsibility to assure that new environmental protection, safety, and health requirements are considered and applied as necessary to their facilities.

c. Deputy Assistant Secretary for Naval Reactors.

- (1) With the assistance of the Managers of Pittsburgh and Schenectady Naval Reactors Offices, is responsible for assuring that adequate provision is made for the protection of health and safety in accordance with the provisions of this chapter for reactors and facilities under his or her cognizance.
- (2) Is responsible for approving initial startup and modifications involving an unreviewed safety question for Naval Reactors prototype

plants and critical facilities at supporting contractor laboratory facilities, for performing appraisals in accordance with DOE 5482.1 as deemed necessary at Naval Reactor prototype plants and supporting contractor laboratory critical facilities and, for selection, qualification, training, and certification of operating personnel for naval reactor prototype plants and critical facilities of supporting contractor laboratory facilities.

- (3) Is exempt from appraisals conducted by EP-1, and for reporting and analysis of occurrences.
 - (4) Fulfills the responsibilities listed under paragraph 5d for Heads of Field Organizations.
- d. Heads of Field Organizations have the immediate responsibility for assuring that adequate provision is made for the protection of health and safety in accordance with the provisions of this chapter. They:
- (1) Assume line management responsibility for the safety of assigned reactors.
 - (2) Provide for an overview of reactor safety in their organization independent of line management responsibility.
 - (3) Review and provide to the appropriate Headquarters offices, Safety Analysis Reports, addenda, and other safety documents for all new reactor construction and for modifications involving an unreviewed safety question.
 - (4) Assure that approved Technical Specifications exist for all reactors under their surveillance.
 - (5) Authorize construction and initial operation of a new reactor or modifications involving an unreviewed safety question. Prior to initial operation or after modifications involving an unreviewed safety question, a preoperational inspection of the reactor shall be conducted and documented.
 - (6) Specify in writing to the contractor those activities for which safety evaluations are to be submitted for Department of Energy review and approval. Field offices shall, as a minimum, review proposed modifications involving plant protection, reactivity control systems, and engineered safety features.
 - (7) Authorize modifications to reactor operations including the addition of critical assemblies or critical assembly rooms to existing and approved critical facilities when these modifications could have

an impact on reactor safety, but do not involve unreviewed safety questions after assuring that:

- (a) The contractor has performed and documented a detailed evaluation of each proposed modification.
 - (b) The field offices' safety reviews are appropriately performed and documented in the depth necessary to justify authorizing the modification.
 - (c) An adequate degree of protection of health and safety exists.
 - (d) Additional requirements of the Headquarters program organization having safety review responsibility have been met.
- (8) Review (either during inspections, appraisals, or through reviews of documents submitted by the contractor) changes made to reactor operations, including revision of procedures, experimental program changes, and physical modifications which could have safety implications, to assure that the contractor has made appropriate reviews and that the changes made do not violate Technical Specifications or involve an unreviewed safety question.
 - (9) Take such actions as may be appropriate including curtailment and suspension of operation of any reactor under their surveillance when, in their opinion, such operation may result in undue risk to health and safety.
 - (10) Monitor contractor activities, as appropriate, during siting, design, construction, operation, modification, and decommissioning phases by periodic inspections of, and visits to, individual reactor facilities.
 - (11) Assure the establishment of an appraisal program in accordance with DOE 5482.1, including periodic appraisal of the reactor operating personnel training program. Appraisals of the overall operation of each reactor facility shall be conducted; however, individual reactor facility appraisal reports may be combined.
 - (12) Assure the establishment of an appropriate quality assurance program by the contractor in accordance with DOE 5700.6.
 - (13) Assure the establishment of a reactor personnel training and qualification program by the contractor in accordance with paragraphs 6e(1) and (2).
 - (14) Assist in the review and development of environmental protection, safety, and health protection codes, standards, and guides.

- (15) Assure the establishment of an unusual occurrence investigation and reporting system in accordance with DOE 5484.1 and 5484.2.
- (16) Prepare a summary of the training plan which defines and describes selective application of ANS 3.1 requirements of Category A reactors. Submit this summary through the cognizant Headquarters program organization to the program Secretarial Officer for approval. The summary shall include a description of the field office review and approval process of contractor prepared training plans.
- (17) Assure that staff includes an individual having broad knowledge in reactor design, construction, operations, and safety, including some experience in the area of reactor operations personnel training.
- (18) Keep appropriate Headquarters program organizations advised of reactor safety problems, deficiencies, and needs, and of actions taken under this chapter.
- (19) Perform additional duties including safety reviews, inspections, and appraisals as directed by the responsible Headquarters program organizations.
- (20) Reviews newly proposed safety requirements and determines applicability to specific reactors and submits assessments of such proposed requirements to the cognizant program Secretarial Officer.

