NOT MEASUREMENT SENSITIVE

DOE-HDBK-1130-2008
Appendix A
December 2008

DOE HANDBOOK

Radiological Worker Training

Radiological Control Training for Supervisors

U.S. Department of Energy
Washington, D.C. 20585

AREA TRNG

Foreword

This Handbook describes an implementation process for training as recommended in Implementation Guide G441.1-1C, Chapter 14, *Radiation Safety Training Guide,* and as outlined in DOE-STD-1098-99, *DOE Radiological Control* (the Radiological Control Standard - RCS). The Handbook is meant to assist those individuals within the Department of Energy, Managing and Operating contractors, and Managing and Integrating contractors identified as having responsibility for implementing training required by Title 10 Code of Federal Regulations Part 835 *Occupational Radiation Protection* (10 CFR 835) and training recommended by the RCS (Article 651). This training is intended for line managers who manage, supervise, or provide oversight of radiological workers and develop and implement measures necessary for ensuring compliance with 10 CFR 835. This training is not intended to be technical training for Radiological Control Supervisors (i.e. individuals responsible for supervising radiological control staff).

While this Handbook addresses many requirements of 10 CFR 835 and recommendations of the RCS, it must be supplemented with facility-specific information to achieve full compliance.

This Handbook contains recommended training materials consistent with other DOE radiological safety training materials. The training material consists of the following five parts:

Program Management Guide - This part contains detailed information on how to use the Handbook material.

Instructor's Guide - This part contains lesson plans for instructor use, including notation of key points for inclusion of facility-specific information and parenthetical recommendations for teaching points.

Overheads - This part contains overheads for instructor use corresponding to the Instructor's Guide.

Student's Guide - This part contains student handout material and also should be augmented by facility-specific information.

Handouts - This part contains several student handouts providing supporting information for various modules.

This training material is targeted for individuals with a basic knowledge of radiological control. At a minimum, trainees should have completed Radiological Worker II training.

This Handbook was produced in Microsoft Word. Overheads were produced in Powerpoint. Copies of this Handbook may be obtained from the DOE Radiation Safety Training Home Page Internet site (http://www.hss.energy.gov/HealthSafety/WSHP/radiation/RST/rstmater.htm) or the DOE Technical Standards Program Internet site (http://www.hss.energy.gov/NuclearSafety/techstds/standard/standard.html).

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DOE-HDBK-1130-2008

Program Management Guide

Office of Health, Safety and Security
U.S. Department of Energy

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Introduction

Purpose and Scope

This program management guide provides guidance for proper implementation of additional standardized training as outlined in the *DOE Radiological Control Standard (RCS).* The guide is meant to assist those individuals within the Department of Energy, Managing and Operating (M&O) contractors, and Managing and Integrating (M&I) contractors identified as having responsibility for implementing the additional standardized training recommended by the *RCS.* Facilities should determine the applicability of this material to support existing programs meant to comply with the training required by 10 CFR 835. Facilities are encouraged to revise these materials as appropriate.

Management Guide Content

The management guide is divided into the following sections:

- Introduction
- Instructional Materials Development
- Training Program Standards and Policies
- Course-Specific Information

Core Training Goal

The goal of the additional standardized training program is to provide a standardized, baseline knowledge for those individuals completing the core training. Standardization of the knowledge provides personnel with the information necessary to perform their assigned duties at a predetermined level of expertise. Implementing a standardized training program ensures consistent and appropriate training of personnel.

Organizational Relationships and Reporting Structure

The DOE Office of Worker Safety and Health Policy (HS-11) is responsible for approving and maintaining the additional standardized training materials.

The establishment of a comprehensive and effective contractor site radiological safety training program is the responsibility of line management and their subordinates. The training function can be performed by a separate training organization, but the responsibility for quality and effectiveness rests with the line management.

Target Audience

Course instructional materials were developed for specific employees who are responsible for knowing or using the knowledge or skills for each course. With this in mind, the participant should never ask the question, "Why do I need to learn this?" However, this question is often asked when the participant cannot apply the content of the program. It is the responsibility of management to select and send workers to training who need the content of the program. When workers can benefit from the course, they can be motivated to learn the content and apply it on their jobs. Care should be taken to read the course descriptions along with the information about who should attend. Participants and DOE facilities alike will not benefit from workers attending training programs unsuitable for their needs.

Prerequisites

A background and foundation of knowledge facilitates the trainee in learning new knowledge or skills. It is much easier to learn new material if it can be connected or associated to what was previously learned or experienced. Curriculum developers who have been involved in preparing instructional materials for the core training know this and have established what is referred to as "prerequisites" for each course.

Certain competencies or experiences of participants were also identified as necessary prior to participants attending a course. Without these competencies or experiences, the participants would be at a great disadvantage and could be easily discouraged and possibly fail the course. It is not fair to the other participants, the unprepared participant, and the instructor to have this misunderstanding.

Training Material

Training materials for this training program consist of a program management guide, an instructor's guide, and a student's guide. This material is designed to be supplemented with facility-specific information.

Supplemental material and training aids may be developed to address facility-specific radiological concerns and to suit individual training styles. References are cited in each lesson plan and may be used as a resource in preparing facility-specific information and training aids.

Each site is responsible for establishing a method to differentiate the facility-specific information from the standardized lesson plan material. When additional or facility-specific information is added to the text of the core lesson plan material, a method should be used to differentiate facility information from standardized material.

Exemptions

Qualified personnel can be exempted from training if they have satisfactorily completed training programs (i.e., facility, college or university, military, or vendor programs) comparable in instructional objectives, content, and performance criteria. Documentation of the applicable and exempted portions of training should be maintained.

Qualification of Instructors

The technical instructor plays a key role in the safe and efficient operation of DOE facilities. Workers must be well qualified and have a thorough understanding of the facility's operation, such as use and maintenance of radiation-producing devices. Workers must know how to correctly perform their duties and why they are doing them. They must know how their actions influence other workers' responsibilities. Because workers' actions are so critical to their own safety and the safety of others, their trainers must be of the highest caliber. The technical instructor must understand thoroughly all aspects of the subjects being taught and the relationship of the subject content to the total facility. Additionally, the instructor must have the skills and

knowledge to employ the instructional methods and techniques that will enhance learning and successful job performance. While the required technical and instructional qualifications are listed separately, it is the combination of these two factors that produces a qualified technical instructor.

The qualifications are based on the best industry practices that employ performance-based instruction and quality assurance. These qualifications are not intended to be restrictive, but to help ensure that workers receive the highest quality training possible. This is only possible when technical instructors possess the technical competence and instructional skills to perform assigned instructional duties in a manner that promotes safe and reliable DOE facility operations.

Technical Qualifications

Instructors must possess technical competence (theoretical and practical knowledge along with work experience) in the subject areas in which they conduct training. The foundation for determining the instructor's technical qualifications is based on two factors:

- the trainees being instructed and
- the subject being presented.

The following is an example of a target audience, subject to be taught, and instructor technical qualifications.

TARGET AUDIENCE	SUBJECT BEING TAUGHT	INSTRUCTOR QUALIFICATIONS
Individuals (supervisors) responsible for supervising radiological workers and developing and implementing measures necessary for ensuring compliance with 10 CFR 835 at a DOE site or facility.	Radiological Control Training for Supervisors.	Demonstrated knowledge and skills in radiation protection, above the level to be achieved by the trainees, as evidenced by previous training/education and through job performance.

Methods for verifying the appropriate level of technical competence may include review of prior training and education, observation, and evaluation of recent related job performance, and oral or written examination. Other factors that may be appropriate for consideration include DOE, NRC, or other government license or certification; vendor or facility certification; and most importantly, job experience. To maintain technical competence, a technical instructor should continue to perform satisfactorily on the job and participate in continuing technical training.

Instructional Capability and Qualifications

Qualifications of instructional capability should be based on demonstrated performance of the instructional tasks for the specific course requirements and the instructor's position. Successful completion of instructor training and education programs, as well as an evaluation of on-the-job performance, is necessary for verification of instructional capability. Instructional capability qualification should be granted as the successful completion of an approved professional development program for training instructors. The program should contain theory and practice of

instructional skills and techniques; adult learning; and planning, conducting, and evaluating classroom, simulator, laboratory, and on-the-job training activities.

Illustrated talks, demonstrations, discussions, role playing, case studies, coaching, and individual projects and presentations should be used as the principal instructional methods for presenting the instructional training program. Each instructional method should incorporate the applicable performance-based principles and practices. Every effort should be made to apply the content to actual on-the-job experience or to simulate the content in the classroom/ laboratory. The appropriate methodology required to present the instructional content will indicate a required level of instructional qualification and skill.

Current instructors' training, education, and job performance should be reviewed to determine their training needs for particular courses. Based on this review, management may provide exemptions based on demonstrated proficiency in performing technical instructor's tasks. Through training or experience, technical instructors should be able to*:

- Review instructional materials and modify to fully meet the needs of the training group.

- Arrange the training facility (classroom/laboratory or other instructional setting) to meet the requirements for the training sessions.

- Effectively communicate, verbally and non-verbally, lessons to enhance learning.

- Invoke student interaction through questions and student activity.

- Respond to students' questions.

- Provide positive feedback to students.

- Use appropriate instructional materials and visual aids to meet the lesson objectives.

- Administer performance and written tests.

- Ensure evaluation materials and class rosters are maintained and forwarded to the appropriate administrative personnel.

- Evaluate training program effectiveness.

- Modify training materials based on evaluation of training program.

*Stein, F. *Instructor Competencies: The Standards.* International Board of Standards for Training, Performance and Instruction; 1992.

Selection of Instructors

Selection of instructors should be based on the technical and instructional qualifications specified in the Course-Specific Information section of this guide. In addition to technical and instructional qualifications, oral and written communication skills and interpersonal skills should be included in the process of selecting and approving instructors.

Since selection of instructors is an important task, those who share in the responsibility for ensuring program effectiveness should:

- interview possible instructors to ensure they understand the importance of the roles and responsibilities of technical instructors and are willing to accept and fulfill their responsibilities in a professional manner.

- maintain records of previous training, education, and work experience.

Procedures for program evaluation will include documentation of providing qualified instructors for generic and facility-specific training programs.

Test Administration

A test bank of questions for each course that has an exam should be developed and content validated. As the test banks are used, statistical validation of the test bank should be performed to fully refine the questions and make the tests as effective as possible. The questions contained in the test bank are linked directly to the objectives for each course. In this way, trainee weaknesses can be readily identified and remedial procedures can be put into place. The test outcomes can also be used to document competence and the acquisition of knowledge.

The test banks should also be used by the instructors to identify possible weaknesses in the instruction. If numerous trainees fail to correctly answer a valid set of questions for an objective, the instruction for that objective needs to be reviewed for deficiencies.

Written examinations may be used to demonstrate satisfactory completion of theoretical classroom instruction. The following are some recommended minimal requirements for the test banks and tests:

- Tests are randomly generated from the test bank.

- Test items represent all objectives in the course.

- All test bank items are content-validated by a subject matter expert.

- Test banks are secured and not released either before or after the test is administered.

- Trainees should receive feedback on their test performance.

- For the first administrations of tests, a minimum of 80% should be required for a passing score. As statistical analyses of test results are performed, a more accurate percentage for a passing score should be identified.

Test administration is critical in accurately assessing the trainee's acquisition of knowledge being tested. Generally, the following rules should be followed:

- Tests should be announced at the beginning of the training sessions.

- Instructors should continuously monitor trainees during examinations.

- All tests and answers should be collected at the conclusion of each test.

- No notes can be made by trainees concerning the test items.

- No talking (aside from questions) should be allowed.

- Answers to questions during a test should be provided, but answers to test items should not be or alluded to or otherwise provided.

- Where possible, multiple versions of each test should be produced from the test bank for each test administration.

- After test completion, trainees may turn in their materials and leave the room while other trainees complete their tests.

- Trainee scores on the tests should be held as confidential.

Program Records and Administration

Training records and documentation shall meet the requirements of 10 CFR 835.704.

Training Program Development/Change Requests

All requests for program changes and revisions should be done in accordance with the DOE Technical Standards Program.

Audit (internal and external)

Internal verification of training effectiveness should be accomplished through senior instructor or supervisor observation of practical applications and discussions of course material. All results should be documented and maintained by the organization responsible for Radiological Control training.

The additional standardized training program materials and processes should be evaluated on a periodic basis by DOE-HQ. The evaluation should include a comparison of program elements with applicable industry standards and requirements.

Evaluating Training Program Effectiveness

Verification of the effectiveness of Radiological Control training should be accomplished per DOE-HDBK-1131-2007, "General Employee Radiological Training," and DOE-HDBK-1130-2008, "Radiological Worker Training." In addition, DOE has issued guidelines for evaluating the effectiveness of radiological training through the DOE Operations Offices and DOE Field Offices. For additional guidance, refer to DOE-STD-1070-94, "Guide for Evaluation of Nuclear Facility Training Programs."

Course-Specific Information

Purpose

This handbook describes a *Radiological Control Training for Supervisors* program. It includes standards and policies as well as recommendations for material development and program administration. It is intended for use by DOE and DOE contractors for the development of facility-specific radiological control training for supervisors.

Course Goal

The goal of the training program is to provide a basic understanding of the skills required to supervise radiological workers in a safe and effective manner. Upon completion, trainees will be

able to discuss DOE's radiation protection requirements and guidance and the manager's roles and responsibilities for implementing those requirements and guidance.

Target Audience

Radiological Control Training for Supervisors may be provided to individuals (supervisors) responsible for supervising radiological workers and developing and implementing measures necessary for ensuring compliance with 10 CFR 835 at a DOE site or facility.

Prerequisites

The material is targeted for individuals with a fundamental knowledge of radiation protection concepts, such as successful completion of Radiological Worker II Training.

Proficiency Requirements

An examination or performance demonstration is not required. Instructors are encouraged to evaluate the effectiveness of the training through use of classroom participation and/or a quiz at the end of the training.

Retraining

Sites are encouraged to develop periodic training and retraining for supervisors. Retraining should focus on lessons learned and site specific events as necessary.

Materials developed in support of training should be documented in accordance with 10 CFR 835 Subpart H "Records."

Instructor Qualifications

All classroom instruction should be provided by instructors qualified in accordance with the

contractor's site instructor qualification program. Training staff (contractor and subcontractor, if used) should possess both technical knowledge and experience, and the developmental and instructional skills required to fulfill their assigned duties.

1. Training staff responsible for program management, supervision, and development should have and maintain the education, experience, and technical qualifications required for their jobs.

2. Instructors should have the technical qualifications, including adequate theory, practical knowledge, and experience, for the subject matter that they are assigned to teach. It may be advisable to use more than one instructor for this material: an instructor with a technical radiological control background to cover modules one and two and an instructor with a management background (e.g., experience in teaching motivational techniques, communications, decision making, and leadership) to cover the remaining modules.

3. Methods should be in place at each contractor site to ensure that individual instructors meet and maintain position qualification requirements.

4. Subject matter experts without instructor qualification may provide training in their area of expertise. However, if these subject matter experts are to be permanent instructors, they should be trained as instructors in the next practical training cycle.

DOE Order 5480.20A, Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities, discusses qualification requirements for instructors.

DOE has also provided guidance on qualifications of radiological instructors in DOE STD-1107-97, Knowledge, Skills, and Abilities for Key Radiation Protection Positions at DOE Facilities.

Training Material Presentation

Training materials consist of lesson plans, overheads, student guides, and handouts. To ensure appropriate training, facility-specific materials must be added to the materials when necessary to adequately train individuals for facility-specific radiological hazards.

It is estimated that this material could be presented in 12 hours.

References and Supporting Documents

National Council on Radiation Protection and Measurement, Report Number 134, Operational Radiation Safety Training, October 2000.

U.S. Department of Energy, DOE Order 5480.20A, Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities, November 1994.

U.S. Department of Energy, DOE-STD-1070-94, Guidelines for Evaluation of Nuclear Facility Training Programs, June 1994.

U.S. Department of Energy, Occupational Radiation Protection, 10 CFR 835, June 2007.

U.S. Department of Energy, DOE-STD-1107-97, Ch 1. Knowledge, Skills, and Abilities for Key Radiation Protection Positions at DOE Facilities, 2007.

U.S. Department of Energy, Implementation Guidance for Use with 10 CFR 835, Occupational Radiation Protection. DOE G 441.1-1C, 2008.

U.S. Department of Energy, DOE-STD-1098-2008, Radiological Control, 2008.

U.S. Department of Energy, DOE-HDBK-1122-xx, Radiological Control Technician Training, (update 2008 or 2009).

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Instructor's Guide

Office of Health, Safety, and Security
U.S. Department of Energy

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DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: Occupational Radiation Protection Program Policy and Guidance Review

Objectives:

Upon completion of this training, the participant will be able to:

1. Identify the hierarchy of regulatory documents.
2. Define the purposes of 10 CFR Parts 820, 830 and 835.
3. Define the purpose of the DOE Radiological Control Standard.
4. Define the terms “shall” and “should” as used in the above documents.
5. Describe the role of the Defense Nuclear Facilities Safety Board (DNFSB) at DOE sites and facilities.

Training Aids:

Overhead Transparencies (OTs): OT 1.1 – OT 1.17 (may be supplemented or substituted with updated or site-specific information)

Equipment Needs:

Overhead projector

Screen

Flip chart

Markers

Masking tape

Student Materials:

Student’s Guide

References:

U.S. Department of Energy, 10 CFR Part 820, *Procedural Rules for DOE Nuclear Facilities*.

U.S. Department of Energy, 10 CFR Part 830, *Nuclear Safety Management*.

U.S. Department of Energy, 10 CFR Part 835, *Occupational Radiation Protection*.

U.S. Department of Energy, 10 CFR 850*, Chronic Beryllium Disease Prevention Program*.

U.S. Department of Energy, 10 CFR 851*, Worker Safety and Health Program*.

U.S. Department of Energy, *Radiological Control*, DOE-STD-1098-2008.

U.S. Department of Energy, *DOE Radiological Health and Safety Policy*, DOE P 441.1, April 26, 1996.

U.S. Department of Energy, DOE P 411.1, *Safety Management Functions, Responsibilities, and Authorities Policy,* 1997.

I. Introduction
(*Show OT 1.1 and OT 1.2. State objectives*)

II. DOE radiological health and safety (*Discuss that this is from DOE P 441.1*)

A. Policy (some key points in summary)

- Conduct oversight to ensure Departmental requirements are being complied with and appropriate radiological work practices are being implemented. (*Show OT 1.3*)

- Ensure radiological measurements, analyses, worker monitoring results, and estimates of public exposures are accurate and appropriately made. (*Show OT 1.4*)

- Incorporate dose reduction, contamination reduction, and waste minimization features into the design of new facilities and significant modifications to existing facilities in the earliest planning stages.

- Establish and maintain, from the lowest to the highest levels, line management involvement and accountability for Departmental radiological performance.

- Establish and maintain a system of regulatory policy and guidance.

- Ensure appropriate training is developed and delivered and the technical competence of the DOE workforce and their technical competence.

- Conduct radiological operations in a manner that controls the spread of radioactive materials and reduces exposure to the work force and the general public and utilizes a process that seeks exposure level as low as reasonably achievable (ALARA).

B. History (*Show OT 1.5*)

DOE has provided numerous written standards for on-site radiological protection, the most recent regulation being 10 CFR Part 835, *Occupational Radiation Protection*. This regulation was preceded by:

- DOE Notice 5480.6 of June 17, 1992, *Radiological Control*, which specified that the *DOE Radiological Control Manual* (DOE/EH-0256T) would supersede DOE Order 5480.11.

- DOE Order 5480.11, *Radiation Protection for Occupational Workers* (effective December, 1988). The purpose was to establish radiation protection standards and program requirements for DOE and DOE contractors for the protection of workers from ionizing radiation.

The establishment of DOE radiological protection standards did not start with these documents. A chronology of dose limits of DOE and its predecessor agencies, the Atomic Energy Commission (1946-1975) and the Energy Research and Development Administration (1975-1977), demonstrate a lowering of whole body dose limits over the last 50 years.

In the establishment of these dose limits, DOE has followed recommendations of national and international radiological protection groups, notably the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP).

C. Hierarchy of requirements (*Show OT 1.6*)

Currently within DOE there are two parallel hierarchies of requirements:

- Rules and/or regulations (these terms are used interchangeably in this training)

- DOE Orders

Rules are codified in the Code of Federal Regulations (CFR) and may be subject to enforcement action including civil and criminal penalties. (*Show OT 1.7*) DOE Orders are contractually implemented and enforced through an award/fee contractual arrangement between DOE and the contractor.

III. Rules and regulations

In response to the enforcement authority in the Price-Anderson Amendments Act (PAAA) of 1988, DOE is converting its contractual requirement in orders to enforceable rules to enhance contractor accountability for safety.

10 CFR 830 governs the conduct of DOE contractors, DOE personnel, and other persons conducting activities (including providing items and services) that affect, or may affect, the safety of DOE nuclear facilities. It includes quality assurance requirements and Technical Safety Requirements.

A. DOE enforcement of rules under PAAA

10 CFR Part 820 (effective on September 16, 1993) sets forth the procedures to implement the provisions of the PAAA. Part 820 requires contractors to comply with DOE Nuclear Safety Requirements.

PAAA demands a “large stick” to enhance contractor accountability for safety. Rules provide authority for the assessment of civil and criminal penalties and thus provide the large stick

B. Penalties under Part 820

1. Civil penalties

   DOE may assess civil penalties against any person subject to Part 820, for violations of:

   - Codified rules in the CFR
   - Compliance orders
   - Any program or plan required by a rule or compliance order

   Note: Certain nonprofit educational institutions and other listed institutions are exempt from assessment of civil penalties.

2. Criminal penalties

   If a person subject to the Atomic Energy Act of 1954, as amended, or Nuclear Safety Requirements, has by action or omission knowingly and willfully violated, caused to be violated, attempted to violate, or conspired to violate any section of the Atomic Energy Act of 1954, as amended, or applicable DOE Nuclear Safety Requirements, the person shall be subject to criminal sanctions.

3. The “carrot and stick” approach

   DOE may provide monetary incentives in its management and operating (M&O) contracts for actions consistent with or exceeding requirements, and to penalize actions and activities that were not in compliance with requirements.

Noncompliance with the Radiation Protection Program can subject a contractor to PAAA enforcement. There are provisions to mitigate penalties for self-identifying and reporting violations.

C. DOE Nuclear Safety Requirements

DOE Nuclear Safety Requirements are the set of enforceable rules, regulations, or orders relating to nuclear safety that have been adopted by DOE (or by another agency if DOE specifically identifies it).

Compliance orders are issued by the Secretary. They identify a situation that violates, potentially violates, or otherwise is inconsistent with the:

- Atomic Energy Act of 1954, as amended
- Nuclear statutes
- Nuclear Safety Requirements

Compliance orders:

- Mandate a remedy or other action
- States the reason for the remedy or other action

D. 10 CFR Part 835 (*Show OT 1.8*)

On December 14, 1993, DOE published a final rule in the *Federal Register* (58 FR 65458) Title 10 Code of Federal Regulations Part 835, *Occupational Radiation Protection* (10 CFR 835). On June 8, 2007, the latest amendment to 10 CFR 835 was published in the *Federal Register* (72 FR 31904).

The purpose of 10 CFR 835 is the codification of radiological protection requirements. It contains “shall” statements, which are legally binding. It also contains:

- Prescriptive language
- Added emphasis on ALARA
- Requirements for a Radiation Protection Program (RPP)
- Federal law
- Criminal and civil penalties for violations

E. Radiation Protection Program (10 CFR Part 835) (*Show OT 1.9*)

Each site, under Part 835, must submit to DOE a written Radiation Protection Program (RPP). The cognizant DOE program office reviews submitted RPPs for approval.

The RPP requires careful consideration because noncompliance may subject a contractor to PAAA enforcement

F. Guidance documents for 10 CFR Part 835 (*Show OT 1.10*)

Two types of regulatory guidance documents have been developed:

- Guidance for implementing the provisions of 10 CFR Part 835.
- Guidance providing technical positions.

