

**Radiological Assessor Training
DOE-HDBK-1141-2001**

Overheads



**Office of Environment, Safety & Health
U.S. Department of Energy**

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Regulatory Documents

Objectives:

- Identify the hierarchy of regulatory documents.
- Define the purpose of 10 CFR Part 835.
- Define the purpose of the DOE Radiological Control Standard.

Regulatory Documents (cont.)

Objectives:

- **Define the terms "shall" and "should" as used in the above documents.**
- **Describe the role of the Defense Nuclear Facilities Safety Board (DNFSB) at DOE sites and facilities.**

DOE Radiological Health and Safety Policy

- **Establish and maintain a system of regulatory policy and guidance.**
- **Ensure appropriate training and the technical competence of the DOE workforce.**
- **Establish and maintain line management involvement and accountability.**

DOE Radiological Health and Safety Policy (cont.)

- **Ensure accurate and appropriately made measurements.**
- **Conduct radiological operations that control the spread of radioactive materials and are ALARA.**
- **Incorporate measures to minimize contamination.**
- **Conduct oversight to ensure compliance.**

Written Standards

- 10 CFR Part 835
- *DOE Radiological Control Standard*

Hierarchy of Requirements

Two parallel hierarchies:

- Rules and/or regulations
- *DOE Orders*

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Rules and Regulations

- Price-Anderson Amendments Act (PAAA) of 1988
- 10 CFR Part 820 of 1993:
 - Civil penalties
 - Criminal penalties
- DOE Nuclear Safety Requirements

10 CFR Part 835

- **Purpose: Codification of radiation protection requirements**
- **Prescriptive language**
- **Emphasis on ALARA**
- **Radiation Protection Program requirements**
- **Federal law**
- **Criminal and civil penalties for violations**

Radiation Protection Program

- **Required by 10 CFR Part 835**
- **Noncompliance may lead to PAAA enforcement**

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Guidance Documents (10 CFR Part 835)

Two types:

- **Implementation guides**
- **Technical positions**

10 CFR 835 vs. 10 CFR 20

10 CFR Part 835: 10 CFR Part 20:

- DOE sites and facilities
- Unique activities
- NRC

DOE Radiological Control Standard

- Originally promulgated as the Radiological Control Manual with DOE Notice 5480.6 (July 1992)
- Purpose: provides guidance for comprehensive radiological control program - not a regulation
- Notice which made the Radiological Control Manual a requirement was cancelled by N441.1 (Sept 1995):
 - May still be be contractual requirement
 - Updated on July 1999 by DOE STD-1098-99 Radiological Control

10 CFR 835 vs. DOE Radiological Control Standard

10 CFR Part 835:

- **EH-10 enforces**
- **“Shall” statements (mandatory requirements)**
- **Program Offices audit**

DOE Radiological Control Standard:

- **Program Offices audit contractual agreements**
- **Mostly “should” statements (recognizes site- or facility-specific attributes)**

Conflicts

**10 CFR 835 requirements take precedence over
DOE Radiological Control Standard**

**Unlikely the two will conflict, one may have a
requirement that is not in other**

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DOE Standards

- **Some DOE Standards are requirements for certain sites: for example, DOELAP**
- **Others provide guidance**
- **As part of assessment, need to review site requirements documents**

Defense Nuclear Facilities Safety Board

- **Five-member board:**
 - **Reviews and evaluates standards**
 - **Investigates any event or practice at DOE nuclear facilities that the Board determines has (or may) adversely affect public health and safety**
 - **May establish reporting requirements for the Secretary of Energy**

DNFSB Recommendations

- 91-6:**
 - **Radiological protection performance**
- 92-7:**
 - **Enhance radiological qualification**
- 98-1:**
 - **Resolution of audit findings**
- 99-1:**
 - **Safe storage of fissionable material**

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10 CFR Part 835, Background and Focus

Objectives:

- Describe the contents of 10 CFR Part 835.
- Identify the site requirements of 10 CFR Part 835.

10 CFR Part 835

- A — General Provisions**
- B — Management and Administrative Requirements**
- C — Standards for Internal and External Exposure**
- D — Reserved**
- E — Monitoring of Individuals and Areas**
- F — Entry Control Program**
- G — Posting and Labeling**

10 CFR Part 835 (cont.)

- H — Records**
- I — Reports to Individuals**
- J — Radiation Safety Training**
- K — Design and Control**
- L — Radioactive Contamination Control**
- M — Sealed Radioactive Source Control**
- N — Emergency Exposure Situations**

Exclusions from 10 CFR Part 835

- **Activities regulated by the NRC**
- **Activities under authority of the Director, Naval Nuclear Propulsion Program**
- **Specified activities conducted under the Nuclear Explosives and Weapons Surety Program**
- **Radioactive material transportation**
- **DOE activities in certain foreign countries**
- **Background radiation**

Exclusions from 10 CFR Part 835 (Cont.)

