Course Title: **Radiological Control Technician**
Module Title: **Radiological Protection Standards**
Module Number: **1.09**

Objectives:

1.09.01 Identify the role of advisory agencies in the development of recommendations for radiological control.

1.09.02 Identify the role of regulatory agencies in the development of standards and regulations for radiological control.

1.09.03 Identify the scope of the 10 CFR Part 835.

References:

1. ANL-88-26 (1988) "Operational Health Physics Training"; Moe, Harold; Argonne National Laboratory, Chicago
2. U.S. Department of Energy, DOE-STD-1098-99, "Radiological Control Standard"
3. 10 CFR Part 835 (1998) "Occupational Radiation Protection"

Instructional Aids:

1. Overheads
2. Overhead projector/screen
3. Chalkboard/whiteboard
4. Lessons learned

I. MODULE INTRODUCTION

A. Self-Introduction

1. Name
2. Phone Number
3. Background
4. Emergency procedure review

B. Motivation

To understand why there are limits to exposure the RCT must understand the history of the development of the limits. The RCT has to be aware of the current CFRs and DOE Orders that may effect them at the work place.

C. Overview of Lesson

1. History of standards
2. Advisory agencies
3. Federal policy on radiation matters
4. Regulating agencies
5. Radiological Control Standard
6. 10 CFR Part 835

D. Introduce Objectives — O.H.: Objectives

II. MODULE OUTLINE

A. History of Standards

1. Setting exposure limits is vital and difficult.
   a. Vital: Workers must be protected from the harmful effects.
   b. Difficult: many factors enter into the effects which radiation produces.

2. Concept of an "acceptable risk"

    a. The benefits are weighed against the potential damage.

    b. Then limits are set at some level at which the most benefit to mankind.

3. Limits are revised as new knowledge is gained.

4. Early use of radiation led to large exposures.

5. As early as 1897, cases of skin damage began to appear.

6. Erythema Dose

    a. Early efforts at control were hampered by a lack of quantitative methods.

    b. There were no units by which one could assess the amount of radiation.

    c. As a result of the use of radiation by doctors in treating patients, a unit called the erythema dose came into use.

    d. Highly qualitative unit; defined in terms of the amount of radiation which would produce a well-defined reddening of the skin.

    e. Not a satisfactory unit.

    f. It varied not only with the type of radiation and the dose rate, but also with the response of different parts of the body.

B. ICRU, ICRP, AND NCRP

Objective 1.09.01

1. 1925, International Commission on Radiological Units and Measurements (ICRU).

    a. 1928, adopted the Roentgen.

    b. ICRU has been the main force in defining and adopting units for use on an international basis.

2. 1928, International Commission on Radiological Protection (ICRP).

    a. This group discusses and reviews basic protection principles.

    b. Recommendations serve as a guide from which regulations can be drawn up by each country.

    c. 1934, recommended a tolerance level of exposure: 0.2 R/day. This limit remained in force until 1950.

3. 1929, National Committee on Radiation Protection and Measurements (NCRP).

    a. Coordinated by the National Bureau of Standards.

    b. Recommendations of the Committee appeared in the National Bureau of Standards Handbooks.

    c. 1946 reorganized

    d. 1964 replaced by a non-profit corporation chartered by Congress National Council on Radiation Protection and Measurements.

    e. The Council is made up of the members and the participants who serve on a number of committees.

    f. These committees develop proposed recommendations on various aspects of radiation protection and radiation measurements, which when approved by the Council, are published as NCRP Reports. The initial report issued by the Council was NCRP Report No. 32.

4. Radiation exposure concerns

    a. Initially, concerns resulted from patients and medical personnel exposure to external radiation from the use of x-rays for diagnosis and therapy.

    b. World War II produced a shift in emphasis due to the increase in the number, type and uses of radioactive materials. This introduced considerations about internal exposure and the dose to the general public.

    c. Potential genetic effects of radiation and the impact of long-term exposure at low dose rates emerged.

d. Data from biological studies seemed to indicate that one could not assume that all effects had a threshold dose. Also, in the case of gene damage, effects could be expected at very low doses.

e. Efforts have been directed toward quantifying the risk associated with a certain level of exposure.

f. Non-threshold relationship, any dose carries some risk of producing damage therefore all exposure should be kept at the lowest practical levels. Several factors need to be considered.