The above are available through the DOE HS-11 website at:

http://www.hss.energy.gov/HealthSafety/WSHP/radiation/regs.htm

Unlike the requirements specifically set forth in 10 CFR Part 835, the provisions in guidance documents are not mandatory. They are intended solely to describe the rationale for, and the objectives of, regulatory requirements and/or to identify acceptable methods for implementing regulatory requirements.

Failure to follow a guidance document does not in itself indicate noncompliance with a specific requirement of the rule. A finding of noncompliance is found for a failure to satisfy the regulatory requirement.

Following a guidance document in the prescribed manner will ordinarily create a presumption of compliance with a related regulatory requirement.

1. Technical guidance

   Technical guidance describes and disseminates technical methods and techniques for fulfilling implementation and, in turn, the requirements in 10 CFR Part 835. Examples of these guidance documents are DOE Technical Standards and DOE Radiological Control Technical Positions (RCTPs).

2. Implementation guide (IG)

Implementation guidance is intended to identify and make available to DOE contractors basic program elements and acceptable methods for implementing specific provisions of the final rule. An implementation guide has been developed for 10 CFR Part 835.

G. Relationship between 10 CFR Part 835 and 10 CFR Part 20 (*Show OT 1.11*)

10 CFR Part 20 is the occupational radiological regulation issued by the Nuclear Regulatory Commission (NRC).

The question of consistency among federal agencies in their occupational radiological protection regulations became a major point of discussion during the rule making process.

While agreeing with the goal of consistency, DOE believes that it must promulgate its own regulations because of the unique nature and diversity of radiological activities within the DOE complex. The final rule allows DOE to establish more rigorous requirements in areas of particular concern. Overall 10 CFR Part 835 has many similarities as 10 CFR Part 20.

IV. DOE STD *Radiological Control* (*Show OT 1.12*)

A. *Radiological Control*

In January 1992, a memorandum was sent to the heads of DOE elements involved in managing radiological control programs. In the memorandum, the Secretary directed a series of initiatives to enhance the conduct of radiological operations within the Department of Energy. Also in this memo, the Assistant Secretary of Environment, Safety and Health was directed to develop a comprehensive and definitive radiological control manual. The *DOE Radiological Control Manual* was developed to meet that directive and was approved by the Secretary and promulgated with DOE Notice 5480.6, *Radiological Control*, in July 1992.

After the issuance of 10 CFR 835 as a final rule in December 1993, DOE Notice N441.1, *Radiological Protection for DOE Activities*, was issued on 9-30-95. This cancelled the notice which made the Radiological Control Manual a requirements document. However, the notice stated that "cancelled orders that are incorporated by reference in a contract shall remain in effect until the contract is modified to delete the reference.

N441.1 also retained some of the radiation protection requirements from the Radiological Control Manual that were not included in 10 CFR 835.

In July, 1999, the Radiological Control Manual was replaced by the standard, DOE-STD-1098-99, *Radiological Control*. Many DOE sites contractually must still adhere to the provisions of either the Radiological Control Manual or the Radiological Control Standard. Subsequent to the 1998 amendment to 10 CFR 835, the effective date of N441.1 has passed.

The DOE Radiological Control Standard is not regulatory in nature. It is a guidance document that describes DOE's policy and expectations for an excellent radiological control program**.**

1. Implementation

   If a site fully implements a provision of the DOE Radiological Control Standard, the user will have most likely complied with any related statutory, regulatory, or contractual requirements. Users are cautioned that they must review the source document (10 CFR 835) to ensure compliance.

2. Enforceability

   When incorporated into contracts, the provisions of the DOE Radiological Control Standard or Manual are binding requirements.

   If portions of the Site-Specific Radiological Control Manual are incorporated in the RPP under Part 835 and approved by DOE, they are also binding.

B. The Site-Specific Radiological Control Manual

- The DOE Radiological Control Standard states that a Site-Specific Radiological Control Manual should be written and followed.

C. Relationship between 10 CFR Part 835 and the DOE Radiological Control Standard (*Show OT 1.13*)

1. Compliance

   - The Office of Enforcement (HS - 40) will enforce 10 CFR Part 835. It can assess fines and penalties.

- The Program Offices will audit for both compliance with 10 CFR 835 and contractual agreements including the DOE Radiological Control Standard or Manual, Orders, etc. Results of these audits can affect the contractor's award fee.

2. What if there are conflicts? (*Show OT 1.14*)

10 CFR Part 835 takes precedence over the DOE Radiological Control Standard and DOE orders. It is unlikely that there will be a conflict between the two documents, although one document may contain provisions that are not addressed in the other.

It is planned that all requirements for nuclear safety will be incorporated into rules.

3. "Shall" and "should" statements

- 10 CFR Part 835 contains "shall" statements. "Shall" statements in Part 835 are legally binding.

  Processes for exemption relief from Part 835 are set forth in Subpart E to Part 820. If relief is requested from provisions of Part 835, the exemption must be considered and granted, if appropriate, by the Chief Health, Safety and Security Officer (HS - 1).

- The use of "should" in the DOE Radiological Control Standard recognizes that there may be site- or facility-specific attributes that warrant special treatment. It also recognizes that literal compliance with the elements and requirements of the provision may not achieve the desired level of radiological control performance.

D. DOE Standards (*Show OT 1.15*)

DOE has developed several technical standards for occupational radiation protection. Depending on the site-specific application, some standards are required to be followed. For example, sites which need to monitor individual external exposures to ionizing radiation need to follow the DOE Laboratory Accreditation Program (DOELAP) standards. Other standards may be incorporated by reference in the site RPP.

Other standards provide technical guidance on specific applications, but adherence to the standard may not be required.

E. Other Safety Policy and Orders

In addition to the occupational radiation protection requirements and recommendations previously discussed, DOE has established requirements for worker protection from other hazards. Some of these include:

- DOE P 411.1 Safety Management Functions, Responsibilities, and Authorities Policy
- 10 CFR 851 Worker Safety and Health Program
- 10 CFR 850 Chronic Beryllium Disease Prevention Program

V. Defense Nuclear Facilities Safety Board (*Show OT 1.16*)

A. Establishment

The Atomic Energy Act of 1954 was amended by adding Chapter 21, Defense Nuclear Facilities Safety Board (DNFSB). This amendment established an independent board in the executive branch to provide oversight of some DOE operations at DOE facilities and sites.

B. Members

The DNFSB consists of five members appointed by the President with consent of the Senate.

The Board shall:

- Review and evaluate standards
- Investigate any event or practice at a DOE defense nuclear facility that the Board determines has adversely affected or may adversely affect public health and safety.

The Board may:

- Establish reporting requirements for the Secretary of Energy

By evaluating how well DOE meets its objectives, the DNFSB helps DOE achieve and maintain excellence in radiological protection.

C. Secretary of Energy

The Secretary of Energy shall fully cooperate with the Board.

D. DNFSB Recommendations (*Show OT 1.17*)

DNFSB provides DOE with recommendations for improving safety at DOE defense nuclear facilities. Examples include:

DNFSB Recommendation 91-6 dealt with radiological protection concerns throughout the DOE defense nuclear facilities complex, and identified several actions to be taken by the Department to improve radiological protection performance.

DNFSB Recommendation 92-7 dealt with training and qualification at DOE sites and facilities.

DNFSB Recommendation 98-1 dealt with resolution of internal audit findings.

DNFSB Recommendation 99-1 dealt with safe storage of fissionable materials.

Implementation of DOE and site commitments made in response to DNFSB recommendations are areas to review during an assessment.

DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: 10 CFR Part 835, Background and Focus

Objectives:

Upon completion of this training, the participant will be able to:

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

Training Aids:

Overhead Transparencies (OTs): OT 2.1 – OT 2.32 (may be supplemented or substituted with updated or site-specific information)

Equipment Needs:

Overhead projector

Screen

Student Materials:

Student's Guide

10 CFR 835

References:

U.S. Department of Energy, 10 CFR Part 820*, Procedural Rules for DOE Nuclear Facilities*.

U.S. Department of Energy, 10 CFR Part 835, *Occupational Radiation Protection*.

U.S. Department of Energy, Order 5400.5, *Radiation Protection of the Public and the Environment,* 1990.

U.S. Department of Energy, DOE-STD-1107-97 *Knowledge, Skills, and Abilities for Key Radiation Protection Positions at DOE Facilities,* 1997.

U.S. Department of Energy, DOE G 441.1-1C, *10 CFR 835 Implementation Guide,* 2008.

U.S. Department of Energy, DOE O 231.1, Change 2, *Environment, Safety and Health Reporting,* 2000.

U.S. Department of Energy, DOE M 231.1-1, Change 2, *Environment, Safety and Health Reporting Manual*, 2000.

I. Introduction (*Introduce module. State objectives. Show OT 2.1.)*
(*Emphasize that this lesson is an overview of major areas of 10 CFR Part 835. Not every provision is addressed in this module 10 CFR 835 should be reviewed in its entirety to ensure compliance. Provide copies of 10 CFR 835 for reference*.)

This module provides an overview of many of the provisions of 10 CFR 835. For completeness, individuals should always reference back to 10 CFR 835 for the complete text.

II. Outline of 10 CFR Part 835 (*Show OT 2.2*)
(*Obj. 1 Describe the contents of 10 CFR Part 835*.)

Part 835 is the codification of radiological protection requirements. Part 835 contains 14 subparts and five appendices. The outline consists of the following subparts:

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
H — Records (*Show OT 2.3*)
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

Under 10 CFR Part 835, each site must submit a Radiation Protection Program (RPP).
(*Obj. 2 Identify the site requirements of 10 CFR Part 835*.)

Part 835 helps to ensure that DOE facilities are operated in a manner such that occupational radiological exposure of workers is maintained within acceptable limits and as low as is reasonably achievable (ALARA).

A. Subpart A - General Provisions (*Show OT 2.4*)

Subpart A contains the scope of the rule. The rule in this part establishes radiological protection standards, limits, and program requirements for

protecting individuals from ionizing radiation resulting from the conduct of DOE activities.

It also includes activities excluded from the provisions of the rule. (*Show OT 2.5*) Activities that are excluded include the following (summarized):

- Activities regulated through a license by the Nuclear Regulatory Commission (NRC) or a state under an agreement with the NRC.
- Activities conducted under the authority of the Director, Naval Nuclear Propulsion Program.
- Specified activities conducted under the Nuclear Explosives and Weapons Surety Program.
- DOE activities in other countries with acceptable radiation protection program.
- Background radiation.
- Radioactive material on or within material, equipment, and real property which is approved for release when the radiological conditions of the material, equipment, and real property have been documented to comply with the criteria for release set forth in a DOE authorized limit which has been approved by a Secretarial Officer in consultation with the Chief Health, Safety and Security Officer.
- Radioactive material transportation not performed by DOE or a DOE contractor.
  (*Discuss radioactive material transportation definition.*)

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).

Subpart A also addresses:

- Definitions
- Radiological units (Curie, rad, roentgen, rem, other conventional units, and multiples)

B. Subpart B - Management and Administrative Requirements (*Show OT 2.6*)

The RPP shall:

- Include formal plans and measures for applying the ALARA process to occupational exposures.

- Specify the existing and/or anticipated operational task.
- Address, but not be limited to, each requirement in Part 835.
- Include plans, schedules, and other measures for achieving compliance.

DOE may direct or make modifications to an RPP. An initial RPP or update shall be considered approved 180 days after its submission unless rejected by DOE at an earlier date.

Internal Audits (10 CFR 835.102)
(*Discuss again DOE's 10 CFR 835 Implementation Guide and its purpose*.)

Internal audits of the radiation protection program, including examination of program content and implementation, shall be conducted through a process that ensures that all functional elements are reviewed no less frequently than every 36 months. This training material and DOE G 441.1-1C provide guidance on DOE's expectations.

Education, Training and Skills (10 CFR 835.103)

Individuals responsible for developing and implementing measures necessary for ensuring compliance with the requirements of this part shall have the appropriate education, training, and skills to discharge these responsibilities. DOE STD-1107-97 *Knowledge, Skills, and Abilities for Key Radiation Protection Positions at DOE Facilities,* provides guidance on DOE's expectations*.*

Written Procedures (10 CFR 835.104)

Written procedures are required, as necessary, to ensure compliance with 835, commensurate with radiological hazards and education, training and skills of exposed individuals.

C. Subpart C - Standards for Internal and External Exposure (*Show OT 2.7*)

This subpart addresses limits for:

- General employees (occupational)
- Embryos/fetus of declared pregnant worker (i.e., A woman who has voluntarily declared to her employer, in writing, her pregnancy for the purpose of being subject to the occupational dose limits to the

embryo/fetus. This declaration may be revoked, in writing, at any time by the declared pregnant worker.)

- Occupationally exposed minors
- General public in a controlled area

It also addresses:

- Planned special exposures
- Nonuniform exposures of the skin
- Concentrations of radioactive material in air

1. Summary of dose limits (*Show OT 2.8*) (*Show OT 2.9*)

   10 CFR Part 835 employs the rem unit for several different physical quantities (i.e. absorbed dose, effective dose, total effective dose, equivalent dose, committed equivalent dose, committed effective dose). For information about these quantities refer to 10 CFR Part 835 definitions. This training will use the term "dose" as a general term for all the above terms.

   These are the Federal limits. DOE encourages sites to adopt more restrictive Administrative Control Levels (ACLs). For most facilities an ACL of 500 mrem or less will be challenging for radiological workers.

Exposed Individual		Annual Limit
General Employee:	Whole Body (internal and external)	5.0 rem
General Employee:	Lens of Eye	15.0 rem
General Employee:	Extremity (below elbow and knees) and skin	50.0 rem
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 (under age 18):		0.1 rem *
Members of the Public in Controlled Areas:		0.1 rem

- And 10% of other general employee limit

2. Planned special exposures (PSEs) (*Show OT 2.10*)

It is acknowledged that unusual conditions can arise in which well documented higher-than-normal doses can be justified. In these well-planned, well-controlled, and highly infrequent and unusual conditions operating management would be permitted to allow specified individual exposures exceeding the occupational limit.

The term "unusual conditions" is made clear by specifying that alternatives which would preclude exposures higher than the prescribed dose limits must be either unavailable or impractical.

10 CFR 835.204 specifies requirements for annual and lifetime dose from PSEs. It also specifies requirements for determining previous individual exposures prior to allowing a PSE.

Every PSE must be approved in advance by DOE and requires the informed consent of the employee involved.

3. Concentration of radioactive material in air (*Show OT 2.11*)
   (*Define DAC in terms of equivalent dose*.)

   Appendices A and C contain the derived air concentration (DAC) values used in the control of occupational exposure to airborne radioactive material.

   DACs are listed in appendices A and C of 10 CFR 835. For intakes (appendix A), 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 m^3).

   The ALI is the smaller value of intake of a given radionuclide in a year by a standardized man that would result in a committed effective doe of 5 rems or a committed equivalent dose of 50 rems to any individual organ or tissue.

   Appendix C contains DACs for controlling external dose from being immersed in a cloud of airborne radioactive material.

   Estimation of internal dose shall be based on bioassay data rather than air concentration values unless bioassay data are:

   - Unavailable (e.g., radon or very short lived radioisotopes)

- Less accurate than internal dose estimates based on representative air concentration values
- Inadequate

D. Subpart D - Reserved

E. Subpart E - Monitoring of Individuals and Areas (*Show OT 2.12*)

This subpart addresses:

- General requirements
- Instrumentation
- Individual monitoring - external
- Individual monitoring - internal
- Air monitoring
- Receipt of packages containing radioactive material

1. General requirements (10 CFR 835.401)

   Monitoring of individuals and areas shall be performed to:

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

2. Instrumentation (*Show OT 2.13*)

Instruments and equipment used for monitoring and contamination control shall be:

- Periodically maintained and calibrated on an established frequency.
- Appropriate for the type(s), levels, and energies of the radiation(s) encountered.
- Appropriate for existing environmental conditions.
- Routinely tested for operability.

3. Individual monitoring - external (10 CFR 835.402) (*Show OT 2.14*)

   For the purpose of monitoring individual exposure to external radiation, personnel dosimetry shall be provided to and used by:

   - Radiological Workers likely to receive:
     – An effective dose to the whole body of 0.1 rem (100 mrem) or more in a year
     – An equivalent dose to the skin or to any extremity of 5 rem or more in a year
     – An equivalent dose to the lens of the eye of 1.5 rem or more in a year
   - Declared Pregnant Workers who are likely to receive from external sources an equivalent dose to the embryo/fetus in excess of 10 percent of the applicable limit in 10 CFR 835.206(a).
   - Members of the public in a controlled area and occupationally exposed minors likely to receive, in one year, from external sources, a dose in excess of 50 percent of the applicable limit in 10 CFR 835 Subpart C.
   - Individuals entering a High or Very High Radiation Area.

   DOE Laboratory Accreditation for Personnel Dosimetry is required for external dose monitoring programs implemented to demonstrate compliance with 10 CFR 835.

4. Individual monitoring - internal (10 CFR 835.402) (*Show OT 2.15*)
   (Emphasize how it is important to integrate several aspects of the radiological control program into an effective internal dose monitoring program. These include: bioassay (selection of participants and isotopes to be monitored), air monitoring, and contamination monitoring (both personnel and area).)

   Internal dose evaluation programs (including routine bioassay programs) shall be conducted for:

   - Radiological Workers who, under typical conditions, are likely to receive 0.1 rem or more committed effective dose from all occupational radionuclide intakes in a year.

   - Declared Pregnant Workers likely to receive an intake or intakes resulting in an equivalent dose to the embryo/fetus in excess of 10 percent of the limit stated in 10 CFR 835.206(a).

   - Members of the public in a controlled area and occupationally exposed minors who are likely to receive a committed effective dose in excess of 50 percent of the applicable limit in 10 CFR 835 Subpart C from all intakes in a year.

   DOE Laboratory Accreditation for Radiobioassay is required for internal dose monitoring programs implemented to demonstrate compliance with 10 CFR 835.

5. Air monitoring (10 CFR 835.403)

   Measurements of radioactivity concentrations in the ambient air of the workplace shall be performed as follows:

   - Air sampling shall be performed in occupied areas where an individual is likely to receive an exposure of 40 DAC-hrs or more in a year (i.e. an annual intake of 2 percent or more of the specific ALI value) for the mixture of isotopes.

   - Samples shall be taken as necessary to characterize the levels or concentration of airborne radioactive material when respirators are worn for radiation protection purposes.

   - Real-time air monitoring shall be performed when there is a need to alert potentially exposed individuals to unexpected increases in airborne radioactivity levels such that immediate

action is necessary in order to minimize or stop inhalation exposures.

6. Receipt of Packages Containing Radioactive Material (10 CFR 835.405) (*Show OT 2.16*)

   Establishes requirements to monitor certain types of packages and sets a time limit of not later than 8 hours after the beginning of the working day following receipt of the package.

F. Subpart F - Entry Control Program (10 CFR 835.501) (*Show OT 2.17*)

Subpart F addresses entry into:

- Radiological Areas
  (*Discuss different types of radiological areas.*)
- High Radiation Areas
- Very High Radiation Areas

1. Radiological Areas

   The degree of control shall be commensurate with existing and potential radiological hazards within the area.

   One or more of the following methods shall be used to ensure control: (*Show OT 2.18*)

   - Signs and barricades
   - Control devices on entrances
   - Conspicuous visual and/or audible alarms
   - Locked entrance ways
   - Administrative controls

   "No control(s) shall be installed at any radiological area exit that would prevent rapid evacuation of personnel under emergency conditions." (*Show OT 2.19*)

2. High Radiation Areas (*Show OT 2.20*)

   A High Radiation Area is an area where radiation levels exist such that an individual could exceed an equivalent dose to the whole body of 0.1 rem in any one hour at 30 centimeters from the source or from any surface that the radiation penetrates.

   If an individual could receive an equivalent dose exceeding 1.0 rem in an hour (at 30 cm), a High Radiation Area shall have one or more of the following:

   - A control device that prevents entry to the area when high radiation levels exist or that, upon entry, causes the radiation level to be reduced below that level that defines a High Radiation Area.

   - A device that functions automatically to prevent use or operation of the radiation source or field while individuals are in the area.

   - A control device that energizes a conspicuous visible or audible alarm signal so that the individual entering the High Radiation Area and the supervisor of the activity are made aware of the entry.

   - Entryways that are locked. During periods when access to the area is required, positive control over each entry is maintained.

   - Continuous direct or electronic surveillance that is capable of preventing unauthorized entry.

   - A control device generating audible and visual alarm signals to alert personnel in the area before use or operation of the radiation source and in sufficient time to permit evacuation of the area or activation of a secondary control device that will prevent use or operation of the source.

3. Very High Radiation Areas (*Show OT 2.21*)

   A Very High Radiation Area is an area in which an individual could receive a dose in excess of 500 rad in one hour at 1 meter from the radiation source or from any surface that the radiation penetrates.

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. (*Show OT 2.22*)

"No control(s) shall be established in a High or Very High Radiation Area that would prevent rapid evacuation of personnel."

G. Subpart G - Posting and Labeling (*Show OT 2.23*)

Subpart G addresses the general requirements for signs:

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

In addition, Subpart G addresses specific posting requirements for:

- Controlled Areas
- Radiation Areas
- High Radiation Areas
- Very High Radiation Areas
- Airborne Radioactivity Areas
- Contamination Areas
- High Contamination Areas
- Radioactive Material Areas

This subpart also addresses exceptions to posting and labeling. (*Discuss posting and labeling exceptions.*)

H. Subpart H - Records (*Show OT 2.24*)

Subpart H addresses requirements for records documenting compliance with Part 835 and with the Radiation Protection Program.

Records that are specifically required include those necessary to demonstrate compliance with the ALARA provisions of the rule.

10 CFR 835 also requires that certain records be maintained, including records of:

- Individual monitoring
- Sealed source inventory and control
- Results of surveys for the release of material and equipment
- Results of specified monitoring for radiation and radioactive material
- Maintenance and calibration of radiation monitoring instruments
- Internal audits

Each individual's training as a general employee and as a Radiological Worker must be recorded. Where appropriate, demonstration and documentation of proficiency is required.

Refer to 10 CFR 835 Subpart H for a complete listing of required records.

Chapter 13 of DOE G 441.1-1C, *Record-Keeping and Reporting*, provides additional guidance on record-keeping requirements, including reference to DOE O 231.1, Change 2, *Environment, Safety and Health Reporting*, and DOE M 231.1-1, Change 2, *Environment, Safety and Health Reporting Manual*. This order and manual specify radiation protection reporting requirements that may be applicable to the site or facility being assessed.

I. Subpart I - Reports to Individuals (10 CFR 835.801)
(*Discuss applicability of O 231.1 to the site or facility*.)

Subpart I addresses reports to individuals and their accessibility to reports, including:

On an annual basis, each DOE or DOE contractor-operated site or facility must provide each individual monitored for occupational exposure a radiation dose report of his/her occupational exposure at that site or facility.

Upon the request from an individual terminating employment, records of exposure shall be provided to that individual as soon as the data are available, but not later than 90 days after termination. A written estimate of the radiation dose received by that employee based on available information shall be provided at the time of termination, if requested.

J. Subpart J - Radiation Safety Training (*Show OT 2.26*)

This subpart addresses radiation safety training. The tailored approach to training requirements is based on:

- Unescorted access to or receiving occupational dose in controlled areas (e.g., General Employees)
- Unescorted access to radiological areas or unescorted assignment as Radiological Workers

Requirements of Part 835 include:

- Verification by examination for certain training (e.g., Radiological Worker Training)
- Intervals of training not to exceed twenty four months
- List of topics which must be included in training
- Provisions for limited use of escorts in lieu of training

Chapter 14 of DOE G 441.1-1C, *Radiation Safety Training*, provides additional guidance on DOE's expectations on radiation safety training.

K. Subpart K - Design and Control (*Show OT 2.27*)

Subpart K addresses added emphasis on facility and equipment design and administrative controls to maintain radiological exposures ALARA.