Occupational doses received as a result of excluded activities and radioactive material transportation, as listed above, shall be considered when determining compliance with the occupational dose limits (835.202 and 835.207), and with the limits for the embryo/fetus (835.206).

Included in the RPP

- **Formal plans and measures for applying ALARA to occupational exposures**
- **Existing and anticipated operational tasks**
- **Each requirement in Part 835**
- **Plans, schedules, and other compliance measures**

Standards for Internal and External Exposure

Addresses limits for:

- **General employees (occupational)**
- **Embryos/fetus**
- **Occupationally exposed minors**
- **Members of public in controlled area**
- **Planned special exposures**
- **Nonuniform exposures of the skin**
- **Concentrations of radioactive material in air**

Summary of Dose Limits

Exposed Individual	Annual Limit
General Employee: Whole Body (internal and external)	5.0 rem
“ “ Lens of Eye	15.0 rem
“ “ Extremity (below elbow and knees) and skin	50.0 rem

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Summary of Dose Limits

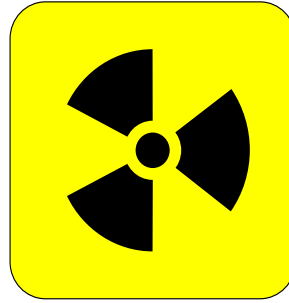
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Exposed Individual	Annual Limit
General Employee: Any Organ or Tissue (other than lens of eye)	50.0 rem
Declared Pregnant Worker: Embryo/Fetus (gestation period)	0.5 rem
Occupationally exposed minors: (also have limit of 10% of other General Employee limits)	0.1 rem
Members of the Public in Controlled Areas:	0.1 rem

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Planned Special Exposures

- Advance approval of DOE
- Informed employee consent



DACs

DACs are listed in appendices A and C of 10 CFR 835.

For intakes, they are the airborne concentration that equals the annual limit on intake (ALI) divided by the volume of air breathed by an average worker for a working year of 2000 hours (assuming a breathing volume of 2400 m³).

Monitoring of Individuals and Areas

- **Demonstrate compliance with Part 835**
- **Document radiological conditions**
- **Detect changes in conditions**
- **Detect the gradual buildup of radioactive material**
- **Verify effectiveness of engineering and process controls**
- **Identify and control potential radiation sources and/or radioactive material**

Instrumentation

- **Periodically maintained and calibrated**
- **Reviewed for appropriateness:**
 - **Types, levels, and energies of radiation**
 - **Environmental conditions**
- **Routinely tested for operability**

Individual Monitoring – External

Dosimetry provided to and used by:

- **Radiological Workers**
- **Declared Pregnant Workers**
- **Occupationally exposed minors and members of the public in controlled area**
- **Persons entering High or Very High Radiation Areas**

Individual Monitoring – Internal

Conducted for:

- **Radiological Workers**
- **Declared Pregnant Workers**
- **Occupationally exposed minors and members of the public in a controlled area**

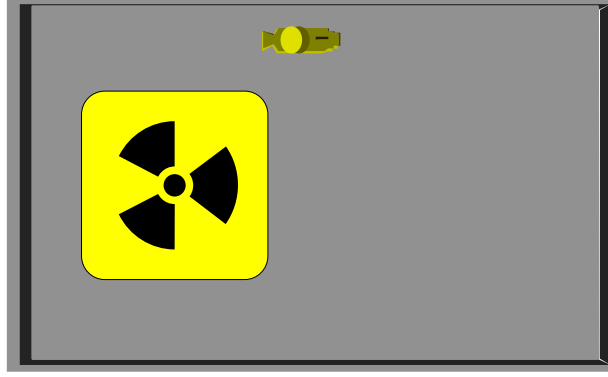
Receipt of Packages of Packages Containing Radioactive Material

Applicable to certain types of packages:

- **Requires monitoring**
- **Specifies time limit for monitoring; within 8 hours after start of next working day**

