


U.S. Environmental Protection Agency

**Review of Radionuclide NESHAPs
Requirements and RPD developed
Computer Models**

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Review and Update on the Radionuclide NESHAPs



2024 Topics

- Review of the Radionuclide NESHAPs
 - History of the Standard
- Program Activities for Compliance Codes
- Future Updates for our Codes

Statutory Basis of the Radionuclide NESHAPs



Section 112 of the Clean Air Act

Requires the Agency to:

- Identify and list hazardous air pollutants
- Identify source categories and set standards
- Standards must provide for the “protection of public health with an ample margin of safety”

Section 122 (1977 amendments)

Congress specifically required the EPA Administrator to consider radionuclides:

§7422. Listing of certain unregulated pollutants

(a) Radioactive pollutants, cadmium, arsenic, and polycyclic organic matter

Not later than one year after August 7, 1977 (two years for radioactive pollutants) and after notice and opportunity for public hearing, the Administrator shall review all available relevant information and determine whether or not emissions of radioactive pollutants (including source material, special nuclear material, and byproduct material), cadmium, arsenic and polycyclic organic matter into the ambient air will cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health.

December 1979 - EPA listed ionizing radiation as a Hazardous Air Pollutant under Section 112 (44 FR 76738)

Development of the Regulations



Regulatory Development

April 1983: First radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAPs) proposed (48 FR 15077)

1987: *NRDC v. EPA “Vinyl Chloride”* decision, D.C. Circuit court

- Rejected the NESHAP for vinyl chloride on the basis that it considered cost and technological feasibility before making an independent decision on health risk
- Required the Administrator to meet the requirements of section 112 in two steps:
 - Determine a “safe” or “acceptable” level of risk based only on health factors
 - Set a standard that provides an “ample margin of safety”, which may consider economic, technological, and other factors
- A court-required review found that the radionuclide NESHAPs did not meet this standard

December 1989: Final NESHAPs published at 40 CFR Part 61 for eight source categories of radionuclides (54 FR 51654 – 51715)

Subparts and Source Categories

40 CFR Part 61



Subpart A: General Provisions

Subpart B: Underground Uranium Mines

Subpart H: Department of Energy Facilities

Subpart I: Non-DOE Federal Facilities

Subpart K: Elemental Phosphorus Plants

Subpart Q: Department of Energy Radon Emissions

Subpart R: Radon from Phosphogypsum Stacks

Subpart T: Disposal of Uranium Mill Tailings

Subpart W: Operating Uranium Mill Tailings Piles

Dose limits to the maximally exposed individual: Uranium mines, DOE, and Federal Facilities (Subparts B, H, and I)

- Dose limited to .1 mSv/yr (10 mrem/yr effective dose equivalent)
- Monitoring facility vents or stacks is required to determine emissions
- **Dose calculations are performed using EPA-supplied computer codes and reported to EPA**

Release limits: Elemental Phosphorus plants (Subpart K)

- Emissions of polonium-210 limited to 166.5 GBq/yr (4.5 Ci/yr)

Work practice requirements and radon flux limits: Phosphogypsum and Uranium Mill Tailings (Subparts Q, R, T and W)

- Process requirements (e.g. limiting open areas or keeping tailings adequately watered) limit radon emissions during operations
- Radon flux measurements and reporting (typically at closure) .74 Bq/m²/sec (20 pCi/m²/sec)

Basis of the Compliance Standards



Conclusions

- Standards are based on the statutory authority of the Clean Air Act
 - Amendments clarified Congress' intent concerning the Agency's responsibilities
- Iterative cycles of rulemaking and litigation defined how the Administrator must protect public health with an “ample margin of safety”
 - Health risks must be analyzed independently
 - Technological, economic, and other factors may be considered in a final standard
- A standard based on a maximum individual risk of 1×10^{-4} met the decision-making criteria
 - Consistent with risk approval to chemical Hazardous Air Pollutants
 - Low incidence of risks below the threshold
 - Acknowledged uncertainties in risk assessment and dose calculation