1. Facility design and modifications (10 CFR 835.1001)

   During the design of new facilities or modification of old facilities, the following objectives shall be adopted:

   - Optimal methods shall be used to assure ALARA
   - Maintain exposure levels below an average of 0.5 mrem/hr

- Avoid release of radioactivity to the workplace atmosphere

- The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and decommissioning

2. Workplace controls (10 CFR 835.1003) (*Show OT 2.28*)

   During routine operations, the combination of engineered and administrative control shall provide that:

   - The anticipated occupational dose to general employees shall not exceed the limits

   - The ALARA process is utilized for personnel exposures to ionizing radiation

L. Subpart L - Radioactive Contamination Control (*Show OT 2.29*)

1. Control of material and equipment

   This section addresses the requirements for release of materials and equipment from radiological areas to controlled areas. Releases to uncontrolled areas are addressed in DOE O 5400.5 and are not addressed in this training. Some of the provisions of 10 CFR 835 Subpart L:

   - Specifies conditions for material and equipment in contamination areas (CAs), high contamination areas (HCAs), and airborne radioactivity areas (ARAs) to be released to a controlled area

   - Addresses movement of material and equipment with removable surface contamination, on-site from one radiological area for immediate placement in another radiological area

   - Specifies conditions for material and equipment with fixed contamination to be released for use in controlled areas outside of radiological areas

Control of Areas (10 CFR 835.1102) addresses

- Prevention of inadvertent transfer or removal of contamination to locations outside radiological areas under normal conditions

- Where contamination levels exceed values in Appendix D, the area is controlled commensurate with hazards

- Areas with fixed contamination exceeding radioactivity values may be located outside radiological areas, provided certain controls, conditions, or provisions are met

- Personnel monitoring for contamination upon exiting CAs, HCAs, or ARAs

- Use of protective clothing in CAs and HCAs

M. Subpart M - Sealed Radioactive Source Control (*Show OT 2.30*)

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

Specifies values (Appendix E) for sources by isotope and Curie content which must be inventoried and leak tested at intervals not to exceed six months.

N. Subpart N - Emergency Exposure Situations (*Show OT 2.31*)

This subpart addresses:

- Employees who have exceeded dose limits as result of authorized emergency exposure

- Nuclear accident dosimetry (*Show OT 2.32*)

  Individuals whose occupational exposures have exceeded any limits as a result of an authorized emergency exposure may be permitted to return to work provided that certain conditions are met.

  Nuclear accident dosimetry

  Nuclear accident dosimetry involves installations possessing sufficient quantities of fissile material to constitute a critical mass, and shall include;

- Method to conduct initial screening of personnel involved
- Method and equipment for analysis of biological materials
- A system of fixed nuclear accident dosimeter units
- Personal nuclear accident dosimeters

(*Summarize lesson.*

Review objectives.

Ask for questions.)

DEPARTMENT OF ENERGY	LESSON PLAN
Course Material	Topic: Administrative Policies and Procedures

Objectives:

Upon completion of this training, the student will be able to:

1. Identify the radiological controlled areas a person should be allowed to enter after successfully completing General Employee Radiological Training, Radiological Worker I training, and Radiological Worker II training.
2. List five actions used to increase the awareness level of workers relating to proper radiological work practices.
3. Identify three conditions when a “Stop Radiological Work” should be initiated.
4. Identify the actions that should be performed, prior to recommencement of work, after a “Stop Radiological Work” order has been initiated.
5. Identify when termination bioassay monitoring should be conducted.

Training Aids:

Overhead Transparencies (OTs): OT 3.1 - OT 3.12 (May be supplemented or substituted with updated or site-specific information)

Handout

Equipment Needs:

Overhead projector/Screen

Flip chart/Markers

Masking tape

Student Materials:

Student’s Guide

DEPARTMENT OF ENERGY	LESSON PLAN
Course Material	Topic: Administrative Policies and Procedures

References:

U.S. Department of Energy, Order 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities,* 1994.

U.S. Department of Energy, 10 CFR Part 835, *Occupational Radiation Protection*.

U.S. Department of Energy, *Radiological Control*, DOE-STD-1098-2008.

Lau & Shani, *Behavior in Organization*, 1992.

I. Introduction

(*Introduce module. State objectives. Show OT 3.1*.) (*Show OT 3.2*)

II. A. The RadCon Standard (DOE-STD-1098-2008) is a guidance document that describes DOE's policy and expectations for an excellent radiological control program, including radiation safety training for general employees, radiological workers and Radiological Control Technicians (RCTs).

Radiological safety training (*Show OT 3.3*)

General Employee Radiological Training

Personnel who may routinely enter controlled areas unescorted or receive occupational exposure during access to controlled areas should receive General Employee Radiological Training (GERT). GERT is generally recommended for all employees.

Radiological Worker I and II

(*Obj. 1 Identify the radiological controlled areas a person should be allowed to enter after successfully completing General Employee Radiological Training, Radiological Worker I training, and Radiological Worker II training*.)

- Workers whose job assignments require access to radiological buffer areas and radiation areas should complete Radiological Worker I training.

  - Workers whose job assignments involve entry to the following areas should complete Radiological Worker II training:
    - Radiological buffer areas
    - Radiation areas
    - High and very high radiation areas
    - Contamination and high contamination areas
    - Soil contamination areas
    - Airborne radioactivity areas

  (*Review: "Radiological Control Training Guidelines" (RadCon Standard, Table 3-1, page 3-15) Insert site-specific information*.)

  - Radiological Worker I training is not a prerequisite for Radiological Worker II training.

  - The following apply to specialized radiological worker training:
    - Completed for nonroutine operations or work in areas with changing radiological conditions
    - Taken in addition to Radiological Worker II training

  - Recommended for personnel planning, preparing, and performing jobs that have the potential for high radiological consequences

- RCTs – Chapter 6 of the Radiological Control Standard provides guidance on training of RCTs.

B. Radiological Controls Program (*Show OT 3.4*)

Line managers who manage, supervise or provide oversight of a Radiological Controls Program should receive training that is helpful in dealing with workers who have anxiety about radiation. This training should include the following:

- Guidance on handling such personnel interactions
- Emphasis on being factual
- Fundamentals of communicating risks
- Importance of keeping management informed

(*Insert site-specific training provided to managers*.)

C. Radiological operations (*Show OT 3.5*)

Conduct radiological operations in a manner that controls the spread of radioactive materials, reduces exposure of the work force and the general public, and utilizes a process that seeks exposure levels that are as low as reasonably achievable.

Responsibilities

1. Supervisors should ensure that orientation, training, and indoctrination reinforce rules and guidelines for each worker to minimize radiation exposure and control radioactivity.

2. Prevention of the spread of radioactivity is less costly than remediation. Management should be willing to accept changes that will improve radiological control and should foster this mindset throughout the organization.

3. Supervisors and managers should encourage the work force to identify radiological control deficiencies and concerns. Prompt action

should be taken to address and eliminate identified issues and prevent recurrence. (*Show OT 3.6 Emphasize prompt action.*)

4. In cases where the work force does not have the required level of sensitivity for radiological work practices, additional management attention is needed to ensure the proper outcome. Actions should include the following:

   - More direct line supervision
   - Curtailment of work schedules
   - Deferral of work
   - Addition of extra radiological control personnel
   - Conduct of additional training

5. As part of their normal work review, work supervisors should periodically review ongoing jobs to ensure prescribed radiological controls are being implemented and periodically monitor those work areas.

6. Identify conditions that could lead to or promote the spread of contamination, or unsafe work and ensure corrections are implemented on a priority basis
   (*Insert site-specific information.*)

7. "Stop Radiological Work" authority (*Show OT 3.7*)

   - "Stop Radiological Work" authority may be initiated for the following reasons:

(*Reference RadCon Standard Article 345 Obj. 3 Identify three conditions when a "Stop Radiological Work" should be initiated.*)

   – Radiological controls are inadequate.
   – Radiological controls not being implemented.
   – Radiological control hold points not being satisfied.
   – Job scope changed.
   – Area conditions changed.

   - Once stopped, work should not be resumed until proper radiological controls have been established.

- Resumption of radiological work should have the approval of the manager responsible for the work and the Radiological Control Manager.

(*Insert site-specific information. Obj. 4 Identify the actions that should be performed, prior to recommencement of work, after a "Stop Radiological Work" order has been initiated.)*

D. Radiological measurements (*Show OT 3.8*)

Ensure radiological measurements, analyses, worker monitoring results, and estimates of public exposure are accurately and appropriately made and documented.

1. Personnel radiological records include the following:

(*Review:"Personnel Radiological Records" (RadCon Standard, page 7-5*))

- Records of doses received by individuals monitored
- Records containing information to identify individuals
- External dose records shall include the following:
  – Applicable extremity, skin, eye, and whole body dose results
  – Evaluations resulting from anomalous dose results
  – Dose reconstruction
  – Evaluation of nonuniform doses
- Internal dose records shall include the following:
  – Applicable whole body and lung counting results
  – Applicable bioassay results
  – Dose assessment
- Records of equivalent dose to any organ
- Total effective dose on annual bases
- Equivalent dose to embryo/fetus of declared pregnant worker
- Lifetime occupational dose, including cumulative total
- Documented counseling of persons about radiological concerns
- Records for authorization to exceed administrative control levels

- Emergency dose (shall be accounted for separately, but maintained with individual's record)
- Records of dose to skin caused by contamination
- Radiological incidents
- Radiological safety concerns, formally investigated
- Records of formal written declaration of pregnancy

2. Internal monitoring

(*Emphasize how it is important to integrate several aspects of the radiological control program into an effective internal dose monitoring program. These include: bioassay (selection of participants and isotopes to be monitored), air monitoring, and contamination monitoring (both personnel and area).)*

- Baseline bioassay monitoring of personnel who are likely to receive intakes resulting in a committed effective dose of 100 mrem or more shall be conducted. This must be done before beginning any work that may expose them to internal radiation exposure.
- Management should require termination bioassay monitoring when a person who participated in the bioassay program terminates employment or concludes work that involves the potential for internal exposure.
- Bioassay analyses (routine bioassay) are performed at site specified frequencies following certain work activities

(*Discuss site program for routine bioassay*.)

- Bioassay analyses (special bioassay) should be performed when any of the following occur: (*Show OT 3.9*)

(*Obj. 5 Identify when termination bioassay monitoring should be conducted*.)

  - Facial or nasal contamination is detected that indicates the potential for internal contamination.
  - Airborne monitoring indicates the potential for intakes exceeding 100 mrem committed effective dose.
  - Any contaminated wound.
  - Contamination on protective clothing, skin or facial area or unplanned spread of contamination on accessible areas above site specified thresholds. (*Show OT 3.10*)

- Detectable contamination inside a respirator after its removal.
- The Radiological Control Organization directs that bioassay analyses be performed when an intake is suspected.

(*See page 55 of DOE-STD-1121-98 for recommended values for thresholds*.)

E. Reducing exposure

Incorporate dose reduction, contamination reduction, and waste minimization features into the design of new facilities, or modification of existing facilities. (*Show OT 3.11*)

1. Maintenance and modification plans and procedures should be reviewed to identify and incorporate radiological requirements, such as the following:

   - Engineered controls
   - Dose reduction considerations
   - Contamination reduction considerations

(*Review: "Checklist for Reducing Occupational Radiation Exposure" (RadCon Standard, page 3-29*))

F. Radiological performance (*Show OT 3.12*)

Establish and maintain, from the lowest to the highest levels, line management involvement and accountability for Departmental radiological performance.

1. Radiological performance goals

(*Show and discuss site-specific goals*.)

- Goals are intended as a measure of and a motivation for improvement, and not an end in themselves.
- Performance goals should have these characteristics:
  – Measurable
  – Achievable
  – Auditable
  – Challenging
  – Meaningful in promoting improvement

- Goals need to be developed primarily by those responsible for performing the work.

- Site-specific goals need to be developed.
  (Identify other site-specific goals. List on flip chart.)

2. Performance indicators

    - Performance indicators should be used as tools to assist management in focusing their priorities and attention.
    - Performance indicators should be tracked and trended for the prior 12-month period.
    - To promote worker awareness of their radiation exposure status, selected indicators related to their work group should be posted in the workplace.
    - Site-specific indicator status reports should be tracked.

(*If available, show a recent site-specific indicator status report.*

Summarize lesson.

Ask for questions.

Review objectives.)

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DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: Fitness for Duty

Objectives:

Upon completion of this training, the student will be able to:

1. Identify ways to verify employee- and operation-specific training requirements for personnel.
2. Identify methods to determine an employee's dose status.
3. Describe how the Lifetime Control Level is calculated for radiological workers.
4. Describe the requirements in order for a female worker to be considered a declared pregnant worker.
5. Identify the dose limits established for a declared pregnant worker.
6. List the three main conditions an employee must meet in order to be issued respiratory protection equipment.
7. Identify the actions that should be taken if intakes of radioactive materials are indicated that could result in a committed effective dose of greater than 100 mrem.
8. Describe the conditions that can induce heat stress and other adverse physical conditions for radiological workers.
9. Describe the actions that should be taken if a worker exhibits symptoms of heat stress or other adverse stress conditions while working in a radiological area.

Training Aids:

Overhead Transparencies (OTs): OT 4.1 - OT 4.12 (May be supplemented or substituted with updated or site-specific information)

Equipment Needs:

Overhead projector

Screen

Student Materials:

Student's Guide

Student Handouts

DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: Fitness for Duty

References:

U.S. Department of Energy, 10 CFR Part 835, *Occupational Radiation Protection*.

U.S. Department of Energy, *Radiological Control*, DOE-STD-1098-2008.

Lau & Shani, *Behavior in Organization*, 1992.

I. Introduction

(*Introduce module. State objectives. Show OT 4.1*.) (*Show OT 4.2*) (*Show OT 4.3*) (*Show OT 4.4*)

II. Overview

The workers participate in the organization radiation protection program and have some responsibility to protect themselves, however, they must rely upon the organization to provide a safe work environment, minimize exposure, and provide adequate training.

The first line supervisor has the final responsibility that supervised workers are fit and prepared for their work in radiological areas. Supervisors should not assume that the organization has assured that the worker is adequately trained and physically and mentally ready for the work. This responsibility, in addition to seeing that the job or task is completed properly, is placed upon the supervisor.

III. Work force

To maintain a healthy work force, it is imperative that individual employees arrive at the workplace mentally and physically prepared to act in a safe and effective manner. Problems that raise doubt regarding an employee's ability to act in a safe manner must be dealt with in a straightforward process that encourages the employee to seek the help needed and ensure that the safety of all workers is maintained. Such problems may include alcoholism, drug abuse, mental health disorders, and personal crises.

For the radiological workers, there are additional considerations that may also affect a worker's fitness for duty. These may include the ability to wear respiratory protection, pregnancies, exceeding exposure limits, and heat stress during work in protective clothing. Supervisors of radiological workers must be conscious of these considerations to ensure that their employees are able to perform radiological work in a safe and effective manner.

IV. Training/qualification (*Show OT 4.5*)

(*Obj. 1 Identify ways to verify employee- and operation-specific training requirements for personnel.*
Review: "Relationship between Radiological Control Technicians and Workers" (RadCon Standard, article 144))

Radiological workers should be sufficiently qualified to recognize the symptoms of deteriorating radiological conditions and seek advice from Radiological Control Technicians and their supervisors.

Training requirements have been established to ensure that personnel have the training to work safely in and around radiological areas and to maintain exposure as low as reasonably achievable.

Examinations for Radiological Worker I and II training, and Radiological Control Technician Qualification shall be used to demonstrate satisfactory completion of theoretical and classroom material. Examinations should be written. However, alternatives may be used to accommodate special needs.
(*Review: "General Requirements" (RadCon Standard, article 613*))

In addition, workers may need job-specific radiological training including specific procedure and hands-on tools/equipment training.
(Instructor may want to insert site-specific alternatives, if any.)

Formal records of training and qualification shall be readily available to first line supervisors of involved personnel to aid in making work assignments.
(*RadCon Standard, article 725*)

V. Dose limits and control levels

A. General

Dose limits provided in Subpart C of 10 CFR 835 shall not be exceeded. Administrative control levels are established to maintain personnel radiation exposure well below regulatory dose limits. These levels are multitiered. Increasing levels of authority are required to approve higher administrative control levels. Special consideration must be taken for radiological workers who are approaching administrative control levels.
(*Review: "Administrative Control Level" (RadCon Standard, article 211)*
Obj. 2 Identify methods to determine an employee's dose status.
Insert site-specific administrative control levels here.
Insert site-specific information as to how supervisors can ascertain the dose status of their employees.)

B. Lifetime control levels (*Show OT 4.6*)
(*Review: "Lifetime Control Levels" (RadCon Standard, article 212*))

To administratively control a worker's lifetime occupational radiation exposure, a lifetime control level of N rem should be established where N is the age of the person in years. Special control levels (see Article 216 of RadCon Standard) should be established for personnel who have doses exceeding N rem.
(*Obj. 3 Describe how the Lifetime Control Level is calculated for radiological*

workers. Insert site-specific levels here.)

A special control level for annual occupational exposure shall be established for each person with a lifetime occupational dose exceeding N rem. The special control level should not exceed 1 rem in a year and should allow the person's lifetime occupational dose to approach N rem as additional occupational exposure is received.

C. Medical exposures
(*Site-specific policy for workers receiving medical exposures may be added*.)

An employer should be attentive to special circumstances of employees, such as those undergoing radiation therapy, and should establish an appropriate special control level.

D. Off-site exposures (*Show OT 4.7*)
(*Review: "Occupational Dose Limits" (RadCon Standard, page 2-5*).)

Workers are responsible for notifying radiological control personnel of off-site occupational exposures so that individual dosimetry records can be updated.
(*DOE administrative levels apply to DOE activities (Art. 211 of the RadCon Standard), while the lifetime control level applies to all occupational exposures. Your site policy should be checked regarding doses incurred from non-DOE activities (e.g., Nuclear Regulatory Commission (NRC) or hospital work*).)

VI. Declared pregnant employee (*Show OT 4.8*)
(*Review: "Embryo/Fetus Dose Limits" (RadCon Standard, article 215*))

A. Notification of employer

After a female radiological worker voluntarily notifies her employer in writing that she is pregnant, for the purposes of embryo/fetal dose protection, she shall be considered a declared pregnant worker. Declarations of pregnancy may be revoked, in writing, by the declared pregnant employee at any time.

1. The employer should provide the option of a mutually agreeable reassignment of work tasks, without loss of pay or promotional opportunity, so that further occupational radiation exposure is unlikely.

(*Obj. 4 Describe the requirements in order for a female worker to be considered a declared pregnant worker*.)

2. For a declared pregnant worker who chooses to continue working as a radiological worker the following apply:

(*Obj. 5 Identify the dose limits established for a declared pregnant worker*.)

- The dose limit for the embryo/fetus for the entire gestation period shall be no greater than 500 mrem.

- Substantial variation above a uniform exposure rate that would satisfy the limits shall be avoided (e.g. 50 mrem/month).

3. If the dose to the embryo/fetus is determined to have already exceeded 500 mrem when a worker notifies her employer of her pregnancy, the worker shall not be assigned to tasks where additional occupational radiation exposure is likely during the remainder of the gestation period.

VII. Respirator protection (*Show OT 4.9*)

There are three main requirements that must be met by personnel prior to being issued a respirator. Personnel must be trained, fitted, and medically qualified to wear that specific type of respirator. Training and qualification testing shall be performed annually.

(*Review: "Respiratory Protection Program Requirements" (RadCon Standard, page 5-10*))

A. Respirator use

While using respiratory protection, personnel are expected to:

(*Obj. 6 List the three main conditions an employee must meet in order to be issued respiratory protection equipment.*
Review: "Use of Respiratory Protection" (RadCon Standard, article 533))

1. Perform fit checks of their respirators to ensure a proper seal before entering areas requiring respirator use.

2. Be clean shaven in the area of the fit.

3. Use corrective lenses, if needed, that are approved for respirators.

4. Be instructed to leave the work area when experiencing respirator failure.

5. Be instructed to remove their respirators to avoid life-threatening situations when exiting an area after respirator failure.

B. Exposure to airborne radioactive materials (*Show OT 4.10*)
(*Review: "Handling Individuals Exposed to Airborne Radioactivity" (RadCon Standard, article 543*))

10 CFR 835 establishes dose limits which includes internal dose from inhaling radioactive material. Use of engineering and administrative controls and proper use of personal protective equipment results in most planned internal doses being very low.

In cases of unplanned internal doses, potential intakes of radioactive material are suspected when personnel without respiratory protection are exposed to airborne radioactive materials or when respiratory protection has been compromised. If unplanned intakes of radioactive material are indicated that could result in a committed effective dose of 100 mrem or more, the following actions should be taken:
(*Obj. 7 Identify the actions that should be taken if intakes of radioactive materials are indicated that could result in a committed effective dose greater than 100 mrem.*)

1. Identify personnel potentially exposed.

2. Determine the duration of potential exposure to airborne radioactivity.

3. Have dose evaluated prior to permitting the worker to return to radiological work.

VIII. Adverse work conditions

A. Heat stress (*Show OT 4.11*)
(*Review: "Heat Stress" (RadCon Standard, article 534*))

Heat stress may result from working in areas of high temperature, humidity, and radiant heat; working in protective clothing; and using respirators, particularly where other protective equipment is required. Heat stress has occurred at ambient temperatures less than 70°F when multiple sets of protective clothing or plastic suits were in use or strenuous work was involved.
(*Obj. 8 Describe the conditions that can induce heat stress and other adverse physical conditions for radiological workers.*)

1. Heat stress controls should be addressed in the planning stages for work.

2. Recommended work time limits and use of body cooling devices should be considered to reduce heat stress.

3. Job supervisors should inform their personnel of heat stress precautions prior to work on job assignments where heat stress may be a factor.

4. (*Show OT 4.12*) If a person begins to feel symptoms of heat stress, the person should immediately notify the nearest coworker, exit the area, remove personal protective equipment, notify the supervisor, and rest in a cool area. In such cases, medical assistance should be provided.

(*Obj. 9 Describe the actions that should be taken if a worker exhibits symptoms of heat stress or other adverse stress conditions while working in a radiological area.)*

B. Other adverse physical conditions

(*Review: "Contaminated Wounds" (RadCon Standard, article 542) Instructor may want to insert any site-specific policies regarding adverse conditions such as cold weather, etc.)*

Medical treatment of injuries takes precedence over radiological considerations. A worker with a contaminated injury should receive treatment by medically qualified personnel. An assessment should be made on the need for bioassay monitoring or further medical treatment. Until this assessment is completed, work restrictions may be needed. The worker should be counseled promptly on the medical and radiological implications resulting from the contaminated wound.

IX. Group activity

(*Divide class into smaller groups (3-5 people). Refer students to page 1 of handouts and allow them to determine the appropriate job assignments for their personnel based on an assessment of each individual's fitness to perform each task.*

Discuss answers.

Summarize lesson.

Ask for questions.

Review objectives.)

DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: Interpersonal Communication

Objectives:

Upon completion of this training, the student will be able to:

1. Identify the components of a communication process model.
2. Describe filters/barriers that distort the communication process.
3. Identify active listening behaviors.
4. Describe the various portions of a conflict resolution model presented in class.
5. Describe some of the key elements in communicating radiation risks to workers.
6. Identify the skills required to conduct a pre-job briefing.
7. Identify the benefits of a successful critique/lessons learned program as described in the *Radiological Control Standard*.

Training Aids:

Overhead Transparencies (OTs): OT 5.1 - OT 5.10 (May be supplemented or substituted with updated or site-specific information)

Exercise (optional)

Equipment Needs:

Overhead projector

Screen

Flip chart

Markers

Masking tape

Student Materials:

Student's Guide

Student Handouts

References:

Lau & Shani, *Behavior in Organization*, 1992.

U.S. Department of Energy, 10 CFR Part 835, *Occupational Radiation Protection*.

U.S. Department of Energy, *Radiological Control*, DOE STD-1098-2008.

I. Introduction (*Introduce module. State objectives. Show OT 5.1*.) (*Show OT 5.2*)

II. Communication

(*Ask students for their definition of communication. Write responses on flip chart. Communication is the process of transferring information from one person to another*.)

A. Communicating is one of the basic functions human beings must perform. Since it is basic, often it is assumed that everyone communicates proficiently. That is not always the case. Often, everyday problems can be traced back to communication as a primary or contributing cause.

III. Interpersonal communication

A. Communication styles

Studies show that people tend to communicate in a style that best suits their given personality. There are many personality trait assessments available that give us a better understanding of who we are. Some examples are Myers-Briggs, Herman's Brain Dominance, and Birkman Methods.