    1) Information available for the quantification of risks is imperfect.

    2) The assumptions of a risk by an individual, in general, presumes a willingness to chance the risk in exchange for some resultant benefit.

    3) The resultant benefit which accrues justifies the risk.

    4) The balancing of risk versus benefit in order to obtain a net benefit is not easily accomplished.

    5) The prudent approach, adopted by both the ICRP and the NCRP is to keep exposures as low as reasonably achievable (ALARA).

g. In addition to the work of the ICRP, NCRP, and ICRU, the National Academy of Sciences National Research Council has undertaken the study of biological effects.

    1) This group consists of a large number of scientists throughout the country.

    2) The group functions as an advisory body.

    3) Purpose is to supply technical information as a basis from which regulations can be developed

h. The results of continuing reviews of biological data have revealed two types of radiation effects.

    1) Those for which a practical threshold dose for occurrence can be demonstrated, nonstochastic effects.

2) Those for which there is apparently no threshold, stochastic effects.

3) Nonstochastic effects can be prevented by limiting the dose to the individual to a value below the threshold dose for occurrence of the effects.

4) Since stochastic effects presume that there is no threshold level, and that the probability of the effect occurring increases with dose, any dose represents some probability of producing that effect.

5) Stochastic effects, limit the probability of occurrence to some level (deemed acceptable) by limiting the radiation exposure.

C. ICRP Basic Recommendations

1. In its current reports, the ICRP recommends a basic system of dose limitation which includes these three interrelated aspects:

   a. No practice shall be adopted unless its introduction produces a positive net benefit.

   b. All exposures shall be kept ALARA, economic and social factors being taken into account.

   c. The dose equivalent to individuals shall not exceed the recommended limits.

D. Federal Policy on Radiation Matters

1. 1959, Federal Radiation Council (FRC) was formed (Public Law 86-373).

   a. Advised the President concerning radiation matters

   b. Provided guidance for all Federal agencies in setting standards and in working with the States.

   c. The recommendations of the FRC were approved in 1960 and formed the basis of the Federal radiation protection guidance.

   d. The FRC was abolished by Reorganization Plan No. 3 in 1970.

2. Environmental Protection Agency (EPA) took over. The Office of Radiation Programs (ORP) of the EPA took over the activities of the FRC.

   a. 1981, the EPA drafted proposed revised recommendations in the Federal Register regarding occupational exposure, and solicited comments.

   b. The EPA believes that it is appropriate to adopt the general features of the ICRP approach in radiation protection guidance for use by Federal agencies for occupational exposure.

   c. The revised EPA guidance was approved and issued in January 1987.

3. The Bureau of Radiological Health of the U.S. Department of Health and Human Services has developed a set of recommendations for protection from diagnostic x-rays.

E. Regulating Agencies — Objective 1.09.02

1. 1954, Atomic Energy Act, the United States Atomic Energy commission (AEC) was given the responsibility of regulating the atomic energy industry.

   a. The Act authorized the AEC to set up a licensing program to be augmented by whatever rules or regulations are deemed appropriate.

   b. The bases for these rules are: to protect the public health and safety, and provide for national defense and security.

2. 1974, Energy Reorganization Act, abolished the AEC and established two agencies to perform the functions of the AEC, Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA).

3. NRC

   a. The regulations of the NRC are set forth in the Code of Federal Regulations (CFR), Title 10.

   b. Part 20, Standards for Protection Against Radiation, deals specifically with the regulations for control of radiation hazards by the licensee.

c. Other parts of Title 10 deal with licensing and regulatory requirements associated with the use of source, special nuclear material and by-product material.

d. The NRC is charged with the task of seeing that these measures prevail. This aspect requires inspection and review in order to assure this.

1) This function is carried out by NRC personnel (inspectors) at regular intervals.

2) Their job is to make the inspections and report their findings. In the event that a failure to comply is noted, the licensee is required to correct this.

e. States have taken up the task of setting up their own safety standards. The NRC has been directed to assist the states to assure that the state and Commission programs are compatible. These states are referred to as Agreement States.

4. ERDA

a. In 1977, the U.S. Department of Energy (DOE) replaced ERDA.

5. DOE

a. The DOE activities relate to energy research and development.

b. The DOE has issued occupational radiation protection standards which pertain to its own activities as well as to those of its contractors.