6. PROGRAM REQUIREMENTS.

- a. Siting. In the selection of the site for a new reactor and during modification of an operating reactor that has a significant impact on property damage or dose commitment, the Code of Federal Regulations, title 10, part 100, shall be considered.
- b. General Design Criteria. The General Design Criteria specified in the Code of Federal Regulations, title 10, part 50, Appendix A, shall be applied to all Department-owned reactors in the following cases:
 - (1) All new construction of reactor facilities.
 - (2) When the Department determines that safety can be significantly improved by implementing one or more of the criteria (for example, when modifications or repairs of those structures, systems, or components which involve an unreviewed safety question are undertaken).
- c. Safety Analysis Reports. New Safety Analysis Reports shall follow the Nuclear Regulatory Commission's guidelines on the Standard Format and Content of Safety Analysis Reports. While this guidance may focus on large complex reactor systems, the format and content is generally

applicable to all reactors. The requirements of this subparagraph and subparagraph (b), above, do not apply to space-based nuclear reactors which will use criteria consistent with space applications.

d. Technical Specifications.

- (1) Each Department-owned reactor shall have a technical specification document meeting the Code of Federal Regulations, title 10, part 50.36. Technical Specifications for Department-owned reactors shall be similar to those required for comparable facilities licensed by the Nuclear Regulatory Commission and yet provide the flexibility necessary for experimental activities. The Technical Specifications serve as an understanding between the Department and the operating contractor regarding limits and conditions under which the reactor will be operated and maintained. Documentation for Naval reactor plants will be in accordance with Naval Reactor requirements.
- (2) The field office manager has the responsibility to transmit proposed and final Technical Specifications to Headquarters and to approve Technical Specifications. The field office manager shall require notification in a timely manner of any violation of the Technical Specifications.

e. Reactor Personnel Training and Qualification Program.

- (1) Category A Reactors. This subparagraph contains the requirements for the qualification and training of personnel involved in the operation of Department-owned Category A reactors. (See Attachment VI-1, paragraph 3.)
 - (a) General. American Nuclear Society Standard 3.1, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants" (Draft), October 1980, shall be the basis for qualification and training requirements for reactor personnel for Category A reactors. The requirements of ANS 3.1 are to be followed to the extent that they are appropriate for the facility or operation being considered. Paragraphs 6e(1)(a) through 6e(1)(d), contain interpretations of, or variations from, ANS 3.1 requirements.
 - 1 Application. In view of the diversity of the Department of Energy Category A reactors and in order to facilitate the application of a power reactor standard to a Department-owned reactor, requirements of ANS 3.1 shall be selectively applied as appropriate to each site or reactor. U.S. NRC Regulatory Guide 1.8 (Draft), of September 1980, shall also be considered, as appropriate, for DOE Category A reactors.

- 2 Training Plans. Training plans, which define and describe the selective application of ANS 3.1 requirements, shall be prepared by the operating contractor of each Category A reactor. Suitable justification shall be included for provisions of ANS 3.1 which are not applied. These plans shall be submitted to the field office manager for final approval.
- 3 Security Requirements. The requirements for security forces, including training, shall be in accordance with Department of Energy requirements.

(b) Definitions (ANS 3.1, Section 2).

- 1 Nuclear Power Plant Experience. Experience acquired at production, training, test, military, and research reactors may also qualify as equivalent experience on a one-for-one time basis.
- 2 Operator. An individual who has been certified by contractor management to operate or direct the operation of a Department-owned reactor is considered comparable to a licensed operator for the purposes of this chapter. Certification shall be valid for a 2-year period.

(c) Qualifications (ANS 3.1, Section 4).

- 1 General. ANS 3.1, Section 4.1, includes provisions for substitution of experience for formal education on a case-by-case basis. Substitution of appropriate formal education for experience may also be considered. However, formal education shall not be allowed to substitute for more than 50 percent of the experience requirements.
- 2 Senior Reactor Operator. Senior reactor operators shall have 1 year experience as a reactor operator at the plant for which the senior operator certification is required (ANS 3.1, Section 4.3.1.2).
- 3 Reactor Operators. The power plant experience required by ANS 3.1, Section 4.5.1.2b, for the reactor operator position may be revised to 2 years.
- 4 Technicians. ANS 3.1, Section 4.5.2, discusses training for technicians, and references Sections 5.3.4 and 5.4 for necessary training. In amplification of these requirements, the training program for radiation protection technicians

should include the training in Sections 5.3.4 and 5.4 and training in:

- a Principles of radiation protection;
- b Standards and regulatory requirements concerning radiation protection;
- c The type and magnitude of potential radiological hazard for each plant system;
- d Responsibilities and authorities for their position; and
- e Tasks to be performed by the technician in normal, abnormal, and emergency situations.