B. The communication process

(*Refer students to page 2 of handouts, "The Communication Process." Obj. 1 Identify the components of a communication process model. Use an example to "walk" through the process from sender to receiver*.)

1. Sender's filters

- The sender has an idea that must be transmitted to a receiver.
- Perceptions, assumptions, attitudes, and past experiences are filters through which the sender's messages must travel. These can distort the idea.
- The sender's message is the focus of the process. It must have an objective (i.e., deliver information, motivate, stimulate, get/provide feedback). It must be concise, logical, and clear.

(Site-specific communication models may be substituted.)

2. Receiver's filters

- Similar to the sender, the receiver has his/her own filters that can also distort the message.

3. Understanding the message

- It is not the logic of the sender's message that is important, but the logic of the received message. The sender must consider *how his message will sound to the receiver.*

- The accuracy of message interpretation depends upon how well the sender projects the intent, motivation, values, and emotions of the message.

4. Medium

- The medium used for communication can definitely distort the message.

(Types: Oral, written, symbols, gestures, etc.
Introduce exercise.
Exercise should be approximately 30 min., including the debriefing.
Participant activity - The objective of the activity is to have each member realize barriers associated with the communication process.
- *Split the group into pairs.*
- *Have each pair designate a sender and a receiver. Have the sender and receiver sit back-to-back.*
- *General rules*

– *The sender must provide instructions to the receiver in order to reproduce a predetermined geometric shape.*
– *The sender must not show the receiver the shape.*
– *The receiver or sender cannot provide any feedback (verbal or physical) to his/her partner.*
– *Set a time limit of 3 to 5 minutes.*
– *Be sure to point out that the drawings should match exactly.*
- *After each pair is finished, have them compare drawings.*
- *Debrief the exercise by asking the senders and receivers these questions:*

– *How did you feel about your role during the exercise?*
– *What barriers were imposed on you?*
– *How could you have done better?*

Write responses on the flip chart. Encourage students to write answers in the Student's Guide.)

C. Barriers/filters (*Show OT 5.3*)

1. Five types of communication barriers/filters

(*Obj. 2Describe filters/barriers that distort the communication process. Relate the barriers/filters to the activity above*.)

- There are two categories of social barriers:
  - Verbal - The use of words with emotional content can interfere with the reception of the intended message (e.g., politics, religion, race).
  - Nonverbal - Nonverbal barriers are usually involuntary or symbolic (e.g., clothes, grooming, or office setup).

- Physical barriers include elements such as noise, distance, data overload, time, media, handicaps, etc.

- Psychological barriers include elements such as tendency to smother information, difference in opinion, lack of trust, assumptions, attitudes, stress, and attention level.

(*Give examples*.)

- Individual barriers include elements such as needs, beliefs, education, religion, socioeconomics, culture, values, and self-concept.

- Neurological barriers occur as a result of the way the nervous system filters, distorts, deletes, and interprets information.

D. Listening skills

1. What is the role of the receiver in regard to listening?

(List roles on flip chart. Encourage students to write responses in the Student's Guide.
Responses should include the following:

- *By your actions, show interest in the individual to whom you are listening. Show your desire to listen.*
- *Take time to listen, and be sure you are ready to listen.*
- *Try to learn something. Be positive rather than negative.*
- *Get the whole message. Ask the sender to repeat or clarify. Ask who, what, why, where, when, and how.*
- *Do not interrupt the sender in mid-sentence. Wait for an appropriate pause.*
- *Concentrate on listening. Ward off distractions.)*

2. Types of listening

(Ask students for the types of listening. List answers on flip chart. Answers should include the following:

- *Appreciative: Hearing what is being said*
- *Discriminating: Sorting stimuli*
- *Critical: Judging*
- *Comprehensive: Understanding*
- *Empathetic: Putting yourself in the sender's position)*

3. Deterrents to effective listening

(Ask students for their responses. List on flip chart. Answers should include the following:

- *Assuming the subject is unimportant*
- *Mentally criticizing the speaker's delivery*
- *Getting over stimulated when opposing an idea*
- *Overreacting to certain words or phrases*
- *Listening only for facts, not overall meaning*
- *Permitting the speaker to be inaudible or incomplete*
- *Avoiding technical messages*
- *Daydreaming*
- *Dual focusing)*

4. Elements of active listening

(Obj. 3Identify active listening behaviors.
Ask participants for their responses. List on flip chart. Answers should include the following:

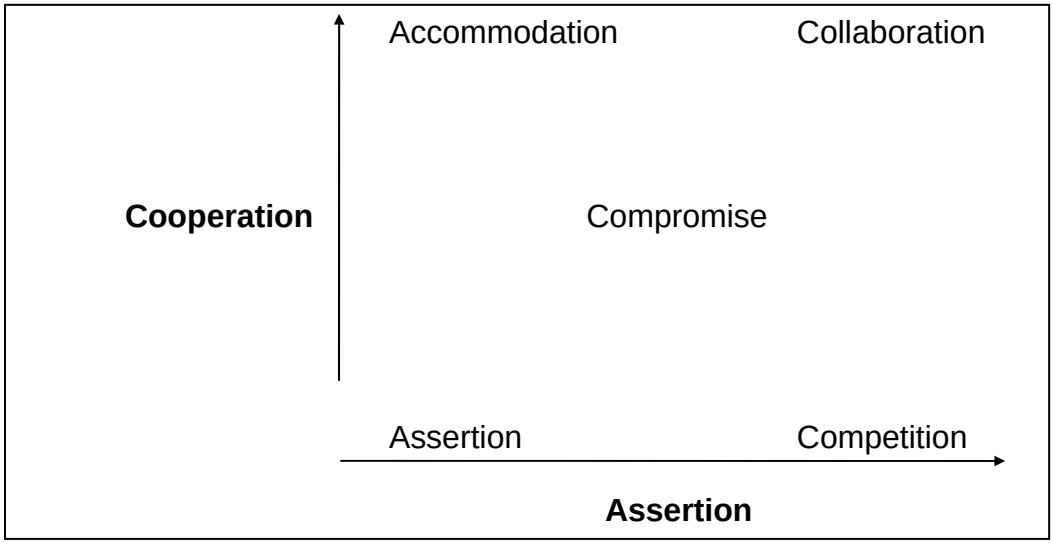
- *Pay close attention.*
- *Label nonverbal "clues" ("You appear upset.").*
- *Put the speaker's words into your own words.*
- *Ask open-ended questions for clarification.*
- *Use prompts for nonverbal reinforcement.*
- *Try to empathize and really feel what the other is feeling.)*

E. Dealing with confrontation

(*Obj. 4 Describe the various portions of a conflict resolution model presented in class.*)

Whenever people come together in any environment, there will be opportunities for confrontation. Confrontation can either stimulate or demoralize individuals. As a supervisor, it is essential that you learn how to deal with these situations appropriately.

Following is a model that illustrates the various approaches to deal with conflict.



1. There are many styles of conflict management: (*Show OT 5.4*)
   (Discuss the conflict management styles.)

   - Avoidance - This style is considered the least cooperative and the least assertive. In this situation, conflict is not addressed. As a short-term strategy, it may work, but as a permanent strategy, problems may never get solved.

   - Accommodation - This style is characterized by cooperative, unassertive behavior. It means to place the needs and concerns of others above your own needs and concerns.

   - Competition - This style is considered the most assertive. It reflects one's desire to meet his or her needs at the expense of others.

- Compromise - This style is between competition and collaboration and avoidance and accommodation. The objective is partial fulfillment of the needs, concerns, and goals of all parties concerned. The solution should be mutually acceptable and partially satisfying to everyone involved. Nobody wins and nobody loses.

- Collaboration - This style uses both cooperation and assertiveness in an effort to satisfy the needs of all parties concerned. Collaboration includes the following:

  – Acknowledgment that conflict exists
  – Identification and acknowledgment of others' needs, concerns, and goals
  – Identification of alternative resolutions and consequences for each party involved
  – Selection of the alternative that meets the needs and concerns of all parties
  – Implementation of the alternative selected

2. Effective conflict resolution (*Show OT 5.5*)

   For effective conflict resolution, establish rules in advance. Rules might include the following:

   - When controversy arises, have one party who is not directly involved state the issues before further discussion is allowed.

   - All parties must agree on the problem and specifically identify the common goal or solution.

   - Each party must be able to restate the other's position to the satisfaction of the individual before any evaluation discussion is allowed.

   - All parties will identify and agree upon the criteria to be used in resolving the controversy.

   In conflict resolution, it is important to focus on issues--not people. When conflicts arise, keep the focus on the issues and not on the personalities involved.

   The key to reaching collaboration is effective communication. The key to communication is trust, and the key to trust is honesty.

IV. Risk communication

(*Obj. 5 Describe some of the key elements in communicating radiation risks to workers.*)

A. Communicating risk

Due to the continuing concerns related to low-level radiation exposure and health effects, managers should be trained to deal with the perceptions that personnel have concerning radiation risks. Managers and first line supervisors should ensure that workers understand the fundamentals of radiation, its risks, and their role in minimizing exposure.

It is not sufficient to rely solely on regulatory limits for establishing or defining acceptable work practices and work environments.

Some personnel, such as those who may have internal deposition of radionuclides from prior years, are concerned about future exposures. Such instances warrant special attention on the part of the manager. Counseling with such personnel should be the preferred way to consider relevant factors. In some cases, special control levels should be applied.

B. Motivation to achieve excellence in radiological control (*Show OT 5.6*)

1. No one should be exposed to radiation unless an overall benefit from the associated activity is expected to be realized. As a corollary, the benefit should be maximized and the risk (exposure) minimized.

2. Some workers and members of the public perceive any radiation exposure as an unduly hazardous risk. Making an effort to reduce doses and documenting the actual doses received can reassure these people and reduce the prospects of litigation.

3. A side effect of trying to reduce doses is often an increase in efficiency and a decrease in incidents in performing radiological jobs, since greater planning is required. Records of past similar jobs can assist in planning future jobs and reduce dose further. (*Show OT 5.7*)

C. Fostering positive worker attitudes toward achieving excellence

Worker attitudes are key to radiological performance. A positive attitude makes a person take that one extra step. When everyone's attitude embraces radiological excellence, and the performance is excellent, the program will reduce exposure and environmental burdens.

(*Discuss students' perception of workers' responsibilities. List on flip chart. Encourage students to write answers in the Student's Guide.*
Answers may include the following:

- *Workers understand that they are responsible for control of radiological work that they perform.*
- *Workers understand the risks of radiation. They convey confidence to family and others.*
- *Improving attitude is part of training.*
- *Radiological control is perceived as integral to the job.*
- *Mechanisms exist to improve worker attitudes, such as a Radiological Awareness Committee and the use of performance indicators.*
- *Constant improvement in radiological performance is occurring.*
- *Cooperation between the work force and radiological control organization is stressed. Radiological control cannot be left solely to the Health Physicists*.)

D. Reducing risk (*Show OT 5.8*)

The following are elements of a radiological control program that help reduce risk:

1. Training must be aimed at what the worker should know in order to do his/her job rather than passing a quiz. The training needs to be documented and recorded accurately.

2. Records and reports are needed for every aspect of the program. Records must be accurate and understandable because they may be used to recreate events that are questioned in the future. Those who fill out, file, review, or otherwise handle records must understand their use and importance.

3. Radiological deficiencies and improvements must be used to develop plans that will further promote radiological excellence. Self-assessments, use of critiques, thorough investigations, and a willingness to be self-critical and accept responsibility are needed. When a radiological deficiency is identified, there should be an honest effort to understand, correct, document, and follow it to closure. Trending deficiencies aids in planning where resources are to be spent to make improvements.

V. Meetings/briefings/critiques (*Show OT 5.9*)

(*Ask students what types of meetings they conduct as supervisors. List responses on flip chart.*)

A. Running an effective meeting

In today's business environment, meetings have become a way of life. Today's work force spends a great deal of time "stuck" in meetings. It is essential for those people leading these meetings to become proficient in chairing a meeting. The following are considerations when conducting a meeting:

1. Objective(s)

   - Is a meeting the best way to handle this? If not, don't have a meeting.

   - What do you want to achieve by the end of the meeting? Ensure that participants are aware of your expectations.

2. Persons attending?

   - Who needs the information?
   - Who can contribute?
   - Who would expect to be involved?

3. Amount of prior notice

   - How much preparation time is required?

   - Should any pre-work be sent? Pre-work (i.e., history, data, graphs, etc.) can cut down on the time spent in the meeting.

4. Agenda

   - Establish a reasonable amount of work that you expect can be accomplished in the specified time.

   - Provide the agenda to participants prior to the meeting.

   - Have enough information in the agenda so that people understand what discussion topics are going to be covered.

   - Establish time limits for each item and attempt to meet them.

5. During the meeting

   - Determine who will be responsible for the meeting minutes.

- Review the agenda and emphasize time limits.
- Keep discussions focused on the topics associated with the meeting.
- If action items are established, ensure individuals understand what is to be accomplished and when it is required to be done.
- Summarize upon completion of the meeting.
- Prepare and distribute the meeting results

B. Pre-job briefings

(*Obj. 6 Identify the skills required to conduct a pre-job briefing. Ask students when a pre-job briefing should be held*.)

"Planning the work" is an essential part of an effective Integrated Safety Management program. During pre-job work planning meetings, all appropriate safety disciplines must be engaged to ensure that all work hazards are adequately addressed. The following addresses pre-job briefings for radiological controls. Other work hazards should be integrated using a similar approach.

(*Review: "Pre-job Briefings" (RadCon Standard, article 324*))

Article 324 of the RadCon Standard recommends pre-job briefings be held prior to the conduct of work anticipated to exceed the site ALARA trigger levels. (This practice further establishes excellence in regard to radiological operations.)

1. The pre-job briefing should be conducted by the cognizant work supervisor. Workers and supervisors directly participating in the job, cognizant radiological control personnel, and representatives from involved support organizations should attend the briefing. A summary of the topics discussed and attendance at the pre-job briefing should be documented.

2. As a minimum, the pre-job briefing should include the following:

   - Scope of the work to be performed
   - Radiological conditions of the work place
   - Procedural and Radiological Work Permit requirements

- Special radiological control requirements
- Radiological limiting conditions, such as contamination or radiation levels that may void the RWP

(Add site-specific information.)

- Radiological control hold points
- Communication and coordination activities with other groups
- Provisions for housekeeping and final cleanup
- Emergency response provisions

C. Post-job evaluations

During the conduct of radiological work and the handling of radioactive materials, abnormal events may occur that could indicate a weakness or area of programmatic breakdown of radiological controls. Prompt, consistent gathering of facts related to such events is required to satisfy reporting and investigation requirements and to formulate corrective actions to prevent recurrence.

In addition, successful performance or completion of unique activities should be evaluated to identify and incorporate appropriate lessons learned. Analysis of the facts should reveal areas where improvements can be made or identify methods to prevent the recurrence of undesired results.

1. (*Show OT 5.10*) Critiques are meetings that document a chronological listing of the facts of an event. The purpose of the critique is not to assign blame. The following guidelines should be followed regarding critiques/occurrence investigations:

(*Obj. 7 Identify the benefits of a successful critique/lessons learned program as described in the Radiological Control Standard. Critiques are described in the RadCon Standard, article 351*.)

- Critique meetings should be conducted for successes and abnormal events.
- Properly trained critique leaders should facilitate the critique process.
- Critique meetings should be conducted as soon as practical after the event or situation is stabilized or completed.

- Minutes of the meeting must be kept.
- All who can contribute should attend.
- Supporting materials should be brought to the critique.

Refer to RadCon Standard Article 351 for a complete list.

2. Post-job ALARA reviews may take the form of a debriefing or may be a review by one or more designated individuals and should be performed in the following cases:

   - After completion of a nonroutine radiological job or operation

   - After completion of a nonroutine or complex radiological job or operation if a pre-job formal radiological review was required or if an ALARA trigger level was exceeded in the course of the work

(*Ask when this is required and what these levels are at their sites (e.g., as given in the RadCon Standard).*
Sites may add site-specific information depending on the involvement of supervisors in the post-job ALARA review.
Ask what is done at students' sites. For example, is the post-job evaluation performed by the site ALARA group?)

3. Lessons learned are available from post-job reviews, critique minutes, and occurrence reports (using the Occurrence Reporting and Processing System [ORPS]). Organizations responsible for radiological work and line management should evaluate lessons learned, provide prompt distribution, and incorporate the lessons into the Radiological Control Program.

(Summarize lesson.

Ask for questions.

Review objectives).

DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: Problem Analysis and Decision Making

Objectives:

Upon completion of this training, the student will be able to do the following:

1. Identify problems or decisions faced by supervisors of radiological workers.
2. Identify the components of decision making.

Training Aids:

Overhead Transparencies (OTs): OT 6.1 - OT 6.4 (May be supplemented or substituted with updated or site-specific information)

Equipment Needs:

Overhead projector

Screen

Flip chart

Markers

Masking tape

Student Materials:

Student's Guide

Student Handouts

References:

Lau & Shani, *Behavior in Organization*, 1992.

I. Introduction
(*Introduce module. State objectives. Show OT 6.1*.) (*Introduce module. State objectives.)*

II. Problem analysis

Supervisors of radiological workers are often faced with critical decisions. Providing a model for strategic decision making will ensure that these critical decisions are made in an efficient, rational manner.

A. Stating the mission

In making decisions, the organization's mission and resultant goals should always be considered. Decisions should be consistent with the stated mission of the organization. Prior to decision making, the organization's mission must be defined. This may be difficult if the organization's mission has not been defined or if there are conflicting goals within the organization.

(*Obj. 1 Identify problems or decisions faced by supervisors of radiological workers.*

Ask students about typical problems faced or decisions made each day as Rad Worker Supervisors.

Take 15-20 minutes and brainstorm inputs. Encourage students to write responses in the Student's Guide. List these on flip chart and post for reference through the rest of the module.

Divide the inputs into categories that are specific to Rad Worker Supervisor and General Supervisor issues.

Typical inputs:
- *Contamination*
- *Exposure limits exceeded*
- *Training*
- *Scheduling*
- *Union relations*
- *Promotions*
- *Performance evaluations*
- *Pregnant workers*
- *Rad work permits*
- *Operating procedure interpretation*
- *Budget*

As the rest of the module progresses, refer back to problems identified by students for examples.)

B. Assessing internal and external environments (*Obj. 2 Identify the components of decision making. Show OT 6.2*)

Prior to making a decision or solving a problem, the problem must be identified and evaluated to ensure that all factors have been included in the problem statement.

1. Problem diagnosis - Identify the problem.

2. Problem specification - Clarify the specific nature of the problem.

3. Problem framing - Frame the problem in a nonjudgmental way.

4. Problem formulation and reformulation - Restructure the problem in a way that will make it easier to solve. This can be done by introducing accurate assumptions.

III. Decision making

A. Developing strategy (*Show OT 6.3*.)

Once the problem has been identified, alternative solutions must be generated. A general rule for decision making is as follows: if an acceptable standard solution is available to a problem, then it should be used instead of spending time and resources reinventing a solution. If a standard solution is not available, alternatives must be developed.

1. Standard solutions involve using standard operating procedures as well as available alternatives. Optimization techniques, which include cost-benefit analysis, are a fundamental part of work reviews and of radiological analyses for new designs and modifications. For review of minor or routine activities with low associated doses, a cost-benefit evaluation may be an intrinsic part of the engineering or operations review process, so a detailed evaluation is usually not necessary. For review and planning of major tasks involving higher collective dose expenditures, a detailed and documented evaluation should be performed.

2. A simple optimization decision may be made by choosing a low-current-dose worker instead of a high-dose worker or by declining to

spend a large sum to save only a few mrem. Note that the writing of work planning documents (e..g., Radiological Work Permits, work packages, procedures, etc.) is also an optimization evaluation, in which the line supervisor must usually concur.

Although the supervisor may not have to perform detailed optimization evaluation, that information may need to be provided to the person(s) who will do the evaluation.

Such information will often be based on past operating experience and may include costs of equipment, person-hours, number of people, amount of time spent in radiological areas, and even subjective judgments regarding the feasibility of alternatives.

(*Emphasize that if supervisors are involved in cost-benefit analysis, they should seek additional training in this area*.)

B. Limits on decision making

1. When supervisors make decisions, they need to determine how much power they have in reaching a final decision and how much influence they have over the process. This is important information when considering the most appropriate alternatives.

2. The decision maker must also determine what the political impact of various decisions will be. There may be political reasons why the most rational solution is not feasible.

3. When selecting an alternative, it is important to consider the repercussions of not selecting various alternatives. If there is strong opposition to a selected alternative, the decision maker needs to be able to support the current decision and explain why the competing solution is less feasible or less desirable.

C. Making the decision (*Show OT 6.4*.)

The formal decision analysis will be as follows:

- Define alternative courses of action, determine the criteria to use in evaluating the alternatives, and identify key uncertainties in the decision.

- Assess the consequences of selecting each alternative.

- Assess the probabilities and preferences by looking at the uncertainties and utilities of each outcome.
- Evaluate alternatives in terms of the stated criteria.
- Analyze the optimal solutions for any adverse consequences.
- Select the most effective solution based on problem analysis.

D. Implementation and controlling execution of strategy

Once a decision is made, the decision will be implemented and evaluated. It is important to monitor events after implementation to ensure that the outcomes are as expected. If not, it may be necessary to revise the original decision. Monitoring outcomes of decisions will also provide lessons learned for future decision making.

E. Case studies

(*Refer students to "Internal Exposure and Contamination During Pump Removal," page 3 of handouts. Allow approximately 30 minutes.*

Read the case and allow a few minutes for students to review the facts. Facilitate discussion and application by working through the steps on the flip chart. Allow 15-20 minutes for discussion of this case.

Using the decision-making model, solicit inputs from the class for each step:

1. *Alternative courses of action might include cutting the pump mount bolts, repairing the pump in place, or removing the mounting plate.*
2. *Assess the consequences of each alternative (e.g., possible damage to the pump, etc.).*
3. *Examine the uncertainties and utilities of each outcome. Can the bolts be cut without damage? Has the pump ever been repaired in place?*
4. *Evaluate alternatives.*
5. *Analyze optimal solutions for any adverse consequences. Should possible hidden contamination have been considered? What about records?*
6. *Select the most effective solution.*

Refer students to "Fire in a Contaminated Cutting Facility," page 4 of handouts. Suggest they take 5-10 minutes to review the case and 15-20 minutes to discuss the alternatives.

The class will then divide into small groups and discuss the second case. Each

group will select a spokesperson to present the group's decision and explain the process to the class.

Each spokesperson will then briefly outline his/her group's decision. The instructor should act as a facilitator at this point, keeping discussion going and on the subject.

Summarize lesson.

Ask for questions.

Review objectives.)

DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: Motivation

Objectives:

Upon completion of this training, the student will be able to do the following:

1. Identify motivation issues faced by radiological worker supervisors.
2. Identify several ways to motivate personnel.
3. Identify several tools of motivation.

Training Aids:

Overhead Transparencies (OTs): OT 7.1 - OT 7.9 (May be supplemented or substituted with updated or site-specific information)

Equipment Needs:

Overhead projector

Screen

Flip chart

Markers

Masking tape

Student Materials:

Student's Guide

References:

Lau & Shani, *Behavior in Organization*, 1992.

I. Introduction (*Introduce module. State objectives. Show OT 7.1.*)

II. Motivation

The roles and responsibilities of a supervisor include motivating personnel to perform quality work. There are many theories of motivation. Some have been found to be effective and some have not. It is important for supervisors to understand which theories of motivation are valid and which techniques will be most effective.

III. Why are people motivated?
(*Obj. 1 Identify motivation issues faced by radiological worker supervisors.*
How do you motivate your employees?
Students will brainstorm a list. Write responses on flip chart. Typical responses:
- *Rewards (pay, bonus)*
- *Recognition*
- *Interesting jobs*
- *Work ethic*

List various theories.)

A. Needs fulfillment theories

Need fulfillment theories of motivation state that people are motivated by inherent needs and specifically by unmet needs. Behavior is based on inherent needs.

1. Maslow's hierarchy of needs

1. Physiological
2. Safety
3. Belongingness
4. Love
5. Self-actualization
(*Show OT 7.2. Define "self-actualization" and give examples.*)

In an organization, one typically assumes that an individual's basic needs have been met (food, shelter, clothing). However, other needs may not have been met. Supervisors should be aware of employees' need for a safe and secure working environment. This is a critical issue for supervisors of radiological workers.

