

Regulations



Module Objectives

- **Be familiar with regulations that govern operational health physics programs.**
- **Be familiar with EPA regulations that apply to facilities.**
- **Be familiar with decommissioning challenges.**

Code of Federal Regulations

- **Regulations of the various federal agencies are found in the Code of Federal Regulations (CFR) and published annually.**
- **Federal regulations pertaining to radioactive materials and radiation can be found in various parts.**

Federal Register

- **Proposals for new regulations and proposed changes to existing regulations first appear in the Federal Register (FR), published on a daily basis.**
- **When new regulations or changes are approved, the final versions appear in the FR before being published in the CFR.**

The Environmental Protection Agency

In 1969, the functions of the Federal Radiation Council (created through an Executive Order of the President) were transferred to the Administrator of the newly formed EPA.

EPA

The Administrator of the EPA is required to “advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all Federal agencies in the formulation of radiation standards....”

EPA

EPA sets the standards for the other agencies, who must then develop or revise their regulatory requirements to comply with EPA standards.

EPA

EPA also develops environmental radiation standards for a variety of practices or sources under authority of other laws such as the Safe Drinking Water Act and Clean Air Act.

EPA

- **These standards are enforced by EPA, and may also apply to DOE facilities and/or NRC licensees.**
- **EPA also has some agreements with the states for various regulatory responsibilities.**

EPA

The Resource Conservation and Recovery Act (RCRA) gives the Environmental Protection Agency authority to regulate the disposal of solid wastes containing radioactive materials other than those materials regulated by the NRC.

EPA 40 CFR Part 61

- **These are the National Emission Standards for Hazardous Air Pollutants (NESHAPS).**
- **The goal of the EPA is:**
 - **To protect the greatest number of people possible to an individual lifetime risk level $<$ one in one million.**
 - **To limit the maximum estimated risk that a person living near a plant would have if he/she were exposed to an emitted pollutant for 70 years to $<$ one in ten thousand.**

EPA 40 CFR Part 61

- **NRC objected to a new standard being applied to NRC licensees by the EPA and argued that as a result of existing NRC regulations, the public was being adequately protected from radioactive emissions from NRC licensed facilities.**



EPA 40 CFR Part 61

- **NRC also desperately wanted to avoid dual regulation of its licensees by EPA.**
- **After legal battles and sometimes fierce negotiations between the two agencies, NRC agreed to revise 10 CFR 20 to include a dose constraint of 10 mrem/yr from air emissions (Section 20.1101(d)), and EPA agreed not to inspect NRC licensees.**



EPA 40 CFR Part 61

- **The EPA has issued NESHAPS for seven source categories:**
 - **Subpart B: Radon Emissions from Underground Uranium Mines (10 mrem/yr).**
 - **Subpart H: Radionuclide Emissions other than radon from DOE Facilities (National Laboratories, Enrichment facilities) (10 mrem/yr).**

EPA 40 CFR Part 61

- **Subpart I: Radionuclide Emissions from Federal facilities not covered under subpart H (uranium mills and tailings, uranium hexafluoride conversion facilities, fuel fabrication facilities) (10 mrem/yr).**
- **Subpart K: Radionuclide Emissions from Elemental Phosphorus Plants (2 Ci/yr from Po-210).**

EPA 40 CFR Part 61

- **Subpart Q: Radon Emissions from DOE Facilities (20 pCi/m²s).**
- **Subpart R: Radon Emissions from Phosphogypsum Stacks (20 pCi/m²s).**
- **Subpart W: Radon Emissions from Operating Uranium Mill Tailings Piles (20 pCi/m²s).**



EPA 40 CFR Part 141

- **These are the National Primary Drinking Water Regulations.**
- **The Safe Drinking Water Act applies to public water systems and establishes primary drinking water regulations, which specify contaminants that in the judgment of the EPA could have an adverse effect on the health of persons.**



EPA 40 CFR Part 141

- The current regulations include maximum contaminant levels (MCLs).
- MCLs are "the maximum permissible level of a contaminant in water which is delivered to any user of a public water system."

EPA 40 CFR Part 141

- **A public water system has at least 15 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.**
- **The regulations do not apply to private water systems such as private wells.**

Current MCLs in EPA Primary Drinking Water Regulations

Contaminant	MCL
Combined Ra-226 and Ra-228	5 pCi/L
Gross α emitters (including Ra-226, but excluding radon and uranium)	15 pCi/l
Betas/Photons from man-made radionuclides	< 4 mrem/yr to any organ, or to the total body



EPA 40 CFR Part 141

- **In 2000, the EPA revised the Safe Drinking Water Act regulations to include a standard for Rn-222 in water.**
- **In 1991 the EPA had proposed a Rn-222 standard in water of 300 pCi/L.**

EPA 40 CFR Part 141

- This proposal was never finalized because of opposition on the grounds that:
 - The mean Rn-222 concentration in ground water in the U.S. is 600 pCi/L.
 - Airborne Rn-222 is so much more of a risk than Radon in water.