Additionally, each radiation protection technician shall have demonstrated an understanding of the elements of the training program by satisfactory completion of both a written examination and a practical demonstration of the tasks referred to in subparagraph e, above.

- 5 Medical Certification. Medical certification requirements shall be in accordance with ANSI N546-1976, "Medical Certification and Monitoring of Personnel Requiring Operator Licenses for Nuclear Power Plants," and USNRC Regulatory Guide 1.134, Rev. 1, March 1979, "Medical Evaluation of Nuclear Power Plant Personnel Requiring Operator Licenses." Form NRC-396, "Certificate of Medical Examination," or an alternative form may be utilized.

(d) Training (ANS 3.1, Section 5).

- 1 Position Task Analysis. A position task analysis shall be conducted by the operating contractor as necessary for operating personnel to define the tasks performed by the person in each position, and to identify the required training, in conjunction with education and experience, necessary to provide assurance that the tasks can be effectively performed. The position task analysis should include normal and emergency duties and place emphasis on the role played by every member of an operating organization that assures safe plant operation. The position task analysis shall support the selection of requirements of ANS 3.1 and any supplemental requirements appropriate to the position.
- 2 Simulator Training. ANS 3.1, section 5, requires specific simulator training. However, adequate training may be

achieved by actual plant maneuvers, drills, partial plant simulators, or combinations of these. The use of a simulator for a Department of Energy Category A reactor shall be based on an evaluation of the ability to adequately provide in-plant training covering all operator actions, where timely operator action must be taken to bring the reactor to a safe state or maintain the reactor in a safe state, and to provide adequate training in normal operations, anticipated transients, and accident conditions. In-plant training shall not lead to or have the potential for significant safety concerns.

3 Retraining and Reexamination Programs.

a Annual retraining and reexamination programs covering abnormal plant procedures and emergencies shall be required. Retraining and reexamination programs meeting all other requirements of ANS 3.1, section 5, shall be scheduled on a biennial basis. Examination content shall be varied from test to test.

b For tasks performed by shift operating personnel in response to off-normal or accident situations, in-plant drills shall be conducted to enable personnel to maintain proficiency in those tasks.

c In addition to the training and retraining addressed in ANS 3.1, section 4, instruction should be provided to operations personnel in the use of plant systems to control or mitigate accidents in which the core may be severely damaged. Such training should include, as a minimum, classroom training and in-plant training.

4 Control Manipulations. ANS 3.1, section 5.5.1.2.1, identifies specific control manipulations and plant evolutions applicable to power reactors. For each Category A reactor, specific control manipulation training requirements shall be developed by the operating contractor and approved by the cognizant Department of Energy field office.

5 Certification. The program leading to certification shall be documented and written procedures for certification by management of shift supervisors, senior reactor operators, and reactor operators shall be made either by senior line management or others designated by management. Neither an operator nor a supervisor may be certified by his or her immediate supervisor. Certification shall be made only after assuring that all the requirements of training and examinations (including written, operating, oral, and medical)

have been satisfied, and management has assured that the individual is capable of performing satisfactorily all functions of the assigned tasks. The qualification of all other personnel shall be appropriately documented, i.e., experience, education, medical condition, training, and testing, as pertinent to the specific job assignment.

- 6 On the Job Training. ANS 3.1, section 5.2.1.3.1, requires that, as part of the operator training program, candidates shall observe operating practices in the control room. In addition:
 - a Operators. Operator trainees should have received 3 months shift training, with no other concurrent duties, at the facility. During this training, under the observation and control of a certified operator, the trainee should have manipulated the facility controls and performed duties a person would perform as a certified operator.
 - b Senior Reactor Operators. Senior reactor operator trainees should have received 3 months of shift training, with no other concurrent duties, at the facility. During this training, under the observation and control of a certified senior reactor operator, the trainee should have supervised the manipulation of the facility controls and performed duties a person would perform as a certified senior operator.
 - 7 Record Requirements. Record retention requirements (ANS 3.1, section 5.6) shall be in accordance with paragraph 6k.
- (e) Implementation. Training plans for each Category A reactor shall be issued within 1 year from the date of issue of this chapter. Effective 3 years from the date of issue of this chapter, all personnel filling the functional or equivalent positions contained in ANS 3.1 shall meet the training requirements of the applicable training plan. Personnel not holding the position prior to 1 year after the date of issue of this chapter shall meet the selection and training requirements of the training plan.
- (2) Category B Reactors. This section contains the requirements for the qualification and training of personnel involved in the operation of Department-owned Category B reactors (see Attachment VI-1, paragraph 3).