It is not the organization's responsibility to fulfill higher level needs (belongingness, love, self-actualization). However, supervisors should understand how these needs translate into motivation. If

employees feel like they are part of a work team, they will be more loyal, and perhaps be motivated to work harder. The need for self-actualization can often be encouraged by providing employees with the authority to make decisions that are critical to their working environment.

2. Job enrichment theory
   (*Show OT 7.3. Obj. 2 Identify several ways to motivate personnel*.)

   The job enrichment theory of motivation states that certain job dimensions will motivate employees to work more effectively.

   Job dimensions include the following:

   - Skill variety
   - Task identity
   - Task significance
   - Autonomy
   - Feedback

   These job dimensions will provide meaning to the job, make an employee responsible for the job, and provide feedback concerning how the job is progressing.

   Supervisors should evaluate the jobs of their workers to determine if these dimensions are part of the job. If not, the need for job redesign may be indicated.

3. Need for achievement theory
   (*Show OT 7.4*.)

   In this theory, it is believed that some employees have a need for achievement, while others do not. If a person has a high need for achievement, he/she will do better in "achieving situations." These situations may be characterized as follows:

   - Personal responsibility is evident. The individual will receive credit for a job well done.

- The task should be at an intermediate to average level of difficulty. There should be a good chance of success.

- The individual needs to receive feedback.

- The individual needs to feel challenged.

- The situation should be ongoing, with consequences in the future.

Although a supervisor cannot change an individual's need for achievement, understanding this theory may explain what motivates some employees.

B. Cognitive theories (*Show OT 7.5*.)

Cognitive theories of motivation state that a person's behavior is based on a cognitive process. People think before they act.

1. Equity (justice) theory

   This theory is based on the equity of input (work) and output (rewards). Employees' output is based on their perceived level of their own input, as well as their perception of the input and output of others.

   If employees believe that their input is greater than that of others (or their output is less), they will try to balance the situation by doing the following:

   - Reducing their input (decreased productivity, absenteeism, tardiness)

   - Increasing their rewards (employee theft, i.e., supplies, phone calls, inflated expense statements)

   - Leaving the job in search of a more equitable situation

   Supervisors should be aware of this theory and assess whether there is equity in the workplace for each worker as well as across the team. By understanding the equity theory, supervisors can understand behaviors stemming from real or perceived inequities.

2. Expectancy (choice) theory

For the expectancy theory, the primary motivation is the attainment of goals. Behavior is based on a person's expectation that his or her effort will lead to a certain type of performance. This in turn will lead to a certain level of reward (e.g., If I work hard, I will do a good job and get a good reward). Employees make clear choices about the level of effort they will exert based on these expectations.

For employees to be motivated, there must be a clearly defined relationship between performance and rewards (compensation system). There also has to be a link between effort and performance. The supervisor must be aware of an individual's effort and consequent performance.

The supervisor must provide feedback to the employee that will enable the link between effort and performance to be more direct.

C. Reinforcement theories

The basic tenet underlying reinforcement theories is that people are motivated by rewards for their behavior. People work because they are rewarded. A reward is considered something of value to the employee. The most basic is compensation (pay, benefits, leave time). Other rewards include recognition and job prerequisites. Following this theory, supervisors should assess the rewards and recognition given to their employees.

IV. Tools of motivation
(Obj. 3
Identify several tools of motivation.

(*Ask students for types of motivational tools. List on flip chart. Encourage students to write responses in the Student's Guide. Allow 30 min. for this activity.*

Responses may include the following:

- *Goal setting*
- *Empowerment*
- *Recognition*
- *Rewards*
- *Coaching and mentoring (covered in leadership module*))

A. Goal setting

Goal setting is one of the most researched areas of motivation, the basic conclusion is that goals motivate people. A goal is something that a

person tries to attain, achieve, or accomplish. Once a goal is set, behavior is based on the attainment of that goal. Specific goal-setting techniques will be presented later.

Why do goals work?
(*Show OT 7.6.*)

- Goals give an employee direction.
- Goals influence the intensity with which an individual works toward attainment of a goal.
- Goals influence the persistence with which an individual works toward attainment of a goal.
- Goals typically require individuals to develop a strategy for goal attainment.

For goals to be effective motivators, they must have the following characteristics:

1. Goal difficulty (*Show OT 7.7.*)

   Employees become more committed to difficult goals. If a goal is too easy, employees will not seriously commit to goal attainment because there is no challenge.

   However, if the goal is too difficult, employees will not make a commitment because they don't believe they can accomplish the goal.

2. Goal specificity

   The more specific a goal, the easier it is to achieve. Specific goals provide more detailed direction toward attaining that goal.

3. Employee participation in goal setting

   An individual must internalize a given goal before it becomes a motivation. The best way to do this is for the individual to participate in setting the goal. When employees are involved in goal setting, they have a much better understanding of the goal, as well as how to achieve it.

4. Feedback

An individual must know when he or she has achieved a set goal. It is important to have progressive feedback on goal attainment.

B. Empowerment

Employee empowerment is a philosophy of transferring power from management to employees. By doing this, employees become more involved in their work and accept responsibility for their actions. Employees will be more motivated to do quality work if they have been involved in critical decisions and have a sense of ownership in the job.

Even though empowerment is a strategy that affects the entire organization, the basic empowering relationship is between a supervisor and subordinate. It is the immediate supervisor who transfers power to an employee.

The steps toward empowerment are listed below: (*Show OT 7.8*.)

1. Develop an operational definition of empowerment. The definition should be very clear as to what empowerment means from both the manager's perspective and the employee's perspective. The goals and objectives of empowerment should be stated clearly and be behaviorally based in order to evaluate the success of any intervention.

2. Assess strategies used to empower employees. Identify techniques that would be appropriate for your group. This list will be tentative and will be refined as more information is gathered. Techniques include participative decision making, job enrichment, redesign of internal processes, etc.

3. Clarify and communicate organization/division mission. (*Show OT 7.9*.) An underlying assumption in empowering employees is that their actions will support the company's goals and objectives. To ensure that this happens, employees need to be very clear on the company's goals and objectives. All employees should know what their mission is and how it fits into the overall mission of the organization.

   The goals and objectives of the division should be concrete and expressed as specific outcomes to be achieved. Employees will need some guidelines for the decisions they will be asked to make. The division goals and objectives provide global guidance.

4. Determine the boundaries and limitations of each strategy used. Decisions can be classified into executive decisions and operational decisions. Executive decisions involve the overall mission of the organization, the political climate, and the global strategy. Operational decisions are day-to-day decisions made in developing the "product." It is important to know which decisions employees will be able to make on their own.

   There are also organizational and regulatory restrictions in decision making that must be clarified. These decisions include fiscal decisions, standard operating procedures within the organization, restrictions imposed by DOE, etc. Identifying decisions that are not appropriate for participative decision making will narrow down those decisions that are appropriate.

5. Assuming participative decision making is to be used, determine what decisions are appropriate to delegate. Once boundaries and limitations are defined, come up with a tentative outline for the types of decisions that are appropriate for sharing with employees and those that are not appropriate. This outline is tentative and requires input from other managers, employees, and the administration prior to being implemented.

6. Decide whether empowerment strategies will be required or voluntary. Will a manager or employee have a choice of whether he/she will participate? What degree of delegation/empowerment will be required?

7. Communicate the tentative plan to managers, supervisors, and the administration. Prior to getting input from employees, get initial input from managers, supervisors, and the administration. This information will help determine the feasibility of employee empowerment.

8. Get input from employees. Find out their concept of empowerment. Determine to what degree employees already feel empowered. This can be done through a survey (preferably anonymously). This step is risky because it can raise expectations. This should only be done if you have definite plans to proceed. However, it should be done prior to developing an elaborate strategy for empowering employees.

   If the goal of empowerment is motivational, you have to find out what the employees want. On the other hand, if the goal of empowerment is to reduce the work load of middle management, you have to get employee buy-in; otherwise, it will flop.

9. Determine skills necessary for empowerment. It cannot be assumed that managers and employees have the skills necessary to transfer power. The first step is to determine what skills are necessary for shifting power. Managers will need the skills necessary to determine what decisions are appropriate for staff to make.

   Employees must know how to make decisions, how to prioritize, when not to make decisions, what the boundaries are, etc. Once the skills have been identified, it is important to know who has the requisite skills and who doesn't. Some type of assessment is necessary.

10. Communicate plan to employees and provide a mechanism for feedback. Introduction to the plan should be low-key and not raise expectations. Consider having each program, or supervisor, communicate the plan as opposed to an announcement from the division office. This will help keep the focus on the program.

11. Provide training if needed. Based on the assessment of skills, training may be necessary for those managers and employees lacking requisite skills.

C. What other tools could be used to motivate employees?

   (*Students will brainstorm a list. List on flip chart.*
   Encourage students to write the list in the Student's Guide.

   Summarize lesson.

   Ask for questions.

   Review objectives.)

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DEPARTMENT OF ENERGY	**LESSON PLAN**
Course Material	Topic: Leadership

Objectives:

Upon completion of this training, the student will be able to do the following:

1. Identify leadership issues faced by radiological worker supervisors.
2. Identify characteristics of a good leader.
3. Describe the various types of power and influence in organizations.
4. Identify several tools of leadership.

Training Aids:

Overhead Transparencies (OTs): OT 8.1 - OT 8.10 (May be supplemented or substituted with updated or site-specific information)

Equipment Needs:

Overhead projector

Screen

Flip chart

Markers

Masking tape

Student Materials:

Student's Guide

Student Handouts

References:

Lau & Shani, *Behavior in Organization*, 1992.

Introduction (*Introduce module. State objectives. Show OT 8.1*.)

II. Leadership

(*Ask students to state what their definition of leadership is. Write definitions on flip chart. Comment on the diverse responses.*

Obj. 1 Identify leadership issues faced by radiological worker supervisors.

Refer to the definition of leadership, and ask for examples under each bullet.

Ask students what issues their employees bring to them. List on flip chart.)

A supervisor is more than just a person who sees that a job is conducted and a task completed in accord with directions; he/she is also a leader. The more an organization rewards it's effective leaders, the fewer employee problems they will have.

A. Definition of leadership

Leadership is a process that includes influencing:

- The objectives and strategies of a group or organization
- People in the organization to implement the strategies and achieve the objectives
- Group maintenance and identification
- The culture of the organization.

B. Characteristics of good leadership

(*Show OT 8.2. Obj. 2 Identify characteristics of a good leader*.)

The characteristics of good leadership can be placed in the following categories:

- Leadership traits
- Motives of leaders
- Leadership skills

1. Leadership traits (*Show OT 8.3*)
    - High energy level
    - Stress tolerance
    - Integrity
    - Emotional maturity
    - Self-confidence
2. Motives of leaders (*Show OT 8.4*)
    - Need for power
    - Need for achievement
    - Need for affiliation
3. Effective leadership skills (*Show OT 8.5*)
    - Planning and organizing
    - Problem solving
    - Clarifying and monitoring
    - Informing
    - Motivating and consulting
    - Recognizing and supporting
    - Team building, networking, and delegating
    - Developing and mentoring
    - Rewarding

(*Show OT 8.6. This section should be followed by a discussion of what the students believe the characteristics of a good leader to be*.)

C. Power/influence

1. Types of power

(*Show OT 8.7. Obj. 3 List the various types of power and influence in organizations*.)

- Legitimate power - Supervisors have legitimate power based on their position in the organization.
- Coercive power - Supervisors have coercive power based on their control (real or perceived) over punishment.
- Reward power - Supervisors have reward power based on their control (real or perceived) over rewards.
- Expert power - Supervisors have expert power based on their level of technical expertise.

(*This section should be followed by a discussion on how students believe power influences leadership*.)

2. Influence tactics include the following:
   (*Show OT 8.8*.)
   - Rational persuasion
   - Inspirational appeals
   - Consultation
   - Ingratiating
   - Personal appeals
   - Upward appeals

III. Tools of leadership

(*Show OT 8.9. Obj. 4 Identify several tools of leadership*.)

A. Providing vision

A good leader provides vision for the work unit. The vision is a clear, concise view of what the work unit is striving to accomplish. The vision for the work unit should be consistent with the vision of the organization.

Ideally, the vision for the work unit will be developed with input by the work unit.

If a vision is clearly stated and accepted by the work unit, it becomes a goal of each member of the unit.

B. Coaching/mentoring

One of the roles of a leader is to develop his or her workers. Leaders are in the best position to see individual efforts and how they help to achieve or hinder goals. By coaching or mentoring, a leader can guide a worker toward goal attainment.

Coaching and mentoring include the following:

- Help each worker set goals and identify barriers to overcome.
- Solicit ideas and assistance from workers in solving problems that arise in the organization.
- Know the deficiencies of employees and develop a plan for them to acquire the knowledge and skill needed. Feedback and training will facilitate development of employee knowledge and skills.
- Reinforce positive behavior changes that increase productivity.

C. Delegating

Part of a leader's role is to delegate tasks and decisions to employees. The level of delegation typically depends on one's style of leadership. Some leaders feel comfortable in delegating responsibility along with the delegated tasks, while others feel more comfortable delegating only the task.

Prior to delegating, a leader must consider the following:

- Is the employee capable of completing the assigned task?
- Does the employee have the necessary resources to complete the task (human resources, financial resources, training)?
- What are the consequences of failure? The supervisor will have to assess the level of risk in the task and determine whether the organization can assume the risk of error.

- What type of supervision is necessary? The supervisor should decide how closely he or she should be involved. This will be contingent on the competency of the employee, the level of risk associated with the task, and the leadership style of the supervisor.

(*Ask students for other items that might need to be considered prior to delegating. List on flip chart*.)

D. Team building

An effective way of leading a group of individuals is to allow them to lead themselves. The use of self-managed work teams can be an effective way to motivate employees to work more efficiently and to work together.

The concept of self-managed work teams focuses on the team member as the expert. By allowing the team to make and implement decisions, decisions are being made by those individuals with the most knowledge and experience.

The following organizational context factors will increase the likelihood of success for teams:

(*Show OT 8.10. Review and discuss page 6 of Student Handout "Supervisor's Responsibilities".)*

- Management support
- Mission clarity
- Autonomy
- Rewards for the team
- Team training
- Feedback on performance
- Organization culture conducive to teamwork
- Appropriate physical facility

The following team development factors will increase the likelihood of success:

- Communication
- Cohesion
- Developed norms
- Role clarity
- Cooperation
- Participation
- Conflict resolution

(*Summarize lesson.*

Ask for questions.

Review objectives.)

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Part 4 of 5

Radiological Worker Training Appendix A
Radiological Control Training for Supervisors
DOE-HDBK-1130-2008

Student's Guide

Office of Health, Safety, and Security
U.S. Department of Energy

Table of Contents

Page

I. Introduction

II. DOE radiological health and safety

A. Policy (some key points in summary)

- Conduct oversight to ensure Departmental requirements are being complied with and appropriate radiological work practices are being implemented.

- Ensure radiological measurements, analyses, worker monitoring results, and estimates of public exposures are accurate and appropriately made.

- Incorporate dose reduction, contamination reduction, and waste minimization features into the design of new facilities and significant modifications to existing facilities in the earliest planning stages.

- Establish and maintain, from the lowest to the highest levels, line management involvement and accountability for Departmental radiological performance.

- Establish and maintain a system of regulatory policy and guidance.

- Ensure appropriate training is developed and delivered and the technical competence of the DOE workforce and their technical competence.

- Conduct radiological operations in a manner that controls the spread of radioactive materials and reduces exposure to the work force and the general public and utilizes a process that seeks exposure level as low as reasonably achievable (ALARA).

B. History

DOE has provided numerous written standards for on-site radiological protection, the most recent regulation being 10 CFR Part 835, *Occupational Radiation Protection*. This regulation was preceded by:

- DOE Notice 5480.6 of June 17, 1992, *Radiological Control*, which specified that the *DOE Radiological Control Manual* (DOE/EH-0256T) would supersede DOE Order 5480.11.

- DOE Order 5480.11, *Radiation Protection for Occupational Workers* (effective December, 1988). The purpose was to establish radiation protection standards and program requirements for DOE and DOE contractors for the protection of workers from ionizing radiation.

The establishment of DOE radiological protection standards did not start with these documents. A chronology of dose limits of DOE and its predecessor agencies, the Atomic Energy Commission (1946-1975) and the Energy Research and Development Administration (1975-1977), demonstrate a lowering of whole body dose limits over the last 50 years.

In the establishment of these dose limits, DOE has followed recommendations of national and international radiological protection groups, notably the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP).

C. Hierarchy of requirements

Currently within DOE there are two parallel hierarchies of requirements:

- Rules and/or regulations (these terms are used interchangeably in this training)

- DOE Orders

Rules are codified in the Code of Federal Regulations (CFR) and may be subject to enforcement action including civil and criminal penalties. DOE Orders are contractually implemented and enforced through an award/fee contractual arrangement between DOE and the contractor.

III. Rules and regulations

In response to the enforcement authority in the Price-Anderson Amendments Act (PAAA) of 1988, DOE is converting its contractual requirement in orders to enforceable rules to enhance contractor accountability for safety.

10 CFR 830 governs the conduct of DOE contractors, DOE personnel, and other persons conducting activities (including providing items and services) that affect, or may affect, the safety of DOE nuclear facilities. It includes quality assurance requirements and Technical Safety Requirements.

A. DOE enforcement of rules under PAAA

10 CFR Part 820 (effective on September 16, 1993) sets forth the procedures to implement the provisions of the PAAA. Part 820 requires contractors to comply with DOE Nuclear Safety Requirements.

PAAA demands a "large stick" to enhance contractor accountability for safety. Rules provide authority for the assessment of civil and criminal penalties and thus provide the large stick

B. Penalties under Part 820

1. Civil penalties

   DOE may assess civil penalties against any person subject to Part 820, for violations of:

   - Codified rules in the CFR
   - Compliance orders
   - Any program or plan required by a rule or compliance order

   Note: Certain nonprofit educational institutions and other listed institutions are exempt from assessment of civil penalties.

2. Criminal penalties

   If a person subject to the Atomic Energy Act of 1954, as amended, or Nuclear Safety Requirements, has by action or omission knowingly and willfully violated, caused to be violated, attempted to violate, or conspired to violate any section of the Atomic Energy Act of 1954, as amended, or applicable DOE Nuclear Safety Requirements, the person shall be subject to criminal sanctions.

3. The "carrot and stick" approach

   DOE may provide monetary incentives in its management and operating (M&O) contracts for actions consistent with or exceeding requirements, and to penalize actions and activities that were not in compliance with requirements.

Noncompliance with the Radiation Protection Program can subject a contractor to PAAA enforcement. There are provisions to mitigate penalties for self-identifying and reporting violations.

C. DOE Nuclear Safety Requirements

DOE Nuclear Safety Requirements are the set of enforceable rules, regulations, or orders relating to nuclear safety that have been adopted by DOE (or by another agency if DOE specifically identifies it).

Compliance orders are issued by the Secretary. They identify a situation that violates, potentially violates, or otherwise is inconsistent with the:

- Atomic Energy Act of 1954, as amended
- Nuclear statutes
- Nuclear Safety Requirements

Compliance orders:

- Mandate a remedy or other action
- States the reason for the remedy or other action

D. 10 CFR Part 835

On December 14, 1993, DOE published a final rule in the *Federal Register* (58 FR 65458) Title 10 Code of Federal Regulations Part 835, *Occupational Radiation Protection* (10 CFR 835). On June 8, 2007, the latest amendment to 10 CFR 835 was published in the *Federal Register* (72 FR 31904).

The purpose of 10 CFR 835 is the codification of radiological protection requirements. It contains “shall” statements, which are legally binding. It also contains:

- Prescriptive language
- Added emphasis on ALARA
- Requirements for a Radiation Protection Program (RPP)
- Federal law
- Criminal and civil penalties for violations

E. Radiation Protection Program (10 CFR Part 835)

Each site, under Part 835, must submit to DOE a written Radiation Protection Program (RPP). The cognizant DOE program office reviews submitted RPPs for approval.

The RPP requires careful consideration because noncompliance may subject a contractor to PAAA enforcement

F. Guidance documents for 10 CFR Part 835

Two types of regulatory guidance documents have been developed:

- Guidance for implementing the provisions of 10 CFR Part 835.
- Guidance providing technical positions.

The above are available through the DOE HS-11 website at:

http://www.hss.energy.gov/HealthSafety/WSHP/radiation/regs.htm

Unlike the requirements specifically set forth in 10 CFR Part 835, the provisions in guidance documents are not mandatory. They are intended solely to describe the rationale for, and the objectives of, regulatory requirements and/or to identify acceptable methods for implementing regulatory requirements.

Failure to follow a guidance document does not in itself indicate noncompliance with a specific requirement of the rule. A finding of noncompliance is found for a failure to satisfy the regulatory requirement.

Following a guidance document in the prescribed manner will ordinarily create a presumption of compliance with a related regulatory requirement.

1. Technical guidance

   Technical guidance describes and disseminates technical methods and techniques for fulfilling implementation and, in turn, the requirements in 10 CFR Part 835. Examples of these guidance are DOE Technical Standards and DOE Radiological Control Technical Positions (RCTPs).

2. Implementation guide (IG)

Implementation guidance is intended to identify and make available to DOE contractors basic program elements and acceptable methods for implementing specific provisions of the final rule. An implementation guide has been developed for 10 CFR Part 835.

G. Relationship between 10 CFR Part 835 and 10 CFR Part 20

10 CFR Part 20 is the occupational radiological regulation issued by the Nuclear Regulatory Commission (NRC).

The question of consistency among federal agencies in their occupational radiological protection regulations became a major point of discussion during the rule making process.

While agreeing with the goal of consistency, DOE believes that it must promulgate its own regulations because of the unique nature and diversity of radiological activities within the DOE complex. The final rule allows DOE to establish more rigorous requirements in areas of particular concern. Overall 10 CFR Part 835 has many similarities as 10 CFR Part 20.

IV. DOE STD *Radiological Control*

A. *Radiological Control*

In January 1992, a memorandum was sent to the heads of DOE elements involved in managing radiological control programs. In the memorandum, the Secretary directed a series of initiatives to enhance the conduct of radiological operations within the Department of Energy. Also in this memo, the Assistant Secretary of Environment, Safety and Health was directed to develop a comprehensive and definitive radiological control manual. The *DOE Radiological Control Manual* was developed to meet that directive and was approved by the Secretary and promulgated with DOE Notice 5480.6, *Radiological Control*, in July 1992.

After the issuance of 10 CFR 835 as a final rule in December 1993, DOE Notice N441.1, *Radiological Protection for DOE Activities*, was issued on 9-30-95. This cancelled the notice which made the Radiological Control Manual a requirements document. However, the notice stated that "cancelled orders that are incorporated by reference in a contract shall remain in effect until the contract is modified to delete the reference.

N441.1 also retained some of the radiation protection requirements from the Radiological Control Manual that were not included in 10 CFR 835.

In July, 1999, the Radiological Control Manual was replaced by the standard, DOE-STD-1098-99, *Radiological Control*. Many DOE sites contractually must still adhere to the provisions of either the Radiological Control Manual or the Radiological Control Standard. Subsequent to the 1998 amendment to 10 CFR 835, the effective date of N441.1 has passed.

The DOE Radiological Control Standard is not regulatory in nature. It is a guidance document that describes DOE's policy and expectations for an excellent radiological control program**.**

1. Implementation

   If a site fully implements a provision of the DOE Radiological Control Standard, the user will have most likely complied with any related statutory, regulatory, or contractual requirements. Users are cautioned that they must review the source document (10 CFR 835) to ensure compliance.

2. Enforceability

   When incorporated into contracts, the provisions of the DOE Radiological Control Standard or Manual are binding requirements.

   If portions of the Site-Specific Radiological Control Manual are incorporated in the RPP under Part 835 and approved by DOE, they are also binding.

B. The Site-Specific Radiological Control Manual

- The DOE Radiological Control Standard states that a Site-Specific Radiological Control Manual should be written and followed.

C. Relationship between 10 CFR Part 835 and the DOE Radiological Control Standard

1. Compliance

   - The Office of Enforcement (HS - 40) will enforce 10 CFR Part 835. It can assess fines and penalties.