Entry Control Program

- Radiological Areas
- High Radiation Areas
- Very High Radiation Areas



Methods to Ensure Control

- Signs and barricades
- Control devices on entrances
- Alarms
- Locked entrances
- Administrative controls

Radiological Area Egress

- No control(s) shall be installed at any radiological area exit that would prevent rapid evacuation of personnel under emergency conditions.**

High Radiation Areas

- Where an individual could exceed a deep dose equivalent of 0.1 rem in one hour, measured 30 cm from the source or from any surface that the radiation penetrates
- If individual could receive a dose > 1.0 rem in an hour require one or more of the following:
 - Control devices
 - Alarms
 - Surveillance to prevent entry
 - Locks

Very High Radiation Areas

- Dose in excess of 500 rad in one hour at 1 meter from source or from any surface that the radiation penetrates

Very High Radiation Areas (Cont.)

- In addition to the requirements for a High Radiation Area, additional measures shall be implemented to ensure individuals are not able to gain unauthorized access to Very High Radiation Areas.**
- “No control(s) shall be established in a High or Very High Radiation Area that would prevent rapid evacuation of personnel.”**

Signs

- **Yellow background**
- **Black or magenta radiation symbol**
- **Clear and conspicuous signs**

Records Requirements Include:

- **Demonstrate compliance with 10 CFR 835**
- **Individual monitoring**
- **Sealed source inventory and control**
- **Results of surveys:**
 - **Release of material and equipment**
 - **Radiation and radioactive material in the workplace**
- **Maintenance and calibration of instruments**
- **Internal audits**
- **Radiation safety training**

Reports to Individuals Include:

- **Annual report of dose**
- **Employment termination record of exposure**

Radiation Safety Training

- **Based on:**
 - Area access
 - Receiving occupational dose
 - Assignment as Radiological Worker
- **Requirements:**
 - Examination for certain level (e.g., Radiological Worker Training)
 - Training intervals of twenty four months or less
 - Specifies topics
 - Provision for allowing use of escorts

Design and Control

- Facility design and modifications:
 - Optimization methods shall be used
 - Maintain dose rates below 0.5 mrem/hour
 - Avoid release of airborne radioactivity
 - Facilitate operation, maintenance, decontamination, and decommissioning

Workplace Controls

- **Physical design features and administrative controls shall provide:**
 - **Occupational dose to general employees not exceed the limits**
 - **ALARA process is utilized**

Radioactive Contamination Control

- **To controlled areas (Part 835)**
- **To uncontrolled areas (DOE O 5400.5)**
- **Monitor contamination level**
- **Provisions to release to controlled area items with fixed contamination**
- **Requires personnel monitoring**
- **Requires protective clothing**

Sealed Radioactive Source Control

- Sealed radioactive sources shall be used, handled and stored in a manner commensurate with the hazard.

Emergency Exposure Situations

Addresses:

- **Employees who have exceeded dose limits as a result of an authorized emergency exposure**
- **Nuclear accident dosimetry**

Nuclear Accident Dosimetry

- **Required for installations possessing potential critical mass**
- **Method to conduct initial screening**
- **Method and equipment to analyze biological materials**
- **A system of fixed nuclear accident dosimeters**
- **Personal nuclear accident dosimeters**

Overview of the DOE Radiological Control Standard

Objectives:

- **Describe the managerial responsibilities in the DOE Radiological Control Standard.**
- **Describe the contents of the DOE Radiological Control Standard.**

Excellence in Radiological Control (Chapter 1)

- *DOE Radiological Control Standard*
- **Leadership in Radiological Control**
- **Improving Radiological Control Performance**
- **Contractor Radiological Control Organization**
- **DOE Management**

Leadership in Radiological Control

- **Commitment of senior management**
- **ALARA accountability**
- **Conduct of radiological operations**

Improving Radiological Performance

- Critiques used as a management tool
- Root cause identification
- Over 20 radiological performance indicators:
 - Tools to focus priorities on radiological control performance

Contractor Radiological Control Organization

- **Requirements for the contractor**
- **Qualifications of the Radiological Control
Manager**

Radiological Standards (Chapter 2)

- **Administrative Control Levels and Dose Limits**
- **Contamination Control and Control Levels**
- **Posting**

Conduct of Radiological Work (Chapter 3)

- **Planning Radiological Work**
- **Work Preparation**
- **Entry and Exit Requirements**
- **Radiological Work Controls**

Conduct of Radiological Work (Chapter 3) (cont.)