(a) Selection.

- 1 Candidates for reactor operator should possess that combination of education, experience, and training which provides the equivalent of at least a high school education. Candidates for reactor supervisor should possess that combination of education, experience, and training which provides the equivalent of at least a college education in engineering or science.
- 2 Contractor management shall specify the demands on health, physical condition, coordination, and manual dexterity required to perform both routine and emergency functions. A health examination shall be given to establish the candidate's fitness to perform all proposed job tasks.

(b) Training.

- 1 Reactor Operator Training. The reactor operator's training shall be sufficiently comprehensive to cover areas which are fundamental to the candidate's job description.
 - a The program shall include on-the-job training for operators and supervisors to assure their familiarity with all required aspects of reactor operations, including normal operations, anticipated transients, and accident conditions. Where construction precludes on-the-job training, practical experience at similar reactors, training on simulators, and other appropriate training are acceptable.
 - b Training categories shall include nuclear theory, principles of reactor operation, features of facility design, design and operating characteristics and limitations, instruments and controls, safety and emergency systems, shielding, engineered safety features, standard and emergency operating procedures, radiation monitoring systems and survey equipment, radiological safety principles, effects of experiments, and manipulation of reactivity controls. Training in heat transfer, fluid flow, and thermodynamics shall also be provided as necessary for the specific design of the reactor.
- 2 Reactor Supervisor Training. The supervisor training program shall include the categories and on-the-job training specified above for reactor operators, but with increased depth to reflect the added responsibilities of the supervisor. In addition, emphasis shall be placed on design and operating limitations, bases for technical specifications, radiation

hazards, reactivity effects during experimental and maintenance activities, fuel handling, burnup and reactivity worth, alterations in core configuration, and administrative responsibilities associated with the facility and appropriate for his or her level of responsibility.

- (c) Examination. Written, operational, and oral examinations shall be prepared and administered by the contractor to satisfactorily demonstrate the required knowledge of reactor operators and supervisors. These examinations shall include questions on all categories listed above and the examination content shall be varied from test to test. The Department shall review the type, depth, and breadth of the examinations for initial certification. Administration of examinations of reactor operators and supervisors shall be by those personnel sufficiently knowledgeable to ascertain candidate deficiencies. The examination contents, administration, and evaluation shall be reviewed by personnel other than the candidate or his immediate supervisor.
- (d) Certification. The program leading to certification shall be documented, and written procedures for certification by management of qualified reactor operators and supervisors shall be made either by senior line management or others designated by management. Neither a reactor operator nor a supervisor may be certified by his or her immediate supervisor. Certification shall be made only after assuring that all the requirements of training and examinations (including written, operating, oral, and medical) have been satisfied, and management has assured that the reactor operator or supervisor is capable of performing satisfactorily all of the functions of the assigned tasks.
- (e) Retraining. A retraining program shall be established to provide training on changes to plant or procedures, areas in which the candidate shows deficiency, areas in which the candidate is not routinely exposed, and other areas necessary to keep operators and supervisors proficient. The retraining program shall include:
 - 1 Periodic refresher training.
 - 2 Indepth retraining and reexamination at least annually in abnormal plant procedures and emergencies.
 - 3 Immediate retraining in identifiable weak areas (see (f)2c, below).

(f) Reexamination.

- 1 The reexamination should emphasize those subjects which are necessary to determine weaknesses which could affect continued proficiency. The reexamination shall:
 - a Include the appropriate categories listed in paragraphs 6e(2)(b) 1 and 2, for operators and supervisors, respectively.
 - b Cover all areas in addition to subparagraph a, above, in which the candidates are expected to be proficient.
 - c Include written, oral, and operational testing.
- 2 The contractor has the following options:
 - a Giving one examination biennially which covers all categories.
 - b Giving examinations on selected categories throughout the 2-year period.
 - c In lieu of retraining prior to examination, give a comprehensive examination (written and oral) in each category, and an operational examination to determine weak areas in which the operator or supervisor shall be retrained and retested.
- 3 A line manager or supervisor may administer the examination if the contractor does not have other qualified personnel from which to draw. However, if the employee who administers the examination is also to be certified or recertified, he shall not be examined by those persons whom he examines nor can he examine himself.

(g) Recertification. The candidate shall not be allowed to function as a certified operator or supervisor if he has not completed all of the requalification program within 2 years from the previous certification. If a certified operator fails a required portion of a recertification examination or shows serious deficiencies which indicate he may operate in an unsafe manner, then he is to be removed from activities requiring certification until retraining and reexamination are satisfactorily completed. In addition the recertification of previously certified operators and supervisors shall be based on:

- 1 Operating records and experiences during the past certification period.