EPA 40 CFR Part 141

- The new regulations (2000) contained a(n):
 - MCLG of 0.
 - MCL of 300 pCi/L.
 - AMCL of 4000 pCi/L.

EPA 40 CFR Part 141

- A state can implement a Multimedia Mitigation (MMM) Program to reduce Rn-222 in air.
- If the MMM program meets the criteria set by EPA, then community water supplies in that state are only required to comply with the Alternative Maximum Contaminant Level (AMCL) of 4,000 pCi/L of Rn-222.

EPA 40 CFR Part 141

- **If the state does not choose to implement an MMM program, then a community water supply can implement one!**
- **Without a MMM program (statewide or a community supply system), the MCL is 300 pCi/L.**

EPA 40 CFR Part 144

- **Underground injection control program, this covers the use of deep injection wells at ISR facilities.**
- **Wells used by ISR facilities for deep well injection are considered class III wells.**
- **Class III-In situ production of uranium or other metals; this category includes only in-situ production from ore bodies which have not been conventionally mined. Solution mining of conventional mines such as stopes leaching is included in Class V.**
- **Requires a permit from the EPA to construct and operate a deep injection well.**



EPA 40 CFR Part 190

- **These are the Environmental Radiation Protection Standards for Nuclear Power Operations.**
- **These regulations apply to radiation doses received by members of the public in the general environment and to RAM introduced into the general environment from the nuclear fuel cycle.**

EPA 40 CFR Part 190

- **The nuclear fuel cycle includes:**
 - **Milling of uranium ore.**
 - **Chemical conversion of uranium.**
 - **Fabrication of uranium fuel.**
 - **Electricity generation in nuclear power plants.**
 - **Fuel reprocessing.**

EPA 40 CFR Part 190

- **These regulations do not include mining, waste disposal operations, transportation, and use of recovered special nuclear and byproduct materials.**

EPA 40 CFR Part 190

- **Section 190.10 contains standards for normal operations.**
 - **Annual dose equivalent to the whole body, thyroid, and to any other organ not exceeding 25 mrem, 75 mrem, and 25 mrem, respectively, to any member of the general public.**



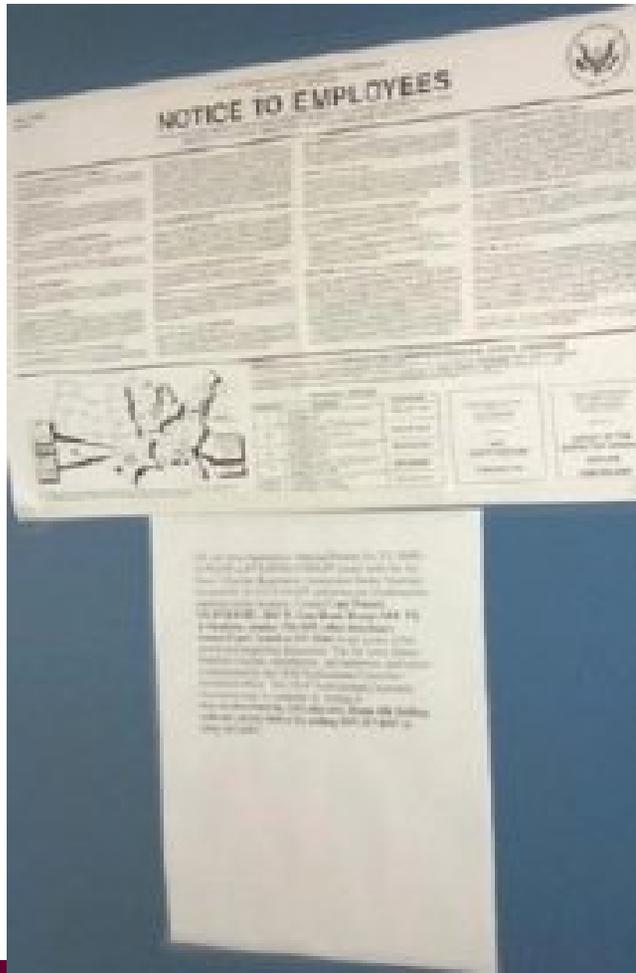
EPA 40 CFR Part 190

- **Total quantity of radioactive materials, per gigawatt-year of electrical energy produced by the fuel cycle, < 50,000 Ci of krypton-85, 5 mCi of iodine-129, and 0.5 mCi combined of plutonium-239 and other alpha-emitting transuranic radionuclides with half-lives greater than one year.**