Basis of the .1 mSv (10 mrem) Standard



Setting the Standard

- Subparts B, H, and I set an annual dose limit of .1 mSv (10 mrem) effective dose equivalent (EDE) to the maximally-exposed individual.
 - This reflects the adoption of ICRP 26 methodology (1982).
- “In light of the numerous uncertainties in both establishing the parameters for the risk assessment and in modelling actual emissions and exposure...EPA judges that the [maximum individual risk] of 2.0×10^{-4} is essentially equivalent to the presumptively safe level of approximately 1.0×10^{-4} .” (54 FR 51664)

“Currently, all DOE sites comply with the dose limit of 10 mrem/year and emissions have been historically below this standard. Nonetheless, stakeholders have raised concerns when reported emissions increase from one year to the next even though emissions may remain within compliance. ...EPA’s position is that year-to-year changes, including increases, are possible. Subpart H does not have a requirement that emissions never increase, only that they shall not exceed the 10 mrem/year standard.” **2007 Memorandum, Inspection of DOE Facilities Subject to 40 CFR Part 61, Subpart H**

Subpart B: Radon Emissions from Underground Uranium Mines



- **Facilities:** 3 active facilities in UT, AZ (EPA Regions 8 and 9)
 - Increase in price of uranium may bring more facilities online

The Standard:

- Emissions of radon to ambient air from an underground uranium mine shall not exceed those amounts that would cause any member of the public to receive an annual effective dose equivalent of 10 mrem/yr.
- Radon is measured at all mine vents using EPA methods, and dose to the MEI calculated using EPA code COMPLY-R.
 - AERMOD has been approved as an alternate model for radon transport at the La Sal mine complex

Annual report

- Report for previous calendar year is due to EPA on March 31
- A list of emission points and their distances to the nearest residence, school, business/office, and producing farm
- The results of emissions testing and dose calculations

Subpart H: Emissions of Radionuclides Other than Radon from Department of Energy Facilities



- **Facilities:** ~35 facilities in EPA Regions 2,3,4,5,6,7,8,9 and 10
 - Large and complex sites with multiple sources and ongoing decommissioning and decontamination

The Standard:

- “Emissions shall not exceed those amounts that would cause any member of the public to receive an annual effective dose equivalent of 10 mrem/yr”
- Monitoring facility vents or stacks is required, to determine emissions
 - Monitoring and sampling must be performed using EPA-approved methods
 - Amended to incorporate HPS/ANSI N13.1-1999 by reference
- **Dose calculations are performed using EPA-supplied codes, unless otherwise approved (CAP88, AIRDOS-PC)**
 - **Reports for previous calendar year must be submitted to EPA on June 30**
- Permission from EPA is required for new construction and/or alternate compliance methods (potential to emit >1% of the standard)

§ 61.08, Approval of construction or modification

“If the Administrator determines that a stationary source for which an application under § 61.07 was submitted will not cause emissions in violation of a standard if properly operated, the Administrator will approve the construction or modification.”



Subpart I: Emissions from Federal Facilities Other Than Nuclear Regulatory Commission Licensees and Not Covered by Subpart H



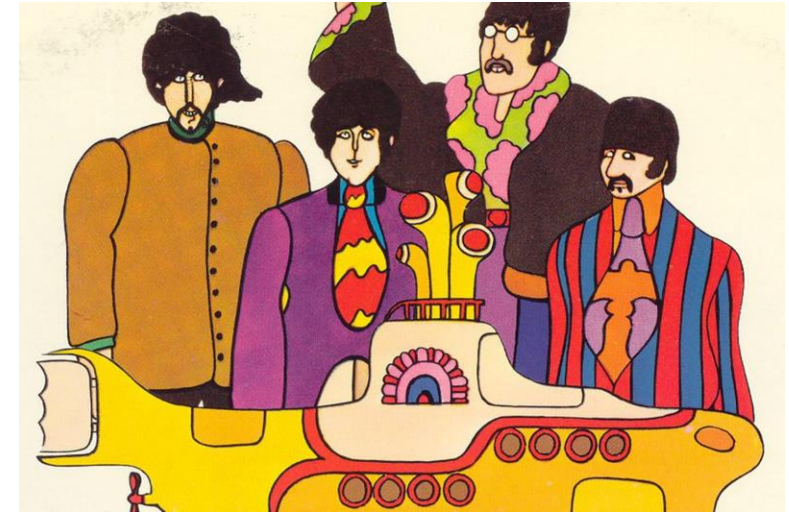
- 1996: Subpart I rescinded for NRC-licensed facilities (61 FR 68981)
- ~20 sites in regions 1,3,4,5,9 and 10

The Standard:

- Emissions of radionuclides, including iodine, shall not exceed those amounts that would cause any member of the public to receive more than an annual effective dose equivalent of 10 mrem/yr; and
- Emissions of iodine shall not exceed those amounts that would cause any member of the public to receive an annual effective dose equivalent of 3 mrem/yr.