- 2 Successful completion of appropriate portions of the retraining and retesting program.
 - 3 A review made either by senior line management by a committee, or by an individual designated by management. Reactor operators and supervisors may not be certified by their immediate supervisors.
 - 4 If an operator or supervisor has been away from reactor operations for a significant period, but less than 12 months, selected retraining including oral, written, and operative examinations shall be given as deemed necessary. However, if the absence is greater than 12 months, comprehensive written, oral, and operating examinations (as required of initial qualifying candidates) shall be given to determine weak areas. Retraining and retesting shall be required in areas of weakness.
 - 5 A health examination shall be administered biennially, or more frequently if circumstances warrant, to assure continued physical stamina, coordination, and manual dexterity, required to perform his or her assigned job tasks. Naval personnel at Naval Reactors prototypes receive medical examinations as required by Department of Navy standards.
- (h) Documentation. The qualification of personnel shall be documented in a form amenable to audit. The documentation shall include:
- 1 Education, experience, employment history, and health evaluation.
 - 2 Training programs completed.
 - 3 Records of initial and most recent written examinations consisting of the candidate's answers and examiner's evaluation.
 - 4 Records of initial and most recent oral and operational demonstration examinations, including:
 - a Either a listing of the basic questions asked and tasks performed, or a general summary of each area covered.
 - b An evaluation of the operator's or supervisor's response.
 - c A general summary of oral examination by the examiner including an evaluation of the knowledge, ability, and performance of the operator or supervisor.

- 5 Records of initial certification and the most recent recertification, with dates and approval signatures.
- (i) Maintenance Personnel. The training requirements for maintenance personnel shall be determined by the class of maintenance which the personnel are to perform, the degree of supervision required, and the required knowledge of the reactor.
- 1 All maintenance operations shall be performed by personnel who are properly trained in their respective discipline or under direct supervision of trained personnel.
 - 2 A written policy shall be established that describes functions, assignments, and responsibilities of the maintenance organization as it relates to reactor safety.
 - 3 The successful completion of the training and qualification effort shall be documented.
- (j) Fuel Handling Operations. All fuel handling operations shall be performed by or under the direct supervision of an individual certified by management as qualified to perform the required functions. The requirements below are not necessary if fuel handling is performed by individuals qualified for such under regular reactor operator and supervisor training programs.
- 1 A specific qualification program shall be established for the fuel handling supervisor. Operators shall receive appropriate training for their assigned tasks.
 - 2 The initial qualification and recertification program for the supervisor shall consist of training, examination, certification, retraining, reexamination, and recertification. The training and testing may be limited to that needed for fuel handling safety, the impact of fuel handling on the safety of the reactor, and actions to be taken during abnormal and emergency conditions.
 - 3 Documentation requirements in subparagraph e(2)(h) above, shall be followed.
- f. Quality Assurance. Department-owned reactors shall adhere to the quality assurance requirements in DOE 5700.6A.
- g. Contractor Independent Review and Appraisal System. The field office shall require each contractor to establish and maintain an internal safety

review system for each phase of the reactor program life (e.g., design, construction, testing, operation) which:

- (1) Functions primarily in an advisory capacity to the line organization, reporting to a designated position at a level of management sufficiently high to take any necessary corrective action. (Safety is a line responsibility; neither review nor subsequent approval releases line management from its responsibility for safety of people and equipment.)
- (2) Is clearly defined and delineated in writing (e.g., purposes, objectives, functions, authority, responsibility, composition, quorum, meeting frequency, and reporting requirements.)
- (3) Can be audited by contractor management and by the Department. The performance of the system shall be recorded in sufficient detail to permit contractor management and the Department to evaluate its effectiveness. Actions taken on any recommendations resulting from reviews, audits, inspections, appraisals, and surveillance shall be included in these records.
- (4) Provides technical competence in the areas being reviewed. Each review, except subparagraph (9), below, shall be carried out by persons whose technical disciplines cover the range of technical fields encountered in performing a safety review. Safety considerations are to be treated in such breadth and depth as is necessary to identify the potential hazards and to evaluate the risks.
- (5) Provides for group discussions between reviewers on all but the more routine matters.
- (6) Provides an independent determination of whether a proposed activity involves an unreviewed safety question, violation of a Technical Specification, or any other matter for which approval is required.
- (7) Provides an appraisal of the overall operation of each facility at least annually. This appraisal shall be made by individuals the majority of whom are independent of the operation being appraised. It shall include, but not be limited to, applicable areas listed in subparagraph (8), below.
- (8) Provides for objective and independent review of:
 - (a) Proposed modifications to plant and equipment having safety significance and safety analysis thereof.
 - (b) Proposed experiments and irradiations having safety significance.