- **Evaluation of Performance**
- **Special Applications**
- **Radiological Design Criteria**
 - **Design of New Facilities**
 - **Modification of Existing Facilities**

Radioactive Materials (Chapter 4)

- **Identification, Storage, and Control**
- **Release and Transportation**
- **Source Controls**
- **Waste Management**
 - **Solids**
 - **Liquids**
- **Airborne Management**

Radiological Health Support Operations (Chapter 5)

- **External Dosimetry**
- **Internal Dosimetry**
- **Respiratory Protection Program**
- **Handling Radiologically Contaminated Personnel**
- **Radiological Monitoring and Surveys**
- **Instrumentation and Calibration**

Training and Qualification (Chapter 6)

- **General Employee Radiological Training**
- **Radiological Worker Training**
- **Radiological Control
Technician/Supervisor Qualification**
- **Other Radiological Training**
- **Training for Special Applications**

Radiological Records (Chapter 7)

Requirements for:

- **Employee Records**
- **Visitor records**
- **Radiological Control Procedures**
- **Radiological Surveys**
- **Instrumentation and Calibration Records**
- **Radiological Reporting**

Elements of a Radiological Control Program

Objectives:

- Identify factors that influence the scope and magnitude of a Radiological Control Program at any nuclear facility.
- Identify typical elements of a Radiological Control Program.

Radiological Control Program

- **Requirements**
- **Responsibilities**
- **Programs/procedures**
- **Assessments**

Radiological Controls Program Elements

- **Organization and administration**
- **Personnel training and qualifications**
- **Quality assurance**
- **ALARA**
- **Radiological work control**
- **Posting and labeling**

Radiological Control Program Elements (cont.)

- **Radioactive material control**
- **Radiation-generating devices**
- **Entry control**
- **Contamination control**
- **Instrumentation/alarms**
- **Monitoring**

Radiological Control Program Elements (cont.)

- **Dosimetry**
- **Respiratory protection**
- **Facility-specific features**
- **Radioactive waste management**
- **Emergency response**
- **Records**
- **Assessments/performance indicators**

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Technical Safety Requirements

Objectives:

- Describe the purpose of DOE Order 5480.22 and its relationship to 10 CFR 830.205.
- Describe the purpose of Technical Safety Requirements (TSRs) in regard to facility operations/activities.
- Identify the source(s) of information required to develop reasonable and appropriate TSRs.

Technical Safety Requirements (cont.)

Objectives:

- **Describe the responsibilities for the development and use of TSRs.**
- **List the criteria for identifying problems in meeting TSRs.**
- **List areas in TSRs which could be reviewed as part of a radiological assessment.**

Technical Safety Requirements

- **Definition**
- **TSRs consist of:**
 - **Safety limits**
 - **Operating limits**
 - **Surveillance requirements**
 - **Administrative controls**
 - **Use and application instructions**
 - **Bases for above items**

Basis

Summary statements of the reasons for the operating limits and associated surveillance requirements. It shows how the numerical value, condition, or the surveillance fulfills the purpose from the safety documentation.

TSRs

- **Contract between operating contractor and DOE management**
- **Minimize potential risk**
- **Controlled document**
- **Reduce likelihood and potential impact of events**

Facility-Specific Safety Analysis

Considers all credible accidents including:

- **Most significant possible releases**
- **Criticality scenarios**
- **Expected accidental releases during life of facility**

Accident Analysis

Provides:

- Values for defining operational limits
- Parameters and operating conditions that should be limited

Requirements Expected to Be Developed

- **Operating limits**
- **Technical and administrative conditions**
- **Availability of safety equipment and systems**
- **Critical functions of instrumentation and controls**

Analyses

- **In order to serve as the basis for the TSRs, studies must systematically evaluate:**
 - **All potential off-normal conditions that could occur during the life of the facility**
 - **What could be considered design basis accidents**

Responsibilities for TSRs

- Preparation → Contractor
- Review → DOE Field Office
- Approval → CSO

Violations of a TSR

Four circumstances:

- **Exceeding Safety Limit**
- **Failure to take necessary actions within time allotted**
- **Failure to perform surveillance within required time**
- **Failure to comply with Administrative Control requirement**

Reporting Requirements

- **Categorization**
- **Notification**
- **Follow-up notification**
- **Occurrence Report preparation**
- **Noncompliance Tracking System**

Area monitors

- **Criticality monitors**
- **Area Radiation Monitors**
- **Air Monitors (i.e., real time air monitors, fixed head air samplers)**

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