NRC Regulations 10 CFR 19 Notices, Instructions

- **Establishes requirements for notices, instructions, and reports by licensees to individuals participating in licensed activities**
- **Establishes the rights and responsibilities of the Commission and individuals during interviews ..."**

10 CFR 19



Specifies that the license, Notice to Employees, and notices of violations must be posted conspicuously or identified as being available

10 CFR 19

Requires that workers be instructed in:

- **the use of radioactive materials.**
- **the precautions and procedures used to minimize exposure.**
- **information required to be provided to employees (e.g., personal dosimetry results).**
- **rights and responsibilities of licensee and workers during routine work activities and inspections.**

10 CFR 20 Standards for Protection Against Radiation

Establishes standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC



10 CFR 20

Purpose is to control the “...receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual . . . does not exceed the standards for protection against radiation prescribed in the regulations in this part”

10 CFR 20 Dose Limits

Population	Dose Limit
Adult Worker	5 rem TEDE 50 rem TODE 15 rem eye dose equivalent
Minor Worker	500 mrem TEDE 5 rem TODE 1.5 rem eye dose equivalent
Member of the Public	100 mrem, with only 10 mrem from airborne emissions
Embryo/fetus of Declared Pregnant Worker	500 mrem during gestation period

10 CFR 20

- **Requires a radiation protection program**
- **Requires a constraint on air emissions of 0.1 mSv/year (10 mrem/year) to a member of the public**
- **Requires compliance with annual dose limits**
- **Requires performance of radiation surveys**

10 CFR 20

- **Sets occupational dose limits for minors (10% those for adults)**
- **Sets dose limits for members of the public of 1 mSv/year (100 mrem/year)**
- **Identifies conditions requiring personal monitoring**
- **Describes the requirements for a respiratory protection program**

10 CFR 20

- **Establishes requirements for the storage and control of licensed material**
- **Establishes posting and labeling requirements**
- **Identifies acceptable methods for and requirements for waste disposal**
- **Identifies requirements pertaining to record keeping and reports**
- **Establishes release criteria for decommissioning**

NRC: Constraint on Air Emissions

- **This section (20.1101(d)) was added in 1996.**
- **It states that licensees must establish a dose constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters.**

NRC: Constraint on Air Emissions

- **The dose constraint must ensure that an individual member of the public likely to receive the highest dose will not be expected to receive a TEDE > 10 mrem/yr (0.1 mSv/yr) from these air emissions.**

NRC: Constraint on Air Emissions

- **Here is another example of a dose constraint on a particular pathway.**
- **In other words, the primary dose limit for the general public of 100 mrem/yr includes exposure from all pathways and all sources.**

NRC: Constraint on Air Emissions

- **Only 10 of the 100 mrem/yr can be from airborne radioactive emissions from a particular practice.**

NRC: Constraint on Air Emissions

- **Which value is controlling in situations where there is a conflict between values in Table 2 of Appendix B (concentrations resulting in 50 mrem/yr from internal exposures) and the dose constraint on air emissions of 10 mrem/yr?**

NRC: Constraint on Air Emissions

- **10 mrem/yr is the controlling value.**
- **The Table 2 of Appendix B concentration is applicable to monitoring at the site boundary.**
- **The 10 mrem/yr value is a dose constraint to the nearest actual member of the public.**

NRC: Constraint on Air Emissions

- **NRC Reg Guide 4.20 Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors is designed to help licensees comply.**

NRC: Criteria for License Termination

- The decommissioning of uranium and thorium mills is not subject to Sections 20.1402 or 20.1403, but addressed in 10 CFR 40.
- 10CFR40 sets the criteria for the decommissioning soils, structures, and disposal of material.



NRC: Criteria for License Termination

- 10 CFR 40 part 42 (g)(1) describes the need for a decommissioning plan for ISR facilities.
- 10 CFR 40 part 42 (h)(1) requires licensee to complete decommissioning within 24 months of the start of decommissioning.
- 10 CFR 40 part 42 (j)(2) requires the licensee to use the criteria listed in Appendix A of 10 CFR part 40.