- (c) Procedures, i.e., administrative, operating (normal and abnormal), maintenance, repair, testing, quality assurance, and emergency and significant changes thereto.
 - (d) Organization and staffing.
 - (e) Safety evaluations and Technical Specifications, and changes thereto.
 - (f) Appropriate training programs, initial and subsequent qualification and certification requirements and procedures. Emphasis in the training program review shall include the involvement of all appropriate levels of management, including senior management, in assuring adequate coverage for: understanding of basic principles, mitigation of the severity of postulated reactor accidents, and understanding of plant-specific limitations; and in reviewing general exam approach, management, and update techniques.
 - (g) Occurrences, including violations of Technical Specifications.
 - (h) The condition of the physical plant.
 - (i) The accuracy and completeness of recordkeeping and documentation.
- (9) Is reviewed by contractor management for adequacy of performance at least every 3 years.
- h. Standards. Reactor operations shall be conducted in accordance with established standards, where applicable. Where established standards are determined to be inadequate or not available, suitable operating standards shall be developed, using contractor expertise as necessary, so that a defined and agreed upon basis for conducting and assessing operations is established and used. The Safety Analysis Report shall identify on a reactor specific basis the standards applied.
 - i. Standby and Decommissioning. Before placing a reactor in standby or decommissioning it (i.e., permanently shutting down the reactor and dismantling or entombing it), the activities shall be planned and documented. The field office manager shall approve all standby and decommissioning plans before implementation.
 - j. Reporting and Analysis of Occurrences. Policies and procedures for reporting and analysis of occurrences shall be in accordance with DOE 5484.1 and DOE 5484.2.
 - k. Emergency Planning. Emergency planning shall be in accordance with DOE 5500.2.

- l. Recordkeeping. Records shall be maintained in accordance with the requirements of DOE 1324.2, RECORDS DISPOSITION.
 - m. Tenant-Landlord Safety Responsibilities. When reactor projects are located at sites which are under the direct control of a field office manager (landlord) other than the field office manager having contractual responsibility for the reactor project (tenant), the tenant shall be assigned a parcel of land (the reactor test area) within which he will confine his activities. Specific authorities, responsibilities, and limitations for the tenant and the landlord shall be described in a written agreement between the two field office managers for each test area that is established. This agreement shall conform to the following general provisions:
 - (1) The reactor test area shall be described in writing.
 - (2) The tenant shall assume responsibility for the health and safety of persons and property within the reactor test area and for keeping the landlord informed regarding the nature of activities undertaken and the condition of the reactors, including any reportable occurrences.
 - (3) The landlord shall have full responsibility for all safety matters except those within the confines of a reactor test area being operated by the tenant.
 - (4) The landlord shall have the right to take whatever action may be appropriate, including curtailment of operations within a reactor test area, when in his opinion such operation may jeopardize the health and safety of persons or property beyond the limits of the reactor test area.
 - (5) The landlord may accept responsibility for certain safety aspects within the tenants' reactor test area, particularly when those activities utilize landlord personnel or landlord contractor personnel and equipment.
7. ORGANIZATIONS HAVING RESPONSIBILITY FOR DEPARTMENT OF ENERGY OWNED REACTORS. Assignments of responsibility for each Department-owned reactor are listed in Attachment VI-1. To facilitate the updating of this information, the Headquarters organization which has the program responsibility for a reactor shall notify EP-30 when additions or changes are made in the responsibility for a reactor or its designation.

ORGANIZATIONS RESPONSIBLE
FOR DEPARTMENT OF ENERGY
OWNED REACTORS

The table provided on the following pages lists all Department of Energy owned reactors. The key to the abbreviations used in the tables and those reactors designated as Category A reactors is provided below.

1. FIELD ORGANIZATIONS AND OPERATING CONTRACTORS.

AL - Albuquerque Operations Office
ANL - Argonne National Laboratory
BNL - Brookhaven National Laboratory
BNW - Battelle Northwest Laboratory
CH - Chicago Operations Office
CRBRP-PO - Clinch River Breeder Reactor Plant - Project Office
Du Pont - E. I. Du Pont de Nemours and Company
Duquesne - Duquesne Light Company
EG&G - EG&G Idaho, Inc.
GE - General Electric Company
HEDL - Hanford Engineering Development Laboratory
ID - Idaho Operations Office
LASL - University of California, Los Alamos National Laboratory
LLL - University of California, Lawrence Livermore Laboratory
OR - Oak Ridge Operations Office
ORNL - Oak Ridge National Laboratory
PRNC - Puerto Rico Nuclear Center
RI - Rockwell International
RL - Richland Operations Office
SAN - San Francisco Operations Office
Sandia - Sandia Laboratories
SR - Savannah River Operations Office
UNI - United Nuclear Industries
WEST - Westinghouse Electric Corporation