- The Program Offices will audit for both compliance with 10 CFR 835 and contractual agreements including the DOE Radiological Control Standard or Manual, Orders, etc. Results of these audits can affect the contractor's award fee.

2. What if there are conflicts?

10 CFR Part 835 takes precedence over the DOE Radiological Control Standard and DOE orders. It is unlikely that there will be a conflict between the two documents, although one document may contain provisions that are not addressed in the other.

It is planned that all requirements for nuclear safety will be incorporated into rules.

3. "Shall" and "should" statements

- 10 CFR Part 835 contains "shall" statements. "Shall" statements in Part 835 are legally binding.

  Processes for exemption relief from Part 835 are set forth in Subpart E to Part 820. If relief is requested from provisions of Part 835, the exemption must be considered and granted, if appropriate, by the Chief Health, Safety and Security Officer (HS - 1).

- The use of "should" in the DOE Radiological Control Standard recognizes that there may be site- or facility-specific attributes that warrant special treatment. It also recognizes that literal compliance with the elements and requirements of the provision may not achieve the desired level of radiological control performance.

D. DOE Standards

DOE has developed several technical standards for occupational radiation protection. Depending on the site-specific application, some standards are required to be followed. For example, sites which need to monitor individual external exposures to ionizing radiation need to follow the DOE Laboratory Accreditation Program (DOELAP) standards. Other standards may be incorporated by reference in the site RPP.

Other standards provide technical guidance on specific applications, but adherence to the standard may not be required.

E. Other Safety Policy and Orders

In addition to the occupational radiation protection requirements and recommendations previously discussed, DOE has established requirements for worker protection from other hazards. Some of these include:

- DOE P 411.1 Safety Management Functions, Responsibilities, and Authorities Policy
- 10 CFR 851 Worker Safety and Health Program
- 10 CFR 850 Chronic Beryllium Disease Prevention Program

V. Defense Nuclear Facilities Safety Board

A. Establishment

The Atomic Energy Act of 1954 was amended by adding Chapter 21, Defense Nuclear Facilities Safety Board (DNFSB). This amendment established an independent board in the executive branch to provide oversight of some DOE operations at DOE facilities and sites.

B. Members

The DNFSB consists of five members appointed by the President with consent of the Senate.

The Board shall:

- Review and evaluate standards
- Investigate any event or practice at a DOE defense nuclear facility that the Board determines has adversely affected or may adversely affect public health and safety.

The Board may:

- Establish reporting requirements for the Secretary of Energy

By evaluating how well DOE meets its objectives, the DNFSB helps DOE achieve and maintain excellence in radiological protection.

C. Secretary of Energy

The Secretary of Energy shall fully cooperate with the Board.

D. DNFSB Recommendations

DNFSB provides DOE with recommendations for improving safety at DOE defense nuclear facilities. Examples include:

DNFSB Recommendation 91-6 dealt with radiological protection concerns throughout the DOE defense nuclear facilities complex, and identified several actions to be taken by the Department to improve radiological protection performance.

DNFSB Recommendation 92-7 dealt with training and qualification at DOE sites and facilities.

DNFSB Recommendation 98-1 dealt with resolution of internal audit findings.

DNFSB Recommendation 99-1 dealt with safe storage of fissionable materials.

Implementation of DOE and site commitments made in response to DNFSB recommendations are areas to review during an assessment.

I. Introduction

This module provides an overview of many of the provisions of 10 CFR 835. For completeness, individuals should always reference back to 10 CFR 835 for the complete text.

II. Outline of 10 CFR Part 835

Part 835 is the codification of radiological protection requirements. Part 835 contains 14 subparts and five appendices. The outline consists of the following subparts:

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
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

Under 10 CFR Part 835, each site must submit a Radiation Protection Program (RPP).

Part 835 helps to ensure that DOE facilities are operated in a manner such that occupational radiological exposure of workers is maintained within acceptable limits and as low as is reasonably achievable (ALARA).

A. Subpart A - General Provisions

Subpart A contains the scope of the rule. The rule in this part establishes radiological protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.

It also includes activities excluded from the provisions of the rule. Activities that are excluded include the following (summarized):

- Activities regulated through a license by the Nuclear Regulatory Commission (NRC) or a state under an agreement with the NRC.
- Activities conducted under the authority of the Director, Naval Nuclear Propulsion Program.
- Specified activities conducted under the Nuclear Explosives and Weapons Surety Program.
- DOE activities in other countries with acceptable radiation protection program.
- Background radiation.
- Radioactive material on or within material, equipment, and real property which is approved for release when the radiological conditions of the material, equipment, and real property have been documented to comply with the criteria for release set forth in a DOE authorized limit which has been approved by a Secretarial Officer in consultation with the Chief Health, Safety and Security Officer.
- Radioactive material transportation not performed by DOE or a DOE contractor.

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).

Subpart A also addresses:

- Definitions
- Radiological units (Curie, rad, roentgen, rem, other conventional units, and multiples)

B. Subpart B - Management and Administrative Requirements

The RPP shall:

- Include formal plans and measures for applying the ALARA process to occupational exposures.

- Specify the existing and/or anticipated operational task.

- Address, but not be limited to, each requirement in Part 835.

- Include plans, schedules, and other measures for achieving compliance.

DOE may direct or make modifications to an RPP. An initial RPP or update shall be considered approved 180 days after its submission unless rejected by DOE at an earlier date.

Internal Audits (10 CFR 835.102)

Internal audits of the radiation protection program, including examination of program content and implementation, shall be conducted through a process that ensures that all functional elements are reviewed no less frequently than every 36 months. This training material and DOE G 441.1.1C provide guidance on DOE's expectations.

Education, Training and Skills (10 CFR 835.103)

Individuals responsible for developing and implementing measures necessary for ensuring compliance with the requirements of this part shall have the appropriate education, training, and skills to discharge these responsibilities. DOE STD-1107-97 *Knowledge, Skills, and Abilities for Key Radiation Protection Positions at DOE Facilities,* provides guidance on DOE's expectations.

Written Procedures (10 CFR 835.104)

Written procedures are required, as necessary, to ensure compliance with 835, commensurate with radiological hazards and education, training and skills of exposed individuals.

C. Subpart C - Standards for Internal and External Exposure

This subpart addresses limits for:

- General employees (occupational)
- Embryos/fetus of declared pregnant worker (i.e., A woman who has voluntarily declared to her employer, in writing, her pregnancy for the purpose of being subject to the occupational dose limits to the embryo/fetus. This declaration may be revoked, in writing, at any time by the declared pregnant worker.)
- Occupationally exposed minors
- General public in a controlled area

It also addresses:

- Planned special exposures
- Nonuniform exposures of the skin
- Concentrations of radioactive material in air

2. Summary of dose limits

   10 CFR Part 835 employs the rem unit for several different physical quantities (i.e. absorbed dose, effective dose, total effective dose, equivalent dose, committed equivalent dose, committed effective dose). For information about these quantities refer to 10 CFR Part 835 definitions. This training will use the term "dose" as a general term for all the above terms.

   These are the Federal limits. DOE encourages sites to adopt more restrictive Administrative Control Levels (ACLs). For most facilities an ACL of 500 mrem or less will be challenging for radiological workers.

Exposed Individual		Annual Limit
General Employee:	Whole Body (internal and external)	5.0 rem
General Employee:	Lens of Eye	15.0 rem
General Employee:	Extremity (below elbow and knees) and skin	50.0 rem
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 (under age 18):		0.1 rem *
Members of the Public in Controlled Areas:		0.1 rem

- And 10% of other general employee limit

2. Planned special exposures (PSEs)

   It is acknowledged that unusual conditions can arise in which well documented higher-than-normal doses can be justified. In these well-planned, well-controlled, and highly infrequent and unusual conditions operating management would be permitted to allow specified individual exposures exceeding the occupational limit.

The term "unusual conditions" is made clear by specifying that alternatives which would preclude exposures higher than the prescribed dose limits must be either unavailable or impractical.

10 CFR 835.204 specifies requirements for annual and lifetime dose from PSEs. It also specifies requirements for determining previous individual exposures prior to allowing a PSE.

Every PSE must be approved in advance by DOE and requires the informed consent of the employee involved.

3. Concentration of radioactive material in air

   Appendices A and C contain the derived air concentration (DAC) values used in the control of occupational exposure to airborne radioactive material.

   DACs are listed in appendices A and C of 10 CFR 835. For intakes (appendix A), 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 m^3).

   The ALI is the smaller value of intake of a given radionuclide in a year by a standardized man that would result in a committed effective doe of 5 rems or a committed equivalent dose of 50 rems to any individual organ or tissue.

   Appendix C contains DACs for controlling external dose from being immersed in a cloud of airborne radioactive material.

   Estimation of internal dose shall be based on bioassay data rather than air concentration values unless bioassay data are:

   - Unavailable (e.g., radon or very short lived radioisotopes)
   - Less accurate than internal dose estimates based on representative air concentration values
   - Inadequate

D. Subpart D - Reserved

E. Subpart E - Monitoring of Individuals and Areas

This subpart addresses:

- General requirements
- Instrumentation
- Individual monitoring - external
- Individual monitoring - internal
- Air monitoring
- Receipt of packages containing radioactive material

1. General requirements (10 CFR 835.401)

   Monitoring of individuals and areas shall be performed to:

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

2. Instrumentation

   Instruments and equipment used for monitoring and contamination control shall be:

   - Periodically maintained and calibrated on an established frequency.

- Appropriate for the type(s), levels, and energies of the radiation(s) encountered.

- Appropriate for existing environmental conditions.

- Routinely tested for operability.

3. Individual monitoring - external (10 CFR 835.402)

   For the purpose of monitoring individual exposure to external radiation, personnel dosimetry shall be provided to and used by:

   - Radiological Workers likely to receive:
     – An effective dose to the whole body of 0.1 rem (100 mrem) or more in a year
     – An equivalent dose to the skin or to any extremity of 5 rem or more in a year
     – An equivalent dose to the lens of the eye of 1.5 rem or more in a year

   - Declared Pregnant Workers who are likely to receive from external sources an equivalent dose to the embryo/fetus in excess of 10 percent of the applicable limit in 10 CFR 835.206(a).

   - Members of the public in a controlled area and occupationally exposed minors likely to receive, in one year, from external sources, a dose in excess of 50 percent of the applicable limit in 10 CFR 835 Subpart C.

   - Individuals entering a High or Very High Radiation Area.

   DOE Laboratory Accreditation for Personnel Dosimetry is required for external dose monitoring programs implemented to demonstrate compliance with 10 CFR 835.

4. Individual monitoring - internal (10 CFR 835.402)

   Internal dose evaluation programs (including routine bioassay programs) shall be conducted for:

- Radiological Workers who, under typical conditions, are likely to receive 0.1 rem or more committed effective dose from all occupational radionuclide intakes in a year.

- Declared Pregnant Workers likely to receive an intake or intakes resulting in an equivalent dose to the embryo/fetus in excess of 10 percent of the limit stated in 10 CFR 835.206(a).

- Members of the public in a controlled area and occupationally exposed minors who are likely to receive a committed effective dose in excess of 50 percent of the applicable limit in 10 CFR 835 Subpart C from all intakes in a year.

DOE Laboratory Accreditation for Radiobioassay is required for internal dose monitoring programs implemented to demonstrate compliance with 10 CFR 835.

5. Air monitoring (10 CFR 835.403)

   Measurements of radioactivity concentrations in the ambient air of the workplace shall be performed as follows:

   - Air sampling shall be performed in occupied areas where an individual is likely to receive an exposure of 40 DAC-hrs or more in a year (i.e. an annual intake of 2 percent or more of the specific ALI value) for the mixture of isotopes.

   - Samples shall be taken as necessary to characterize the levels or concentration of airborne radioactive material when respirators are worn for radiation protection purposes.

   - Real-time air monitoring shall be performed when there is a need to alert potentially exposed individuals to unexpected increases in airborne radioactivity levels such that immediate action is necessary in order to minimize or stop inhalation exposures.

6. Receipt of Packages Containing Radioactive Material (10 CFR 835.405)

   Establishes requirements to monitor certain types of packages and sets a time limit of not later than 8 hours after the beginning of the working day following receipt of the package.

F. Subpart F - Entry Control Program (10 CFR 835.501)

Subpart F addresses entry into:

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

1. Radiological Areas

   The degree of control shall be commensurate with existing and potential radiological hazards within the area.

   One or more of the following methods shall be used to ensure control:

   - Signs and barricades
   - Control devices on entrances
   - Conspicuous visual and/or audible alarms
   - Locked entrance ways
   - Administrative controls

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

2. High Radiation Areas

   A High Radiation Area is an area where radiation levels exist such that an individual could exceed an equivalent dose to the whole body of 0.1 rem in any one hour at 30 centimeters from the source or from any surface that the radiation penetrates.

   If an individual could receive an equivalent dose exceeding 1.0 rem in an hour (at 30 cm), a High Radiation Area shall have one or more of the following:

- A control device that prevents entry to the area when high radiation levels exist or that, upon entry, causes the radiation level to be reduced below that level that defines a High Radiation Area.

- A device that functions automatically to prevent use or operation of the radiation source or field while individuals are in the area.

- A control device that energizes a conspicuous visible or audible alarm signal so that the individual entering the High Radiation Area and the supervisor of the activity are made aware of the entry.

- Entryways that are locked. During periods when access to the area is required, positive control over each entry is maintained.

- Continuous direct or electronic surveillance that is capable of preventing unauthorized entry.

- A control device generating audible and visual alarm signals to alert personnel in the area before use or operation of the radiation source and in sufficient time to permit evacuation of the area or activation of a secondary control device that will prevent use or operation of the source.

3. Very High Radiation Areas

   A Very High Radiation Area is an area in which an individual could receive a dose in excess of 500 rad in one hour at 1 meter from the radiation source or from any surface that the radiation penetrates.

   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."

G. Subpart G - Posting and Labeling

Subpart G addresses the general requirements for signs:

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

In addition, Subpart G addresses specific posting requirements for:

- Controlled Areas
- Radiation Areas
- High Radiation Areas
- Very High Radiation Areas
- Airborne Radioactivity Areas
- Contamination Areas
- High Contamination Areas
- Radioactive Material Areas

This subpart also addresses exceptions to posting and labeling.

H. Subpart H - Records

Subpart H addresses requirements for records documenting compliance with Part 835 and with the Radiation Protection Program.

Records that are specifically required include those necessary to demonstrate compliance with the ALARA provisions of the rule.

10 CFR 835 also requires that certain records be maintained, including records of:

- Individual monitoring
- Sealed source inventory and control
- Results of surveys for the release of material and equipment

- Results of specified monitoring for radiation and radioactive material
- Maintenance and calibration of radiation monitoring instruments
- Internal audits

Each individual's training as a general employee and as a Radiological Worker must be recorded. Where appropriate, demonstration and documentation of proficiency is required.

Refer to 10 CFR 835 Subpart H for a complete listing of required records.

Chapter 13 of DOE G 441.1-1C, *Record-Keeping and Reporting*, provides additional guidance on record-keeping requirements, including reference to DOE O 231.1, Change 2, *Environment, Safety and Health Reporting*, and DOE M 231.1-1, Change 2, *Environment, Safety and Health Reporting Manual*. This order and manual specify radiation protection reporting requirements that may be applicable to the site or facility being assessed.

I. Subpart I - Reports to Individuals (10 CFR 835.801)

Subpart I addresses reports to individuals and their accessibility to reports, including:

On an annual basis, each DOE or DOE contractor-operated site or facility must provide each individual monitored for occupational exposure a radiation dose report of his/her occupational exposure at that site or facility.

Upon the request from an individual terminating employment, records of exposure shall be provided to that individual as soon as the data are available, but not later than 90 days after termination. A written estimate of the radiation dose received by that employee based on available information shall be provided at the time of termination, if requested.

J. Subpart J - Radiation Safety Training

This subpart addresses radiation safety training. The tailored approach to training requirements is based on:

- Unescorted access to or receiving occupational dose in controlled areas (e.g., General Employees)

- Unescorted access to radiological areas or unescorted assignment as Radiological Workers

Requirements of Part 835 include:

- Verification by examination for certain training (e.g., Radiological Worker Training)
- Intervals of training not to exceed twenty four months
- List of topics which must be included in training
- Provisions for limited use of escorts in lieu of training

Chapter 14 of DOE G 441.1-1C, *Radiation Safety Training*, provides additional guidance on DOE's expectations on radiation safety training.

K. Subpart K - Design and Control

Subpart K addresses added emphasis on facility and equipment design and administrative controls to maintain radiological exposures ALARA.

1. Facility design and modifications (10 CFR 835.1001)

   During the design of new facilities or modification of old facilities, the following objectives shall be adopted:

   - Optimal methods shall be used to assure ALARA
   - Maintain exposure levels below an average of 0.5 mrem/hr
   - Avoid release of radioactivity to the workplace atmosphere

- The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and decommissioning

2. Workplace controls (10 CFR 835.1003)

   During routine operations, the combination of engineered and administrative control shall provide that:

- The anticipated occupational dose to general employees shall not exceed the limits

- The ALARA process is utilized for personnel exposures to ionizing radiation

L. Subpart L - Radioactive Contamination Control

1. Control of material and equipment

This section addresses the requirements for release of materials and equipment from radiological areas to controlled areas. Releases to uncontrolled areas are addressed in DOE O 5400.5 and are not addressed in this training. Some of the provisions of 10 CFR 835 Subpart L:

- Specifies conditions for material and equipment in contamination areas (CAs), high contamination areas (HCAs), and airborne radioactivity areas (ARAs) to be released to a controlled area

- Addresses movement of material and equipment with removable surface contamination, on-site from one radiological area for immediate placement in another radiological area

- Specifies conditions for material and equipment with fixed contamination to be released for use in controlled areas outside of radiological areas

Control of Areas (10 CFR 835.1102) addresses

- Prevention of inadvertent transfer or removal of contamination to locations outside radiological areas under normal conditions

- Where contamination levels exceed values in Appendix D, the area is controlled commensurate with hazards

- Areas with fixed contamination exceeding radioactivity values may be located outside radiological areas, provided certain controls, conditions, or provisions are met

- Personnel monitoring for contamination upon exiting CAs, HCAs, or ARAs

- Use of protective clothing in CAs and HCAs

M. Subpart M - Sealed Radioactive Source Control

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

Specifies values (Appendix E) for sources by isotope and Curie content which must be inventoried and leak tested at intervals not to exceed six months.

N. Subpart N - Emergency Exposure Situations

This subpart addresses:

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

Individuals whose occupational exposures have exceeded any limits as a result of an authorized emergency exposure may be permitted to return to work provided that certain conditions are met.

Nuclear accident dosimetry

Nuclear accident dosimetry involves installations possessing sufficient quantities of fissile material to constitute a critical mass, and shall include;

- Method to conduct initial screening of personnel involved
- Method and equipment for analysis of biological materials
- A system of fixed nuclear accident dosimeter units
- Personal nuclear accident dosimeters

I. Introduction

III. A. The RadCon Standard (DOE-STD-1098-2008) is a guidance document that describes DOE's policy and expectations for an excellent radiological control program, including radiation safety training for general employees, radiological workers and Radiological Control Technicians (RCTs).

Radiological safety training

General Employee Radiological Training

Personnel who may routinely enter controlled areas unescorted or receive occupational exposure during access to controlled areas should receive General Employee Radiological Training (GERT). GERT is generally recommended for all employees.

Radiological Worker I and II

- Workers whose job assignments require access to radiological buffer areas and radiation areas should complete Radiological Worker I training.

- Workers whose job assignments involve entry to the following areas should complete Radiological Worker II training:
  - Radiological buffer areas
  - Radiation areas
  - High and very high radiation areas
  - Contamination and high contamination areas
  - Soil contamination areas
  - Airborne radioactivity areas

- Radiological Worker I training is not a prerequisite for Radiological Worker II training.

- The following apply to specialized radiological worker training:
  - Completed for nonroutine operations or work in areas with changing radiological conditions
  - Taken in addition to Radiological Worker II training
  - Recommended for personnel planning, preparing, and performing jobs that have the potential for high radiological consequences

- RCTs – Chapter 6 of the Radiological Control Standard provides guidance on training of RCTs.

B. Radiological Controls Program

Line managers who manage, supervise or provide oversight of a Radiological Controls Program should receive training that is helpful in dealing with workers who have anxiety about radiation. This training should include the following:

- Guidance on handling such personnel interactions
- Emphasis on being factual
- Fundamentals of communicating risks
- Importance of keeping management informed

C. Radiological operations

Conduct radiological operations in a manner that controls the spread of radioactive materials, reduces exposure of the work force and the general public, and utilizes a process that seeks exposure levels that are as low as reasonably achievable.

Responsibilities

1. Supervisors should ensure that orientation, training, and indoctrination reinforce rules and guidelines for each worker to minimize radiation exposure and control radioactivity.

2. Prevention of the spread of radioactivity is less costly than remediation. Management should be willing to accept changes that will improve radiological control and should foster this mindset throughout the organization.

3. Supervisors and managers should encourage the work force to identify radiological control deficiencies and concerns. Prompt action should be taken to address and eliminate identified issues and prevent recurrence.

4. In cases where the work force does not have the required level of sensitivity for radiological work practices, additional management attention is needed to ensure the proper outcome. Actions should include the following:

   - More direct line supervision

- Curtailment of work schedules
- Deferral of work
- Addition of extra radiological control personnel
- Conduct of additional training

5. As part of their normal work review, work supervisors should periodically review ongoing jobs to ensure prescribed radiological controls are being implemented and periodically monitor those work areas.

6. Identify conditions that could lead to or promote the spread of contamination, or unsafe work and ensure corrections are implemented on a priority basis

7. “Stop Radiological Work” authority

   - “Stop Radiological Work” authority may be initiated for the following reasons:
     – Radiological controls are inadequate.
     – Radiological controls not being implemented.
     – Radiological control hold points not being satisfied.
     – Job scope changed.
     – Area conditions changed.

   - Once stopped, work should not be resumed until proper radiological controls have been established.

   - Resumption of radiological work should have the approval of the manager responsible for the work and the Radiological Control Manager.

D. Radiological measurements

Ensure radiological measurements, analyses, worker monitoring results, and estimates of public exposure are accurately and appropriately made and documented.

1. Personnel radiological records include the following:

   - Records of doses received by individuals monitored

- Records containing information to identify individuals

- External dose records shall include the following:
  – Applicable extremity, skin, eye, and whole body dose results
  – Evaluations resulting from anomalous dose results
  – Dose reconstruction
  – Evaluation of nonuniform doses

- Internal dose records shall include the following:
  – Applicable whole body and lung counting results
  – Applicable bioassay results
  – Dose assessment

- Records of equivalent dose to any organ

- Total effective dose on annual bases

- Equivalent dose to embryo/fetus of declared pregnant worker

- Lifetime occupational dose, including cumulative total

- Documented counseling of persons about radiological concerns

- Records for authorization to exceed administrative control levels

- Emergency dose (shall be accounted for separately, but maintained with individual's record)

- Records of dose to skin caused by contamination

- Radiological incidents

- Radiological safety concerns, formally investigated

- Records of formal written declaration of pregnancy

2. Internal monitoring

   - Baseline bioassay monitoring of personnel who are likely to receive intakes resulting in a committed effective dose of 100 mrem or more shall be conducted. This must be done before beginning any work that may expose them to internal radiation exposure.

- Management should require termination bioassay monitoring when a person who participated in the bioassay program terminates employment or concludes work that involves the potential for internal exposure.

- Bioassay analyses (routine bioassay) are performed at site specified frequencies following certain work activities

- Bioassay analyses (special bioassay) should be performed when any of the following occur:

    - Facial or nasal contamination is detected that indicates the potential for internal contamination.
    - Airborne monitoring indicates the potential for intakes exceeding 100 mrem committed effective dose.
    - Any contaminated wound.
    - Contamination on protective clothing, skin or facial area or unplanned spread of contamination on accessible areas above site specified thresholds.
    - Detectable contamination inside a respirator after its removal.
    - The Radiological Control Organization directs that bioassay analyses be performed when an intake is suspected.

E. Reducing exposure

Incorporate dose reduction, contamination reduction, and waste minimization features into the design of new facilities, or modification of existing facilities.