NRC: Criteria for License Termination

- **Appendix A 10 CFR part 40**
- **The concentration averaged over 100 square meters of byproduct material does not exceed the background level by more than 5 pCi/g for radium 226 averaged in the first 15 cm of soil and by 15 pCi/g of radium 226 averaged over 15 cm thick layers more than 15 cm below the surface.**
- **Byproduct material containing radionuclides other than radium in soil and surface activity on remaining structures must not exceed the TEDE from cleanup of radium contaminated soil to the above standard (radium benchmark dose).**

NRC: Criteria for License Termination

- **Appendix A 10 CFR part 40**
- **If more than one residual radionuclide is present in the same 100 square meter area, the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed 1 (unity).**
- **The calculation of the potential peak annual TEDE within 1000 years to the average member of the critical group that would result from applying the radium standard (excluding radon) must be submitted for approval.**

NRC: Criteria for License Termination

- Dose modeling codes and calculations that can be used are:
 - RESRAD
 - Not good for groundwater calculations but does not effect ISR facilities
 - D&D code
 - Does not allow for modeling subsurface soil contamination and source material removal due to erosion.
 - GENII
 - For modeling dose due to off-site contamination.

NRC: Criteria for License Termination

- Once criteria are established surveys and sampling must be conducted to demonstrate compliance with the limits.
- NUREG 1575 (MARSSIM) is adequate to use to demonstrate compliance with the limits.

NRC Regulatory Guides

- **Provide guidance to licensees and license applicants on implementing specific parts of the regulations**
- **Provide guidance on techniques used by the NRC staff in evaluating specific problems or postulated accidents**
- **Clarify data needed by the NRC staff in their review of applications for permits or licenses**

NRC Regulatory Guides

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust and Financial Review
10. General

NRC Regulatory Guides

- **8.25 Air Sampling in the Workplace**
- **8.29 Instruction Concerning Risks from Occupational Radiation Exposure**
- **8.34 Monitoring Criteria and Methods To Calculate Occupational Radiation Doses**
- **8.36 Radiation Dose to the Embryo/Fetus**
- **8.13 Instruction Concerning Prenatal Radiation Exposure**

NUREGS

- **The NRC publishes NUREG documents as guidance on compliance with regulations.**
- **They provide the methodology and technical basis for implementation of programs or related requirements.**



NUREGS

- Like the NRC Regulatory Guides, NUREGs are not regulations and compliance is not required.
- Many NUREGs are available electronically, at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/>

NUREGS

- **NUREG 1556 Consolidated Guidance about Materials Licenses is comprised of many volumes, each on a different topic.**
- **For example, volume 11 is titled: *Program Specific Guidance About Materials Licenses (1999)*.**

Other NRC Guidance

- **Information Notices - issued to addressees to provide significant recently identified information about safety, safeguards, or environmental issues**
- **Event Reports**
- **Health Physics Position Papers - a compilation of NRC staff positions on a wide range of topics involving radiation protection**

New Design Considerations

- In general design features that aid in contamination control during operation also facilitate decommissioning.
- Maintenance procedures that are used during operation are also important in controlling the spread of contamination to clean areas and therefore facilitate decommissioning.

Building Materials

- **The less permeable building materials are the more easily they are decontaminated.**
- **Any concrete with uncoated surfaces that comes into contact with uranium solutions or uranium contaminated air will require surface removal and disposal as radioactive waste.**
- **If there are cracks through which contaminated solutions have penetrated, the entire structure may need to be disposed of as radioactive waste.**
- **Metal surfaces may also require decontamination, the more highly polished the metal the easier it is to decontaminate.**

Building Materials

- If filtration has failed roofs may be contaminated metal roofs are easier to decontaminate.
- Interior surfaces are easier to clean if they have been primed and painted.
- Wood and plasterboard will usually have to be disposed of as radioactive waste.
- Floor surfaces will be a problem
- Single sheet vinyl flooring with heat sealed seams is effective.

Ventilation Systems

- **Ventilation systems should be designed based on the operations anticipated in the work area.**
- **Adequate air flow for all operations and good design practices will help keep the facility clean during operations.**
- **Stainless steel ductwork is preferred for ease of decontamination.**
- **Welded joints are less likely to collect contamination than bolted joints cut bolted joints are easier to remove and allow access to the internals of the ductwork.**

Piping Systems

- **Potentially contaminated piping systems imbedded in concrete are a common decommissioning problem.**
- **Usually they are sealed and left in place until final demolition of the facility.**
- **It is best to run pipes in chases or tunnels that have been lined (preferable with stainless steel) to prevent contamination from penetrating building surfaces.**
- **Floor drains should not be encased in concrete to allow ease of removal.**

Lessons Learned from D&D

- Seal concrete floors and seal the floor wall junction.
- Self cleaning floors are bad.
- If using paint as a fixative in lieu of cleanup document for D&D and operations purposes.
- Beware of midnight shift.
- Natural uranium is everywhere.