2. HEADQUARTERS ORGANIZATIONS.

DP-1 - Defense Programs
EP-14 - Environmental Safety Engineering Division
ER-10 - Office of Basic Energy Sciences
ER-30 - Office of Health and Environmental Research
NE-40 - Office of Naval Reactors
NE-530 - Office of Reactor Research and Technology

3. DESIGNATED CATEGORY A REACTORS. Department-owned reactors designated as Category A reactors are as listed below. Designation as a Category A reactor is generally based on power level (e.g., 20 MW steady state), potential fission product inventory, and experimental capability. All other DOE-owned reactors (not including Naval Reactors) are designated Category B.

ATR - Advanced Test Reactor
C - C Production Reactor
EBR-II - Experimental Breeder Reactor II
ETR - Engineering Test Reactor
FFTF - Fast Flux Test Facility
HFBR - High Flux Beam Reactor
HFIR - High Flux Isotope Reactor
K - K Production Reactor
LOFT - Loss of Fluid Test
N - N Production Reactor
ORR - Oak Ridge Research Reactor
P - P Production Reactor
PBF - Power Burst Facility

REACTORS

Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status
Annular Core	ACRR	AL	DP-1	Sandia	Operable
Kinetic Intense Neutron Generator Critical Assembly	KINGLET	AL	DP-1	LASL	In Standby
Pajarito: Los Alamos Critical Assembly Facility	Big Ten	AL	DP-1	LASL	Operable
	Coment	AL	DP-1	LASL	Operable
	Flattop	AL	DP-1	LASL	Operable
	Godiva IV	AL	DP-1	LASL	Operable
	Honeycomb	AL	DP-1	LASL	Operable
	Jezebel	AL	DP-1	LASL	Operable
	Parka	AL	DP-1	LASL	Operable
	Mars (Plasma Core Assembly)	AL	DP-1	LASL	Operable
	Skua	AL	DP-1	LASL	Operable
	Venus	AL	DP-1	LASL	Operable
Omega West Reactor	OWR	AL	DP-1	LASL	Operable
	SUPO	AL	DP-1	LASL	Shutdown (No fuel)

REACTORS					
Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status
Rocky Flats Nuclear Safety Facility (Critical Facility)	RFP-NSF: Horizontal Split Table	AL	DP-1	RI	Operable
	RFP-NSF: Vertical Split: Table	AL	DP-1	RI	Operable
	RFP-NSF: Solution System	AL	DP-1	RI	Operable
	RFT-NSF: Tank Reservoir	AL	DP-1	RI	Operable
Sandia Pulsed Reactor II	SPR II	AL	DP-1	SANDIA	Operable
Sandia Pulsed Reactor III	SPR III	AL	DP-1	SANDIA	Operable
Argonne Fast Source Reactor	AFSR	CH	NE-530	ANL	Operable
Argonne Thermal Source Reactor	ATSR	CH	NE-530	ANL	Operable
Biological Research Reactor	JANUS	CH	ER-1	ANL	Operable
Chicago Pile No. 5	CP-5	CH	ER-10	ANL	Shutdown

REACTORS						
Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status	
Experimental Breeder Reactor II	EBR II	CH	NE-530	ANL	Operable	
Transient Reactor Test	TREAT	CH	NE-530	ANL	Operable	
Neutron Radioograph Facility	NRAD	CH	NE-530	ANL	Operable	
Zero Power Reactor-6	ZPR-6	CH	NE-530	ANL	Operable	
Zero Power Reactor-9	ZPR-9	CH	NE-530	ANL	Operable	
Zero Power Plutonium Reactor	ZPPR	CH	NE-530	ANL	Operable	
Brookhaven Medical Research Reactor	BMRRIII	CH	ER-30	BNL	Operable	
High Flux Beam Reactor	HFBR	CH	ER-10	BNL	Operable	
Clinch River Breeder Reactor Plant	CRBRP	CRBRP-PO	NE-530	PMC	Operable	
Advanced Reactivity Measurement Facility (Critical Facility)	ARMF I	ID	NE-530	EG&G	Operable	