Reporting Requirements:

- Report for previous calendar year is due to EPA on March 31
- Compliance methods are largely similar to Subpart H
 - COMPLY code is used



Subpart I: Alternate procedures



- ANSI N13.1 methods are frequently impractical for sampling emissions from vessel reactor compartments and other naval nuclear propulsion activities
- 1992-1997: collaborative work between EPA and Naval Sea Systems Command to develop alternate compliance procedures for measurement and estimation of radionuclide emissions for demonstrating compliance with Subpart I
- October 1, 1997: EPA granted final approval of alternate methods

SUMMARY OF FINAL PROCEDURES

1. Existing Sources:

<u>Type of Source</u>	<u>Final Navy Procedure</u>
Monitored Ventilation	Existing Particulate Sampling
Noble Gases and Radioiodine	Noble Gas and Radioiodine from Norfolk Naval Base Test
C-14	C-14 Based on a Specific Quantity per MW-hr
Tritium	1 Curie plus Planned Releases for Tritium
Engine Rooms	Concentration Equal to Main Shore Facility
Tank Vents	Tank Volume $\times 5 \times 10^{-10}$ uCi/ml
Hull Decon	Appendix D Release Fraction
Surface Ship RC	5×10^{-14} uCi/ml
Minor Availability RC Exhaust	Concentration Equal to Main Shore Facility

Note: (Noble gases, radioiodine, carbon-14, and tritium apportioned among the sources.)

2. New Sources

<u>Type of Source</u>	<u>Final Navy Procedure</u>
Monitored Ventilation	Particulate Concentration from Similar Source (Construct or Modify)
Potential Sources	Same as Above for Engine Rooms, tank vents. surface ship RC exhaust. hull

Program Implementation



- **ORIA:** Sets regulatory standards, guidance for program implementation.
- **OEI and OECA:** Set quality assurance authority for inspections.
- **EPA Regions:** Primarily responsible for interacting with regulated parties and delegated states.
 - Implementation has been delegated to WA, UT, NC, SC, TN, KY, MS, and NV

“ Implementing the radionuclides NESHAPs involves two main types of activities. One is inspection/enforcement: determining that the emissions or work practice standards are met and that other requirements of the standards, such as testing, monitoring and recordkeeping, are properly followed. The other is examining and responding to applications for compliance waivers, construction or modification, and alternative monitoring plans or compliance demonstrations.” - **Radiation NESHAPs Implementation Guidance, 1991, Office of Radiation Programs**

RPD Developed Compliance Codes



The Radiation Protection Division maintains two main computer models that are used to show compliance with the Agency's radiation National Emission Standards for Hazardous Air Pollutants (NESHAPs) requirements:

- **COMPLY – Agency requested NCRP to develop simple screening methods for showing compliance with our NESHAPs Subpart I requirement**
 - **COMPLY-R – Similarly this code was developed to show compliance with our NESHAPs Subpart B requirements**
- **CAP88 PC - Most sophisticated of our models, this code was specifically developed for showing compliance with our NESHAPs Subpart H requirement**

- **CAP88-PC Version 4.2**

- Updates to address technical shortcomings of existing versions
- Radon models – Revised calculations to better address current radon risk estimates
- Carbon-14 model – Revised to account for increasing CO₂ in atmosphere and associated C-14 in the atmosphere
- Tritium model – Revised to update methodology to that recommended in NCRP Report 123 “*Screening Models for Releases of Radionuclides to the Atmosphere, Surface Water, and Ground (1996)*”

- **COMPLY-R Version 1.3**

- Updated only to run on current disk operating systems
 - No updates to calculation or user interface