1. These standards appear in 10 CFR Part 835.

2. These standards are based upon the recommendations of the ICRP, NCRP and the guidance of the EPA.

3. Rule 10 CFR 835

   The scope of 10 CFR 835 establishes radiation protection standards, limits and program requirements for protecting individuals from radiation resulting from the conduct of DOE activities.

   a) Implemented by the Price-Anderson Amendments Act

   b) Civil penalties may be assessed

   c) Requires DOE activities be conducted with a written radiation protection program.

   d) Some sites may still contractually be obligated to adhere to provisions of the DOE RCS.

d. Similar to the NRC, the DOE is charged with the inspection of its contractors to see that they are in compliance with DOE requirements.

6. Department of Transportation (DOT)

   a. Safety in the shipment of radioactive substances

   b. Title 49 Transportation, of the CFRs, deals with hazardous shipments including radioactive materials.

7. Other Agencies

   a. Interstate Commerce Commission,

   b. Coast Guard,

   c. Federal Aviation Agency,

   d. Postal Service,

   e. International Atomic Energy Agency.

F. DOE Radiological Control Standard (RCS)

1. Radiological Control Policy

   a. The fundamental principle underlying the RCS is:

Insert site-specific information addressing DOE orders/standards applicable to radiological control at the site, based on contracts.

Objective 1.09.03

1) "There should not be any occupational exposure of workers to ionizing radiation without the expectation of an overall benefit from the activity causing the exposure."

b. Applies to those DOE activities that manage radiation and radioactive materials and that may potentially result in radiation exposure to workers, the public, or the environment.

c. ALARA

1) Personal radiation exposure shall be maintained ALARA.

2) Exposure shall be controlled below regulatory limits and there is no exposure without commensurate benefit.

d. Ownership

1) Each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined and cautious attitude toward radiation and radioactivity.

e. Excellence

1) Evident when radiation exposures are maintained well below regulatory limits, contamination is minimal, radioactivity is well controlled and radiological spills or uncontrolled releases are prevented.

2) Continuing improvement is essential to excellence in radiological control.

2. Standard Applicability and Control

a. Recommends practices for the conduct of radiological control activities.

b. Best courses of action currently available and should be viewed by contractors as an acceptable technique.

c. Not a substitute for regulations.

d. Following the course of action will achieve and surpass requirements, but RCS is not sufficient to ensure compliance with all of 10 CFR 835.

e. Revision

1) The RCS is a living document.

2) Revision will be made to incorporate lessons learning and suggestions.

3) The Assistant Secretary for Environment, Safety and Health is responsible for this task.

4) Recommendations are requested.

f. Use of the RCS is recommended to conduct DOE-funded radiological activities at DOE and non-DOE sites.

g. In those cases at non-DOE sites or facilities where a specific activity is being conducted pursuant to an NRC or Agreement State license, the provisions of the RCS are not binding to that activity.

h. The RCS should be kept current and should be entered into the contractor document control system.

i. The RCS does not apply to the Naval Nuclear Propulsion Program.

3. Compliance

The RCS is a guidance document and compliance is not mandatory, unless the contractor is contractually obligated to follow provisions of the RCS.

4. Site-Specific Manual

a. A Site-Specific RCM should be issued and endorsed by the contractor senior site executive.

b. DOE-EH approval is not required.

c. Management policies, requirements, expectations and objectives for the site Radiological Control Program should be clearly and unambiguously stated.

d. The Site-Specific Manual should be kept current and entered into the contractor document control system.

e. Subcontractors should comply with the Site-Specific RCM.

5. Application of Requirements

a. It is not the intent of the RCS to unnecessarily create new or separate organizations if those functions can be incorporated into existing ones.

b. Existing charters may need to be revised to address RCS recommendations.

c. The degree of program formality and extent of the associated administrative process are expected to be commensurate with the radioactive material contamination and dose potential.

III. SUMMARY

A. Review major topics

1. History of standards

2. Advisory agencies

3. Federal policy on radiation matters

4. Regulating agencies

5. Radiological Control Standard

B. Review of learning objectives

IV. EVALUATION

Evaluation should consist of a written examination comprised of multiple choice questions. 80% should be the minimum passing criteria for the examination.