REACTORS

Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status
Advanced Test Reactor	ATR	ID	NE-530	EG&G	Operable
Advanced Test Reactor Critical Facility	ATRC	ID	NE-530	EG&G	Operable
Coupled Fast Reactor Measurement Facility (Critical Facility)	CFRMF	ID	NE-530	EG&G	Operable
Engineering Test Reactor	ETR	ID	NE-530	EG&G	Operable
Engineering Test Reactor Critical Facility	ETRC	ID	NE-530	EG&G	Operable
Loss of Fluid Test	LOFT	ID	EP-14	EG&G	Operable
Power Burst Facility	PBF	ID	EP-14	EG&G	Operable
Critical Facilities (1 cell)	BETTIS	NE-40	NE-40	WEST	In Standby
Critical Facilities (1 cell)	BETTIS	NE-40	NE-40	WEST	Operable

REACTORS					
Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status
Critical Facilities (1 cell)	KAPL	NE-40	NE-40	GE	Operable
Critical Facilities (2 cells)	KAPL	NE-40	NE-40	GE	In Standby
Destroyer Reactor Prototype	DIG	NE-40	NE-40	GE	Operable
Large Ship Reactor Prototype (2 reactors)	AIW	NE-40	NE-40	WEST	Operable
Modifications and Additions to Reactor Facilities	MARF	NE-40	NE-40	GE	Operable
Natural Circulation West Plant	S5G	NE-40	NE-40	WEST	Operable
S1W Facility	S1W	NE-40	NE-40	WEST	Operable
Shippingport Atomic Power Station	SHIPPINGPORT	NE-40	NE-40	Duquesne	Operable
Small Submarine Reactor Prototype	S1C	NE-40	NE-40	GE	Operable

REACTORS

Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status
Submarine Advanced Reactor Prototype	S3G	NE-40	NE-40	GE	Operable
Thermal Reactor No. 1	TTR-1	NE-40	NE-40	GE	Operable
Trident Reactor Prototype	S8G	NE-40	NE-40	GE	Operable
Bulk Shielding Reactor	BSR	OR	ER-10	ORNL	Operable
High Flux Isotope Reactor	HFIR	OR	ER-10	ORNL	Operable
Health Physics Research Reactor	HPRR	OR	ER-30	ORNL	Operable
Oak Ridge Critical Experiments Facility	OR-CEF: Cell "W"	OR	ER-10	ORNL	Operable
Oak Ridge Research Reactor	ORR	OR	ER-10	ORNL	Operable
Pool Critical Assembly	PCA	OR	ER-10	ORNL	Operable
Tower Shielding Reactor II	TSR-II	OR	NE-530	ORNL	Operable

REACTORS						
Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status	
Puerto Rico Nuclear Center pe L-77	PRNC-L-77	OR	ER-30	PRNC	Shutdown	
B Production Reactor	B	RL	DP-1	UNI	Shutdown	
C Production Reactor	C	RL	DP-1	UNI	Shutdown	
Fast Flux Test Facility	FFTF	FFTFPO	NE-530	HEDL	Under Construction	
Neutron Radiography Facility	NRF	FFTFPO	NE-530	HEDL	Operable	
K East Production Reactor	KE	RL	DP-1	UNI	In Standby	
K West Production Reactor	KW	RL	DP-1	UNI	In Standby	
N Production Reactor	N	RL	DP-1	UNI	Operable	

REACTORS

Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status
Pacific Northwest Lab - Critical Mass Lab	PNL-CML: Split Table	RL	NE-530	BNW	Operable
	PNL-CML: Plutonium Solution System	RL	NE-530	BNW	Operable
Pacific Northwest Lab Plutonium Recycle Critical Facility	PNL-PRCF	RL	NE-530	BNW	Shutdown
Livermore Pool Type Reactor	LPTR	SAN	DP-1	LLL	Shutdown
Nuclear Effects Reactor	SUPER KUKLA	SAN	DP-1	LLL	In Standby
C Production Reactor	C	SR	DP-1	Du Pont	Operable
K Production Reactor	K	SR	DP-1	Du Pont	Operable
L Production Reactor	L	SR	DP-1	Du Pont	In Standby
Nuclear Test Gauge (Subcritical Facility)	NTG	SR	DP-1	Du Pont	Operable
P Production Reactor	P	SR	DP-1	Du Pont	Operable
Process Development Pile	PDP	SR	DP-1	Du Pont	In Standby

REACTORS

Name	Designation	Responsible Field Organization	Headquarters Program Responsibility	Operating Contractor	Current Status
R Production Reactor	R	SR	DP-1	Du Pont	In Standby
Resonance Test Reactor	RTR	SR	DP-1	Du Pont	In Standby
Subcritical Experiment	SE	SR	DP-1	Du Pont	In Standby
Standard Pile	SP	SR	DP-1	Du Pont	In Standby
Savannah River Test Pile 305	SP	SR	DP-1	Du Pont	Operable