1. Maintenance and modification plans and procedures should be reviewed to identify and incorporate radiological requirements, such as the following:

    - Engineered controls

    - Dose reduction considerations

    - Contamination reduction considerations

F. Radiological performance

Establish and maintain, from the lowest to the highest levels, line management involvement and accountability for Departmental radiological performance.

1. Radiological performance goals

    - Goals are intended as a measure of and a motivation for improvement, and not an end in themselves.

    - Performance goals should have these characteristics:
        – Measurable
        – Achievable
        – Auditable
        – Challenging
        – Meaningful in promoting improvement

    - Goals need to be developed primarily by those responsible for performing the work.

    - Site-specific goals need to be developed.

2. Performance indicators

        - Performance indicators should be used as tools to assist management in focusing their priorities and attention.
        - Performance indicators should be tracked and trended for the prior 12-month period.
        - To promote worker awareness of their radiation exposure status, selected indicators related to their work group should be posted in the workplace.
        - Site-specific indicator status reports should be tracked.

I. Introduction

II. Overview

The workers participate in the organization radiation protection program and have some responsibility to protect themselves, however, they must rely upon the organization to provide a safe work environment, minimize exposure, and provide adequate training.

The first line supervisor has the final responsibility that supervised workers are fit and prepared for their work in radiological areas. Supervisors should not assume that the organization has assured that the worker is adequately trained and physically and mentally ready for the work. This responsibility, in addition to seeing that the job or task is completed properly, is placed upon the supervisor.

III. Work force

To maintain a healthy work force, it is imperative that individual employees arrive at the workplace mentally and physically prepared to act in a safe and effective manner. Problems that raise doubt regarding an employee's ability to act in a safe manner must be dealt with in a straightforward process that encourages the employee to seek the help needed and ensure that the safety of all workers is maintained. Such problems may include alcoholism, drug abuse, mental health disorders, and personal crises.

For the radiological workers, there are additional considerations that may also affect a worker's fitness for duty. These may include the ability to wear respiratory protection, pregnancies, exceeding exposure limits, and heat stress during work in protective clothing. Supervisors of radiological workers must be conscious of these considerations to ensure that their employees are able to perform radiological work in a safe and effective manner.

IV. Training/qualification

Radiological workers should be sufficiently qualified to recognize the symptoms of deteriorating radiological conditions and seek advice from Radiological Control Technicians and their supervisors.

Training requirements have been established to ensure that personnel have the training to work safely in and around radiological areas and to maintain exposure as low as reasonably achievable.

Examinations for Radiological Worker I and II training, and Radiological Control Technician Qualification shall be used to demonstrate satisfactory completion of theoretical and classroom material. Examinations should be written. However, alternatives may be used to accommodate special needs.

In addition, workers may need job-specific radiological training including specific procedure and hands-on tools/equipment training.

Formal records of training and qualification shall be readily available to first line supervisors of involved personnel to aid in making work assignments.

V. Dose limits and control levels

A. General

Dose limits provided in Subpart C of 10 CFR 835 shall not be exceeded. Administrative control levels are established to maintain personnel radiation exposure well below regulatory dose limits. These levels are multitiered. Increasing levels of authority are required to approve higher administrative control levels. Special consideration must be taken for radiological workers who are approaching administrative control levels.

B. Lifetime control levels

To administratively control a worker's lifetime occupational radiation exposure, a lifetime control level of N rem should be established where N is the age of the person in years. Special control levels (see Article 216 of RadCon Standard) should be established for personnel who have doses exceeding N rem.

A special control level for annual occupational exposure shall be established for each person with a lifetime occupational dose exceeding N rem. The special control level should not exceed 1 rem in a year and should allow the person's lifetime occupational dose to approach N rem as additional occupational exposure is received.

C. Medical exposures

An employer should be attentive to special circumstances of employees, such as those undergoing radiation therapy, and should establish an appropriate special control level.

D. Off-site exposures

Workers are responsible for notifying radiological control personnel of off-site occupational exposures so that individual dosimetry records can be updated.

VI. Declared pregnant employee

A. Notification of employer

After a female radiological worker voluntarily notifies her employer in writing that she is pregnant, for the purposes of embryo/fetal dose protection, she shall be considered a declared pregnant worker. Declarations of pregnancy may be revoked, in writing, by the declared pregnant employee at any time.

1. The employer should provide the option of a mutually agreeable reassignment of work tasks, without loss of pay or promotional opportunity, so that further occupational radiation exposure is unlikely.

2. For a declared pregnant worker who chooses to continue working as a radiological worker the following apply:

   - The dose limit for the embryo/fetus for the entire gestation period shall be no greater than 500 mrem.

   - Substantial variation above a uniform exposure rate that would satisfy the limits shall be avoided (e.g. 50 mrem/month).

3. If the dose to the embryo/fetus is determined to have already exceeded 500 mrem when a worker notifies her employer of her pregnancy, the worker shall not be assigned to tasks where additional occupational radiation exposure is likely during the remainder of the gestation period.

VII. Respirator protection

There are three main requirements that must be met by personnel prior to being issued a respirator. Personnel must be trained, fitted, and medically qualified to wear that specific type of respirator. Training and qualification testing shall be performed annually.

A. Respirator use

While using respiratory protection, personnel are expected to:

1. Perform fit checks of their respirators to ensure a proper seal before entering areas requiring respirator use.

2. Be clean shaven in the area of the fit.

3. Use corrective lenses, if needed, that are approved for respirators.

4. Be instructed to leave the work area when experiencing respirator failure.

5. Be instructed to remove their respirators to avoid life-threatening situations when exiting an area after respirator failure.

B. Exposure to airborne radioactive materials

10 CFR 835 establishes dose limits which includes internal dose from inhaling radioactive material. Use of engineering and administrative controls and proper use of personal protective equipment results in most planned internal doses being very low.

In cases of unplanned internal doses, potential intakes of radioactive material are suspected when personnel without respiratory protection are exposed to airborne radioactive materials or when respiratory protection has been compromised. If unplanned intakes of radioactive material are indicated that could result in a committed effective dose of 100 mrem or more, the following actions should be taken:

1. Identify personnel potentially exposed.

2. Determine the duration of potential exposure to airborne radioactivity.

3. Have dose evaluated prior to permitting the worker to return to radiological work.

VIII. Adverse work conditions

A. Heat stress

Heat stress may result from working in areas of high temperature, humidity, and radiant heat; working in protective clothing; and using respirators, particularly where other protective equipment is required. Heat stress has occurred at ambient temperatures less than 70^{o}F when multiple sets of protective clothing or plastic suits were in use or strenuous work was involved.

1. Heat stress controls should be addressed in the planning stages for work.

2. Recommended work time limits and use of body cooling devices should be considered to reduce heat stress.

3. Job supervisors should inform their personnel of heat stress precautions prior to work on job assignments where heat stress may be a factor.

4. If a person begins to feel symptoms of heat stress, the person should immediately notify the nearest coworker, exit the area, remove personal protective equipment, notify the supervisor, and rest in a cool area. In such cases, medical assistance should be provided.

B. Other adverse physical conditions

Medical treatment of injuries takes precedence over radiological considerations. A worker with a contaminated injury should receive treatment by medically qualified personnel. An assessment should be made on the need for bioassay monitoring or further medical treatment. Until this assessment is completed, work restrictions may be needed. The worker should be counseled promptly on the medical and radiological implications resulting from the contaminated wound.

IX. Group activity

I. Introduction

II. Communication

A. Communicating is one of the basic functions human beings must perform. Since it is basic, often it is assumed that everyone communicates proficiently. That is not always the case. Often, everyday problems can be traced back to communication as a primary or contributing cause.

III. Interpersonal communication

A. Communication styles

Studies show that people tend to communicate in a style that best suits their given personality. There are many personality trait assessments available that give us a better understanding of who we are. Some examples are Myers-Briggs, Herman's Brain Dominance, and Birkman Methods.

B. The communication process

1. Sender's filters

- The sender has an idea that must be transmitted to a receiver.
- Perceptions, assumptions, attitudes, and past experiences are filters through which the sender's messages must travel. These can distort the idea.
- The sender's message is the focus of the process. It must have an objective (i.e., deliver information, motivate, stimulate, get/provide feedback). It must be concise, logical, and clear.

2. Receiver's filters

- Similar to the sender, the receiver has his/her own filters that can also distort the message.

3. Understanding the message

- It is not the logic of the sender's message that is important, but the logic of the received message. The sender must consider *how his message will sound to the receiver.*

- The accuracy of message interpretation depends upon how well the sender projects the intent, motivation, values, and emotions of the message.

4. Medium

   - The medium used for communication can definitely distort the message.

C. Barriers/filters

1. Five types of communication barriers/filters

   - There are two categories of social barriers:
     – Verbal - The use of words with emotional content can interfere with the reception of the intended message (e.g., politics, religion, race).
     – Nonverbal - Nonverbal barriers are usually involuntary or symbolic (e.g., clothes, grooming, or office setup).

   - Physical barriers include elements such as noise, distance, data overload, time, media, handicaps, etc.

   - Psychological barriers include elements such as tendency to smother information, difference in opinion, lack of trust, assumptions, attitudes, stress, and attention level.

   - Individual barriers include elements such as needs, beliefs, education, religion, socioeconomics, culture, values, and self-concept.

   - Neurological barriers occur as a result of the way the nervous system filters, distorts, deletes, and interprets information.

D. Listening skills

1. What is the role of the receiver in regard to listening?

2. Types of listening

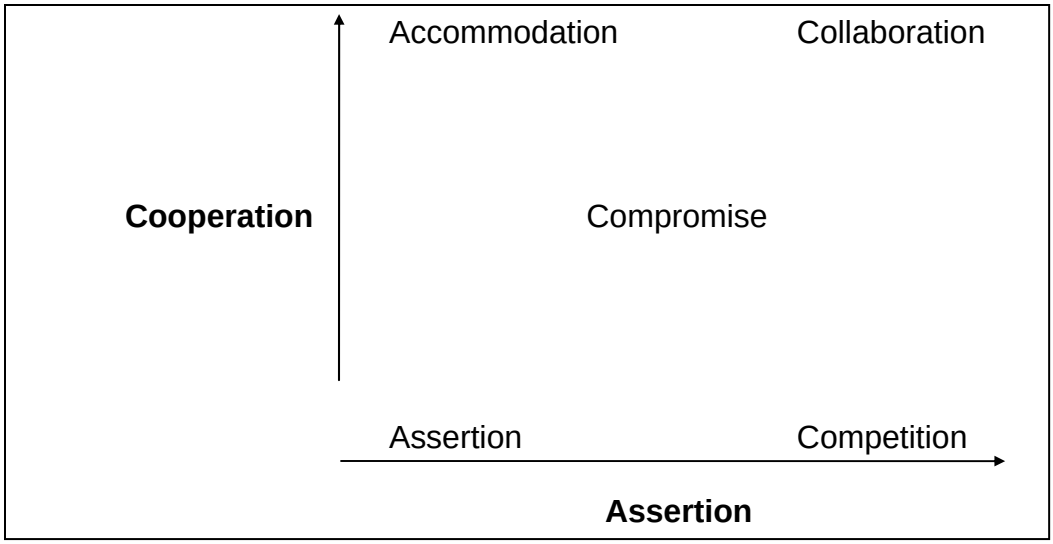
3. Deterrents to effective listening

4. Elements of active listening

E. Dealing with confrontation

Whenever people come together in any environment, there will be opportunities for confrontation. Confrontation can either stimulate or demoralize individuals. As a supervisor, it is essential that you learn how to deal with these situations appropriately.

Following is a model that illustrates the various approaches to deal with conflict.



1. There are many styles of conflict management:

   - Avoidance - This style is considered the least cooperative and the least assertive. In this situation, conflict is not addressed. As a short-term strategy, it may work, but as a permanent strategy, problems may never get solved.

   - Accommodation - This style is characterized by cooperative, unassertive behavior. It means to place the needs and concerns of others above your own needs and concerns.

   - Competition - This style is considered the most assertive. It reflects one's desire to meet his or her needs at the expense of others.

   - Compromise - This style is between competition and collaboration and avoidance and accommodation. The objective is partial fulfillment of the needs, concerns, and goals of all parties concerned. The solution should be mutually acceptable and partially satisfying to everyone involved. Nobody wins and nobody loses.

- Collaboration - This style uses both cooperation and assertiveness in an effort to satisfy the needs of all parties concerned. Collaboration includes the following:

  – Acknowledgment that conflict exists
  – Identification and acknowledgment of others' needs, concerns, and goals
  – Identification of alternative resolutions and consequences for each party involved
  – Selection of the alternative that meets the needs and concerns of all parties
  – Implementation of the alternative selected

2. Effective conflict resolution

   For effective conflict resolution, establish rules in advance. Rules might include the following:

   - When controversy arises, have one party who is not directly involved state the issues before further discussion is allowed.

   - All parties must agree on the problem and specifically identify the common goal or solution.

   - Each party must be able to restate the other's position to the satisfaction of the individual before any evaluation discussion is allowed.

   - All parties will identify and agree upon the criteria to be used in resolving the controversy.

   In conflict resolution, it is important to focus on issues--not people. When conflicts arise, keep the focus on the issues and not on the personalities involved.

   The key to reaching collaboration is effective communication. The key to communication is trust, and the key to trust is honesty.

IV. Risk communication

A. Communicating risk

Due to the continuing concerns related to low-level radiation exposure and health effects, managers should be trained to deal with the perceptions that personnel have concerning radiation risks. Managers and first line supervisors should ensure that workers understand the fundamentals of radiation, its risks, and their role in minimizing exposure.

It is not sufficient to rely solely on regulatory limits for establishing or defining acceptable work practices and work environments.

Some personnel, such as those who may have internal deposition of radionuclides from prior years, are concerned about future exposures. Such instances warrant special attention on the part of the manager. Counseling with such personnel should be the preferred way to consider relevant factors. In some cases, special control levels should be applied.

B. Motivation to achieve excellence in radiological control

1. No one should be exposed to radiation unless an overall benefit from the associated activity is expected to be realized. As a corollary, the benefit should be maximized and the risk (exposure) minimized.

2. Some workers and members of the public perceive any radiation exposure as an unduly hazardous risk. Making an effort to reduce doses and documenting the actual doses received can reassure these people and reduce the prospects of litigation.

3. A side effect of trying to reduce doses is often an increase in efficiency and a decrease in incidents in performing radiological jobs, since greater planning is required. Records of past similar jobs can assist in planning future jobs and reduce dose further.

C. Fostering positive worker attitudes toward achieving excellence

Worker attitudes are key to radiological performance. A positive attitude makes a person take that one extra step. When everyone’s attitude embraces radiological excellence, and the performance is excellent, the program will reduce exposure and environmental burdens.

D. Reducing risk

The following are elements of a radiological control program that help reduce risk:

1. Training must be aimed at what the worker should know in order to do his/her job rather than passing a quiz. The training needs to be documented and recorded accurately.

2. Records and reports are needed for every aspect of the program. Records must be accurate and understandable because they may be used to recreate events that are questioned in the future. Those who fill out, file, review, or otherwise handle records must understand their use and importance.

3. Radiological deficiencies and improvements must be used to develop plans that will further promote radiological excellence. Self-assessments, use of critiques, thorough investigations, and a willingness to be self-critical and accept responsibility are needed. When a radiological deficiency is identified, there should be an honest effort to understand, correct, document, and follow it to closure. Trending deficiencies aids in planning where resources are to be spent to make improvements.

V. Meetings/briefings/critiques

A. Running an effective meeting

In today's business environment, meetings have become a way of life. Today's work force spends a great deal of time "stuck" in meetings. It is essential for those people leading these meetings to become proficient in chairing a meeting. The following are considerations when conducting a meeting:

1. Objective(s)

   - Is a meeting the best way to handle this? If not, don't have a meeting.

   - What do you want to achieve by the end of the meeting? Ensure that participants are aware of your expectations.

2. Persons attending?

   - Who needs the information?
   - Who can contribute?
   - Who would expect to be involved?

3. Amount of prior notice

- How much preparation time is required?
- Should any pre-work be sent? Pre-work (i.e., history, data, graphs, etc.) can cut down on the time spent in the meeting.

4. Agenda

   - Establish a reasonable amount of work that you expect can be accomplished in the specified time.
   - Provide the agenda to participants prior to the meeting.
   - Have enough information in the agenda so that people understand what discussion topics are going to be covered.
   - Establish time limits for each item and attempt to meet them.

5. During the meeting

   - Determine who will be responsible for the meeting minutes.
   - Review the agenda and emphasize time limits.
   - Keep discussions focused on the topics associated with the meeting.
   - If action items are established, ensure individuals understand what is to be accomplished and when it is required to be done.
   - Summarize upon completion of the meeting.
   - Prepare and distribute the meeting results

B. Pre-job briefings

"Planning the work" is an essential part of an effective Integrated Safety Management program. During pre-job work planning meetings, all appropriate safety disciplines must be engaged to ensure that all work hazards are adequately addressed. The following addresses pre-job briefings for radiological controls. Other work hazards should be integrated using a similar approach.

Article 324 of the RadCon Standard recommends pre-job briefings be held prior to the conduct of work anticipated to exceed the site ALARA trigger levels. (This practice further establishes excellence in regard to radiological operations.)

1. The pre-job briefing should be conducted by the cognizant work supervisor. Workers and supervisors directly participating in the job, cognizant radiological control personnel, and representatives from involved support organizations should attend the briefing. A summary of the topics discussed and attendance at the pre-job briefing should be documented.

2. As a minimum, the pre-job briefing should include the following:

   - Scope of the work to be performed
   - Radiological conditions of the work place
   - Procedural and Radiological Work Permit requirements
   - Special radiological control requirements
   - Radiologically limiting conditions, such as contamination or radiation levels that may void the RWP
   - Radiological control hold points
   - Communication and coordination activities with other groups
   - Provisions for housekeeping and final cleanup
   - Emergency response provisions

C. Post-job evaluations

During the conduct of radiological work and the handling of radioactive materials, abnormal events may occur that could indicate a weakness or area of programmatic breakdown of radiological controls. Prompt, consistent gathering of facts related to such events is required to satisfy reporting and investigation requirements and to formulate corrective actions to prevent recurrence.

In addition, successful performance or completion of unique activities should be evaluated to identify and incorporate appropriate lessons

learned. Analysis of the facts should reveal areas where improvements can be made or identify methods to prevent the recurrence of undesired results.

1. Critiques are meetings that document a chronological listing of the facts of an event. The purpose of the critique is not to assign blame. The following guidelines should be followed regarding critiques/occurrence investigations:

   - Critique meetings should be conducted for successes and abnormal events.
   - Properly trained critique leaders should facilitate the critique process.
   - Critique meetings should be conducted as soon as practical after the event or situation is stabilized or completed.
   - Minutes of the meeting must be kept.
   - All who can contribute should attend.
   - Supporting materials should be brought to the critique.

   Refer to RadCon Standard Article 351 for a complete list.

2. Post-job ALARA reviews may take the form of a debriefing or may be a review by one or more designated individuals and should be performed in the following cases:

   - After completion of a nonroutine radiological job or operation

   - After completion of a nonroutine or complex radiological job or operation if a pre-job formal radiological review was required or if an ALARA trigger level was exceeded in the course of the work

3. Lessons learned are available from post-job reviews, critique minutes, and occurrence reports (using the Occurrence Reporting and Processing System [ORPS]). Organizations responsible for radiological work and line management should evaluate lessons learned, provide prompt distribution, and incorporate the lessons into the Radiological Control Program.

I. Introduction

II. Problem analysis

Supervisors of radiological workers are often faced with critical decisions. Providing a model for strategic decision making will ensure that these critical decisions are made in an efficient, rational manner.

A. Stating the mission

In making decisions, the organization's mission and resultant goals should always be considered. Decisions should be consistent with the stated mission of the organization. Prior to decision making, the organization's mission must be defined. This may be difficult if the organization's mission has not been defined or if there are conflicting goals within the organization.

B. Assessing internal and external environments

Prior to making a decision or solving a problem, the problem must be identified and evaluated to ensure that all factors have been included in the problem statement.

1. Problem diagnosis - Identify the problem.

2. Problem specification - Clarify the specific nature of the problem.

3. Problem framing - Frame the problem in a nonjudgmental way.

4. Problem formulation and reformulation - Restructure the problem in a way that will make it easier to solve. This can be done by introducing accurate assumptions.

III. Decision making

A. Developing strategy

Once the problem has been identified, alternative solutions must be generated. A general rule for decision making is as follows: if an acceptable standard solution is available to a problem, then it should be used instead of spending time and resources reinventing a solution. If a standard solution is not available, alternatives must be developed.

1. Standard solutions involve using standard operating procedures as well as available alternatives. Optimization techniques, which include cost-benefit analysis, are a fundamental part of work reviews and of radiological analyses for new designs and modifications. For review of minor or routine activities with low associated doses, a cost-benefit evaluation may be an intrinsic part of the engineering or operations review process, so a detailed evaluation is usually not necessary. For review and planning of major tasks involving higher collective dose expenditures, a detailed and documented evaluation should be performed.

2. A simple optimization decision may be made by choosing a low-current-dose worker instead of a high-dose worker or by declining to spend a large sum to save only a few mrem. Note that the writing of work planning documents (e..g., Radiological Work Permits, work packages, procedures, etc.) is also an optimization evaluation, in which the line supervisor must usually concur.

   Although the supervisor may not have to perform detailed optimization Evaluation, that information may need to be provided to the person(s) who will do the evaluation.

   Such information will often be based on past operating experience and may include costs of equipment, person-hours, number of people, amount of time spent in radiological areas, and even subjective judgments regarding the feasibility of alternatives.

B. Limits on decision making

1. When supervisors make decisions, they need to determine how much power they have in reaching a final decision and how much influence they have over the process. This is important information when considering the most appropriate alternatives.

2. The decision maker must also determine what the political impact of various decisions will be. There may be political reasons why the most rational solution is not feasible.

3. When selecting an alternative, it is important to consider the repercussions of not selecting various alternatives. If there is strong opposition to a selected alternative, the decision maker needs to be able to support the current decision and explain why the competing solution is less feasible or less desirable.

C. Making the decision

The formal decision analysis will be as follows:

- Define alternative courses of action, determine the criteria to use in evaluating the alternatives, and identify key uncertainties in the decision.
- Assess the consequences of selecting each alternative.
- Assess the probabilities and preferences by looking at the uncertainties and utilities of each outcome.
- Evaluate alternatives in terms of the stated criteria.
- Analyze the optimal solutions for any adverse consequences.
- Select the most effective solution based on problem analysis.

D. Implementation and controlling execution of strategy

Once a decision is made, the decision will be implemented and evaluated. It is important to monitor events after implementation to ensure that the outcomes are as expected. If not, it may be necessary to revise the original decision. Monitoring outcomes of decisions will also provide lessons learned for future decision making.

E. Case studies

I. Introduction

II. Motivation

The roles and responsibilities of a supervisor include motivating personnel to perform quality work. There are many theories of motivation. Some have been found to be effective and some have not. It is important for supervisors to understand which theories of motivation are valid and which techniques will be most effective.

III. Why are people motivated?

A. Needs fulfillment theories

Need fulfillment theories of motivation state that people are motivated by inherent needs and specifically by unmet needs. Behavior is based on inherent needs.

1. Maslow's hierarchy of needs

6. Physiological
7. Safety
8. Belongingness
9. Love
10. Self-actualization

In an organization, one typically assumes that an individual's basic needs have been met (food, shelter, clothing). However, other needs may not have been met. Supervisors should be aware of employees' need for a safe and secure working environment. This is a critical issue for supervisors of radiological workers.

It is not the organization's responsibility to fulfill higher level needs (belongingness, love, self-actualization). However, supervisors should understand how these needs translate into motivation. If employees feel like they are part of a work team, they will be more loyal, and perhaps be motivated to work harder. The need for self-actualization can often be encouraged by providing employees with the authority to make decisions that are critical to their working environment.

2. Job enrichment theory

The job enrichment theory of motivation states that certain job dimensions will motivate employees to work more effectively.

Job dimensions include the following:

- Skill variety
- Task identity
- Task significance
- Autonomy
- Feedback

These job dimensions will provide meaning to the job, make an employee responsible for the job, and provide feedback concerning how the job is progressing.

Supervisors should evaluate the jobs of their workers to determine if these dimensions are part of the job. If not, the need for job redesign may be indicated.

3. Need for achievement theory

   In this theory, it is believed that some employees have a need for achievement, while others do not. If a person has a high need for achievement, he/she will do better in "achieving situations." These situations may be characterized as follows:

   - Personal responsibility is evident. The individual will receive credit for a job well done.
   - The task should be at an intermediate to average level of difficulty. There should be a good chance of success.
   - The individual needs to receive feedback.
   - The individual needs to feel challenged.
   - The situation should be ongoing, with consequences in the future.

Although a supervisor cannot change an individual's need for achievement, understanding this theory may explain what motivates some employees.

B. Cognitive theories

Cognitive theories of motivation state that a person's behavior is based on a cognitive process. People think before they act.

1. Equity (justice) theory

This theory is based on the equity of input (work) and output (rewards). Employees' output is based on their perceived level of their own input, as well as their perception of the input and output of others.

If employees believe that their input is greater than that of others (or their output is less), they will try to balance the situation by doing the following:

- Reducing their input (decreased productivity, absenteeism, tardiness)
- Increasing their rewards (employee theft, i.e., supplies, phone calls, inflated expense statements)
- Leaving the job in search of a more equitable situation

Supervisors should be aware of this theory and assess whether there is equity in the workplace for each worker as well as across the team. By understanding the equity theory, supervisors can understand behaviors stemming from real or perceived inequities.

2. Expectancy (choice) theory

For the expectancy theory, the primary motivation is the attainment of goals. Behavior is based on a person's expectation that his or her effort will lead to a certain type of performance. This in turn will lead to a certain level of reward (e.g., If I work hard, I will do a good job and get a good reward). Employees make clear choices about the level of effort they will exert based on these expectations.

For employees to be motivated, there must be a clearly defined relationship between performance and rewards (compensation

system). There also has to be a link between effort and performance. The supervisor must be aware of an individual's effort and consequent performance.

The supervisor must provide feedback to the employee that will enable the link between effort and performance to be more direct.

C. Reinforcement theories

The basic tenet underlying reinforcement theories is that people are motivated by rewards for their behavior. People work because they are rewarded. A reward is considered something of value to the employee. The most basic is compensation (pay, benefits, leave time). Other rewards include recognition and job prerequisites. Following this theory, supervisors should assess the rewards and recognition given to their employees.

IV. Tools of motivation

A. Goal setting

Goal setting is one of the most researched areas of motivation, the basic conclusion is that goals motivate people. A goal is something that a person tries to attain, achieve, or accomplish. Once a goal is set, behavior is based on the attainment of that goal. Specific goal-setting techniques will be presented later.

Why do goals work?

- Goals give an employee direction.
- Goals influence the intensity with which an individual works toward attainment of a goal.
- Goals influence the persistence with which an individual works toward attainment of a goal.
- Goals typically require individuals to develop a strategy for goal attainment.

For goals to be effective motivators, they must have the following characteristics:

1. Goal difficulty

Employees become more committed to difficult goals. If a goal is too easy, employees will not seriously commit to goal attainment because there is no challenge.

However, if the goal is too difficult, employees will not make a commitment because they don't believe they can accomplish the goal.

2. Goal specificity

   The more specific a goal, the easier it is to achieve. Specific goals provide more detailed direction toward attaining that goal.

3. Employee participation in goal setting

   An individual must internalize a given goal before it becomes a motivation. The best way to do this is for the individual to participate in setting the goal. When employees are involved in goal setting, they have a much better understanding of the goal, as well as how to achieve it.

4. Feedback

   An individual must know when he or she has achieved a set goal. It is important to have progressive feedback on goal attainment.

B. Empowerment

Employee empowerment is a philosophy of transferring power from management to employees. By doing this, employees become more involved in their work and accept responsibility for their actions. Employees will be more motivated to do quality work if they have been involved in critical decisions and have a sense of ownership in the job.

Even though empowerment is a strategy that affects the entire organization, the basic empowering relationship is between a supervisor and subordinate. It is the immediate supervisor who transfers power to an employee.

The steps toward empowerment are listed below:

1. Develop an operational definition of empowerment. The definition should be very clear as to what empowerment means from both the manager's perspective and the employee's perspective. The goals

and objectives of empowerment should be stated clearly and be behaviorally based in order to evaluate the success of any intervention.

2. Assess strategies used to empower employees. Identify techniques that would be appropriate for your group. This list will be tentative and will be refined as more information is gathered. Techniques include participative decision making, job enrichment, redesign of internal processes, etc.

3. Clarify and communicate organization/ division mission. An underlying assumption in empowering employees is that their actions will support the company's goals and objectives. To ensure that this happens, employees need to be very clear on the company's goals and objectives. All employees should know what their mission is and how it fits into the overall mission of the organization.

   The goals and objectives of the division should be concrete and expressed as specific outcomes to be achieved. Employees will need some guidelines for the decisions they will be asked to make. The division goals and objectives provide global guidance.

4. Determine the boundaries and limitations of each strategy used. Decisions can be classified into executive decisions and operational decisions. Executive decisions involve the overall mission of the organization, the political climate, and the global strategy. Operational decisions are day-to-day decisions made in developing the "product." It is important to know which decisions employees will be able to make on their own.

   There are also organizational and regulatory restrictions in decision making that must be clarified. These decisions include fiscal decisions, standard operating procedures within the organization, restrictions imposed by DOE, etc. Identifying decisions that are not appropriate for participative decision making will narrow down those decisions that are appropriate.

5. Assuming participative decision making is to be used, determine what decisions are appropriate to delegate. Once boundaries and limitations are defined, come up with a tentative outline for the types of decisions that are appropriate for sharing with employees and those that are not appropriate. This outline is tentative and requires

input from other managers, employees, and the administration prior to being implemented.

6. Decide whether empowerment strategies will be required or voluntary. Will a manager or employee have a choice of whether he/she will participate? What degree of delegation/empowerment will be required?

7. Communicate the tentative plan to managers, supervisors, and the administration. Prior to getting input from employees, get initial input from managers, supervisors, and the administration. This information will help determine the feasibility of employee empowerment.

8. Get input from employees. Find out their concept of empowerment. Determine to what degree employees already feel empowered. This can be done through a survey (preferably anonymously). This step is risky because it can raise expectations. This should only be done if you have definite plans to proceed. However, it should be done prior to developing an elaborate strategy for empowering employees.

   If the goal of empowerment is motivational, you have to find out what the employees want. On the other hand, if the goal of empowerment is to reduce the work load of middle management, you have to get employee buy-in; otherwise, it will flop.

9. Determine skills necessary for empowerment. It cannot be assumed that managers and employees have the skills necessary to transfer power. The first step is to determine what skills are necessary for shifting power. Managers will need the skills necessary to determine what decisions are appropriate for staff to make.

   Employees must know how to make decisions, how to prioritize, when not to make decisions, what the boundaries are, etc. Once the skills have been identified, it is important to know who has the requisite skills and who doesn't. Some type of assessment is necessary.

10. Communicate plan to employees and provide a mechanism for feedback. Introduction to the plan should be low-key and not raise expectations. Consider having each program, or supervisor, communicate the plan as opposed to an announcement from the division office. This will help keep the focus on the program.

11. Provide training if needed. Based on the assessment of skills, training may be necessary for those managers and employees lacking requisite skills.

C. What other tools could be used to motivate employees?

I. Introduction

II. Leadership

A supervisor is more than just a person who sees that a job is conducted and a task completed in accord with directions; he/she is also a leader. The more an organization rewards it's effective leaders, the fewer employee problems they will have.

A. Definition of leadership

Leadership is a process that includes influencing:

- The objectives and strategies of a group or organization
- People in the organization to implement the strategies and achieve the objectives
- Group maintenance and identification
- The culture of the organization

B. Characteristics of good leadership

The characteristics of good leadership can be placed in the following categories:

- Leadership traits
- Motives of leaders
- Leadership skills

1. Leadership traits

- High energy level
- Stress tolerance
- Integrity
- Emotional maturity
- Self-confidence

2. Motives of leaders

    - Need for power
    - Need for achievement
    - Need for affiliation

3. Effective leadership skills

    - Planning and organizing
    - Problem solving
    - Clarifying and monitoring
    - Informing
    - Motivating and consulting
    - Recognizing and supporting
    - Team building, networking, and delegating
    - Developing and mentoring
    - Rewarding

C. Power/influence

1. Types of power

    - Legitimate power - Supervisors have legitimate power based on their position in the organization.
    - Coercive power - Supervisors have coercive power based on their control (real or perceived) over punishment.
    - Reward power - Supervisors have reward power based on their control (real or perceived) over rewards.
    - Expert power - Supervisors have expert power based on their level of technical expertise.

2. Influence tactics include the following:

    - Rational persuasion
    - Inspirational appeals
    - Consultation
    - Ingratiating
    - Personal appeals
    - Upward appeals

III. Tools of leadership

A. Providing vision

A good leader provides vision for the work unit. The vision is a clear, concise view of what the work unit is striving to accomplish. The vision for the work unit should be consistent with the vision of the organization.

Ideally, the vision for the work unit will be developed with input by the work unit.

If a vision is clearly stated and accepted by the work unit, it becomes a goal of each member of the unit.

B. Coaching/mentoring

One of the roles of a leader is to develop his or her workers. Leaders are in the best position to see individual efforts and how they help to achieve or hinder goals. By coaching or mentoring, a leader can guide a worker toward goal attainment.

Coaching and mentoring include the following:

- Help each worker set goals and identify barriers to overcome.
- Solicit ideas and assistance from workers in solving problems that arise in the organization.

- Know the deficiencies of employees and develop a plan for them to acquire the knowledge and skill needed. Feedback and training will facilitate development of employee knowledge and skills.

- Reinforce positive behavior changes that increase productivity.

C. Delegating

Part of a leader's role is to delegate tasks and decisions to employees. The level of delegation typically depends on one's style of leadership. Some leaders feel comfortable in delegating responsibility along with the delegated tasks, while others feel more comfortable delegating only the task.

Prior to delegating, a leader must consider the following:

- Is the employee capable of completing the assigned task?

- Does the employee have the necessary resources to complete the task (human resources, financial resources, training)?

- What are the consequences of failure? The supervisor will have to assess the level of risk in the task and determine whether the organization can assume the risk of error.

- What type of supervision is necessary? The supervisor should decide how closely he or she should be involved. This will be contingent on the competency of the employee, the level of risk associated with the task, and the leadership style of the supervisor.

D. Team building

An effective way of leading a group of individuals is to allow them to lead themselves. The use of self-managed work teams can be an effective way to motivate employees to work more efficiently and to work together.

The concept of self-managed work teams focuses on the team member as the expert. By allowing the team to make and implement decisions, decisions are being made by those individuals with the most knowledge and experience.

The following organizational context factors will increase the likelihood of success for teams:

- Management support
- Mission clarity
- Autonomy
- Rewards for the team
- Team training
- Feedback on performance
- Organization culture conducive to teamwork
- Appropriate physical facility

The following team development factors will increase the likelihood of success:

- Communication
- Cohesion
- Developed norms
- Role clarity
- Cooperation
- Participation
- Conflict resolution

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Part 5 of 5

Radiological Worker Training Appendix A
Radiological Control Training for Supervisors
DOE-HDBK-1130-2008

Handouts

Office of Health, Safety and Security
U.S. Department of Energy

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Table of Contents

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Choosing the Correct Workers

Your site has an administrative control level (ACL) of 700 mrem. There are seven workers in your group who are qualified to do a hot job requiring three individuals (one job leader and two workers). You have the information below.

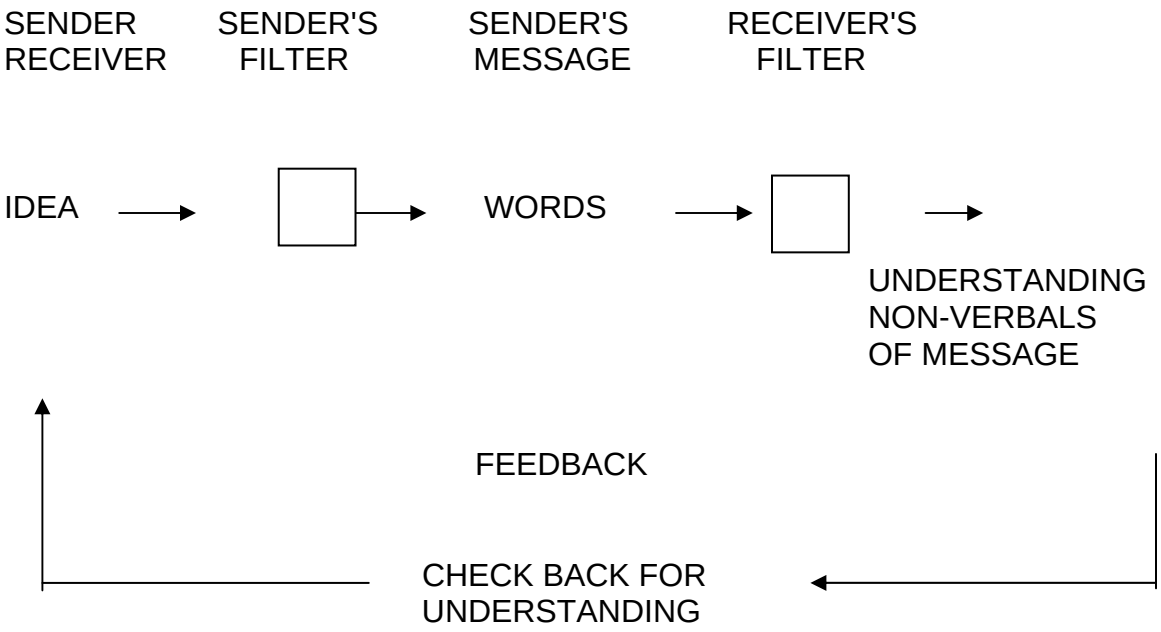
	AGE	Lifetime Dose-to-Date Rem	Current Annual Dose-to-Date mrem
Barbie	25	.7	150
Cleo	40	2.5	250
Egmont	50	55.0	100
Harpo	65	31.0	250
Julius	35	6.5	400
Tito	30	24.5	300
Selda	55	17.0	300

It's Tuesday and the job is to be done Friday. The job leader will get 200 mrem and the other two will get between 300 and 400 mrem. It's near the end of the year, so it looks as though there will be no work involving any significant dose after this job until well into next year.

Egmont, your most experienced worker, is restricted to 200 mrem per year because of an incident several years ago which put his lifetime (committed) dose over his age in Rem. Harpo is going in for an outpatient radioactive test Thursday. Julius is new, so you are reluctant to choose him to be the leader, and Barbie and Selda don't have experiences to be the leader. (All the others do)

Cleo has just quietly told you she is pregnant. She will get the declaration form signed Monday, when your group secretary gets back from vacation and can type up the form as management requires. Barbie was saying only last month that she and her husband Chancy are "trying" and she hopes she gets pregnant right away. You have no idea if she has succeeded. Tito used to be a "jumper" in the nuclear power industry but has gotten married and settled down. He says he and his wife want a family "real soon."

Which workers should you choose? Why?


SENDER
RECEIVER
SENDER'S
FILTER
SENDER'S
MESSAGE
RECEIVER'S
FILTER
IDEA
WORDS
UNDERSTANDING
NON-VERBALS
OF MESSAGE
FEEDBACK
CHECK BACK FOR
UNDERSTANDING

Internal Exposure and Contamination During Pump Removal

A work crew was assigned to rebuild a small pump in a non-radioactive system located in an uncontaminated radiation area. In accordance with good ALARA practices, the work plan called for removal of the pump to a shop area for the repairs. The work supervisor and the Radiological Control Technician (RCT) inspected and surveyed the pump area together to discuss the radiological conditions and radiological controls necessary for the job. The small pump was bolted to a metal mounting plate which was in turn bolted to anchors on a concrete ledge. The plan was to remove the piping, unbolt the pump from the mounting plate, have it surveyed for release, and carry it out to the shop. Since the system was not radioactive, any contamination would be external. The RCT surveyed all accessible areas of the pump and found no removable contamination. He also used cotton swabs to check the area between the bottom of the pump and the base plate. Again no removable contamination was found. He allowed the job to proceed with no protective clothing on a routine radiation area maintenance Radiation Work Permit.

When the crew tried to unbolt the pump from the base plate they found that some of the bolts were rusty and could not be removed. They contacted the supervisor and were given the okay to try the anchor bolts holding the base plate to the concrete ledge. They removed the pump and base plate and exited the area. Upon frisking out of the building, two of the workers were contaminated at various locations on both skin and clothing. One worker had positive nasal smears and the pump was contaminated. The highest levels of contamination were on the underside of the base plate.

The room where the pump was located had been flooded with highly contaminated water in an incident several years ago. All accessible areas of the room were subsequently decontaminated to undetectable levels and routine access without protective equipment had been restored.

Fire in a Contaminated Cutting Facility

An area was set aside in a decontamination facility to be used to reduce the size of metal contaminated waste by cutting large pieces into smaller pieces for easier handling and disposal. Since some of the cutting operations employed oxygen-acetylene cutting torches, the area had to be approved in accordance with the plant fire protection program.

The plant fire protection engineer inspected the facility and developed a procedure to control the use of cutting torches in the facility. The procedure required:

1. A metal enclosure that would prevent the passing of slag and sparks to surrounding areas had to be constructed and equipped with a portable ventilation unit.

2. Two fully charged fire extinguishers and a fire watch must be present in the area at all times while torch cutting is in progress.

3. Removal of all loose combustible materials from the facility before torch cutting operations begin.

4. Protection of any fixed combustible materials with fire retardant materials.

5. No storage of combustible materials within forty feet of the cutting enclosure.

A welder and a fire watch were assigned to cut up several large pieces of steel in the facility. When operation had been underway for several minutes, the fire watch noticed flames in the corner of the facility. He notified the welder to stop cutting operations and picked up one of the two fire extinguishers only to find it empty. He then took the second fire extinguisher and put the fire out.

The investigation determined that the fire had started in a pile of paper towels in the corner and would soon have spread to the unprotected combustible ventilation trunk which had been moved from its original protected location several weeks earlier for better smoke control.

Interviews with the workers involved and other workers who were periodically assigned to work in the facility revealed that they were not satisfied with the safety conditions in the facility in general and one had mentioned it to the supervisor. Since work force cut-backs and lay-offs were expected, no one wanted to "make waves."

Fire in a Contaminated Cutting Facility (continued)

The supervisor of the area was tasked by management to "...bring the facility into full compliance with the fire protection program and procedures before resuming torch cutting operations."

All loose combustible materials in the facility were removed and all fixed combustible materials were protected.

Two days after resumption of torch cutting operations, a passing technician noticed a fire in some bags of trash stored outside the facility metal wall. He found the nearest fire extinguisher and put out the fire.

Follow-up investigation found that the seam where the metal wall met the floor had been separated by visible damage allowing the passage of sparks outside the wall. Further inspection of the area found numerous instances of combustible materials stored within the forty foot limit.

None of the workers in the facility during the two occurrences were aware of the procedural requirements specific to that facility.

Supervisor's Responsibilities

I. Radiological Control Documents

A. 10 CFR 835

- Codified DOE radiation protection requirements
- Applies to all persons (§835.3)
- Forms basis for potential civil and criminal penalties under the Price-Anderson Amendments Act
- Requires a DOE-approved Radiation Protection Program for all DOE radiological activities

B. Radiological Control Standard

- Establishes DOE's views on the proper course of action in radiological control
- Includes best-practices guidance
- Includes use of Site-Specific Radiological Control Manual

II. Supervisor Involvement and Accountability

A. Review work in advance

- Participate in review of nonroutine or complex work activities exceeding site trigger levels requiring reviews. These trigger levels are in the site-specific Radiological Control Manual.
- Approve the Radiological Work Permit (RWP) with the Radiological Control Supervisor.
- Conduct pre-job briefing prior to work exceeding the trigger levels.

B. Walk your space

- As part of their normal work review, supervisors should periodically review ongoing jobs to ensure prescribed radiological controls are being implemented, and good work practices followed.

Supervisor's Responsibilities (continued)

- Periodically monitor the work areas.
- Conditions that could lead to or promote spread of contamination, or unsafe work, should be corrected on a priority basis.

III. Conduct a safe operation

A. Abnormal conditions

- Although the organization is established and operates to assure worker protection, it is not infallible.
- The line supervisor is the last line of defense for the worker should the system fail or should a deficiency occur in the workplace, such as with ventilation controls, air monitors, instrumentation, fire control systems, etc.
- Act upon abnormal situations or signals immediately, whether from your own observation or brought to you by workers.
- Assure that your workers know the alarms for abnormal conditions, and know their appropriate response.

B. Assure adequate training

- Although training in most cases is provided by the training organization, the responsibility for quality and effectiveness rests with line management.
- Assure workers have the training required for entry. If the training requirement is not in the posting or in the RWP.

Supervisor's Responsibilities (continued)

IV. Control the spread of contamination

- Assure that material is not removed to uncontrolled areas without survey.
- Assure cleanliness and good housekeeping in the work area.
- Reduce materials entering radiological areas to minimize waste generation and potential for fire.

V. Reduce worker exposure

A. Administrative dose limits

- Your workers should not be allowed to go above the facility Administrative Control Level for dose without the prior approval of the contractor senior site executive.
- Approval by the appropriate Secretarial Officer or designee should be obtained prior to allowing a person to exceed 2,000 mrem.

B. Use the RWP

- Verify that entry points to radiological work areas and radiation areas are posted to state basic entry requirements, such as dosimetry, Radiological Work Permits (RWP) and respiratory equipment required. The dose rate and contamination level or range of each should be included in the posting.
- Ensure that your workers have read, understood and will comply with the RWP.
- Assure that workers use the dosimetry, personal protective equipment and clothing prescribed in the RWP.

Supervisor's Responsibilities (continued)

C. Assure good work practices

- Assure that your workers follow good radiological control practices, such as when frisking and removing protective clothing.
- Stop work and obtain guidance if during the use of procedures, a written requirement cannot be responsibly followed.
- Recognize that any worker through their supervisor has the authority and responsibility to stop radiological work activities for any of the following reasons:
  - Inadequate radiological control
  - Radiological controls not being implemented
  - Radiological Control Hold Point not satisfied

VI. Supervisory Training Requirements

Supervisory skills training include the following (or equivalent):

- Leadership
- Interpersonal communication
- Responsibilities and authority
- Motivation of personnel
- Problem analysis and decision making
- Fitness for duty procedures
- Administrative policies and procedures (These will generally be site-specific.)

Choosing the Correct Workers

Suggested Answer Key

Whom to Choose?

Answer: One reasonable choice would be Barbie (400 mrem), Tito (200 mrem), and Selda (300 mrem), with Tito as the leader. At the end of the year the final doses would look like this:

	Age	Lifetime Dose-to-Date Rem	Current Annual Dose-to-Date mrem
Barbie	25	1.1	550
Cleo	40	2.5	250
Egmont	50	55.0	100
Harpo	65	31.0	250
Julius	35	6.5	400
Tito	30	24.7	500
Selda	55	17.3	600

Workers	Explanation
Egmont	He is restricted to 200 mrem/yr and he already has 100 mrem.
Harpo	He is scheduled to have a medical procedure involving a radioactive isotope. The RadCon Standard recommends special consideration be given to keeping down the occupational doses of those receiving additional doses for medical purposes. If he ingested a radioactive isotope during the medical procedure on Thursday, during monitoring for contamination on Friday the frisker may not be able to identify whether the dose was from an internal or external source.
Julius	He can't be the leader. He also can't receive the 300 to 400 mrem dose unless you get special permission to exceed the ACL of 700 mrem per year. NOTE: If he does not participate, he will still end up the year as the median person of the group in terms of dose, so by not choosing him you are not favoring him.
Barbie	The genetic risk effects due to irradiation of sperm and unfertilized eggs at these dose levels are considered to be extremely low. The important risk is to a developing embryo-fetus.
Cleo	Technically she has not declared her pregnancy in written form, however, management should not put unreasonable obstacles in the way of a woman being able to declare her pregnancy. The best route to take is to get her to write in the information on the form until the secretary returns.