



EPA's Environmental Radiation Protection Standards for SNF, HLW, and TRU Waste

Applicability of 40 CFR Part 191 to Deep Boreholes

October 21, 2015

Presented by:

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Presented to:

Nuclear Waste Technical Review Board
International Technical Workshop
Deep Borehole Disposal of Radioactive
Waste
Washington, DC

Overview

Background

- U.S. Geologic Repository Responsibilities
- Blue Ribbon Commission
- Nuclear Waste Policy Act
- Applicability of 40 CFR Part 191 to boreholes







40 CFR Part 191

- Definitions and Standards

Questions raised by the use of boreholes



U.S. Geologic Repository Responsibilities

	Site Developer	Regulator	
		General Standards	Compliance Criteria
WIPP			
NWPA/Yucca Mountain			



Blue Ribbon Commission

The Blue Ribbon Commission on America's Nuclear Future recommended that

“...the EPA and NRC develop a new safety standard and regulatory framework for deep boreholes...informed by RD&D efforts aimed at developing a licensed demonstration project.”

--Final Report, January 2012, page 96

In the absence of borehole-specific standards and requirements, what can we say about the existing regulatory framework?



Nuclear Waste Policy Act

Section 121 (a) directs EPA to

- “...promulgate **generally applicable standards for protection of the general environment from offsite releases from radioactive material in repositories.**”
- EPA promulgated final 40 CFR part 191 in 1993
 - Standards currently applied to transuranic waste at Waste Isolation Pilot Plant

Section 2(18) defines “repository”

- Any system licensed by the [Nuclear Regulatory] Commission
- Used for the permanent deep geologic disposal of HLW and SNF
- Whether designed to allow recovery of waste or not
- Includes both surface and subsurface

We can conclude that boreholes that meet these conditions are repositories (for purposes of the NWPA)

Does 40 CFR part 191 address boreholes?



Applicability of 40 CFR Part 191

EPA explained its view of 40 CFR part 191 as broader than “mined geologic repositories”:

“We concentrated on geologic repositories because much more information is available on this approach than on other methods, and because the DOE has decided to focus the national program on this method (46 FR 26677). **Our disposal standards, however, are meant to apply to any method of disposal, except disposal directly into the ocean or ocean sediments.** Thus, another disposal method would have to provide at least as much protection as that projected for geologic disposal.”

--47 FR 58199, December 29, 1982

—original Notice of Proposed Rulemaking

We can conclude that 40 CFR part 191 does apply to any boreholes used for disposal of SNF, HLW or TRU waste



40 CFR Part 191 – General Public Health and Safety Standards

Pre-Closure Operational Safety Standards (Subpart A)

- Definitions, Dose Limits, Management and Storage

Post-Closure Public Health and Safety Standards (Subparts B and C)

- Definitions
- Containment Requirements: Timeframe, Allowable Releases (Release Limit, Dose, Risk)
- Assurance Requirements Methodology
- Individual Protection Requirements
- Scope Of Performance (Safety) Assessment
- Ground-Water Protection



Subpart A, Management and Storage

40 CFR 191.01, Applicability

- Limits radiation doses received by members of the public as a result of the management (except for transportation) and storage of SNF, HLW, or TRU radioactive wastes
 - (a) at any facility regulated by the Nuclear Regulatory Commission or by Agreement States
 - to the extent that such management and storage operations are not subject to 40 CFR part 190
 - (b) at any disposal facility that is operated by the Department of Energy and that is not regulated by the Commission or by Agreement States.



Subpart B, Disposal

40 CFR 191.11, Applicability

(a) This subpart applies to:

- (1) Radioactive materials released into the accessible environment **as a result of the disposal of spent nuclear fuel or high-level or transuranic radioactive wastes;**
- (2) Radiation doses received by members of the public as a result of such disposal; and
- (3) Radioactive contamination of certain sources of ground water **in the vicinity of disposal systems for such fuel or wastes.**



Relevant Definitions from 40 CFR part 191

Disposal

- **Permanent isolation of waste from the accessible environment with no intent of recovery**
- Whether or not such isolation permits recovery
- Example: disposal in a mined geologic repository occurs when all of the shafts to the repository are backfilled and sealed.

Disposal system

- Any **combination of engineered and natural barriers** that isolate spent nuclear fuel or radioactive waste after disposal.

Controlled area

- (1) A surface location that
 - Encompasses no more than 100 square kilometers
 - Extends no more than five kilometers in any direction
 - Is identified by passive institutional controls
- (2) The subsurface underlying such a surface location.



Recovery, Retrieval, Removal of Waste

Nuclear Waste Policy Act Section 122

- any repository “**shall be designed and constructed to permit the retrieval of any spent nuclear fuel placed in such repository, during an appropriate period of operation of the facility**”
 - for the public health and safety or the environment
 - for economic recovery
 - DOE determines the period of retrieval, NRC approves or disapproves

40 CFR part 191

- §191.14(f) Disposal systems shall be selected so that removal of most of the wastes is not precluded for a reasonable period of time **after disposal**.



Subpart B, Containment Requirements

40 CFR 191.13 limits cumulative releases of radionuclides to the accessible environment (outside the controlled area) for 10,000 years after disposal

- Based upon **performance assessments**
 - Incorporate all significant processes and events that may affect the disposal system
- Release limits calculated per metric ton of heavy metal in the repository
- Probabilistic criteria for determining a reasonable expectation of compliance



Subpart B, Individual Protection Standards

40 CFR 191.15 limits public exposures

- 15 mrem annual committed effective dose to any member of the public in the accessible environment for 10,000 years after disposal
 - All pathways of exposure
 - Undisturbed performance of the repository
 - Reasonable expectation of compliance



Subpart C, Ground-water Protection Standards

40 CFR 191.24 limits releases to ground water

- Releases shall not cause concentrations in ground water in the accessible environment to exceed Maximum Contaminant Levels (MCLs) for 10,000 years after disposal
 - 4 mrem annual dose equivalent for man-made beta/photon emitters
 - Applies to underground sources of drinking water
 - Undisturbed performance of the repository
 - Reasonable expectation of compliance

History

- 1985 standards challenged as allowing “endangerment” of ground water, contrary to Safe Drinking Water Act underground injection provisions
- First Circuit opinion: “We conclude that the primary disposal method being considered, underground repositories, *would likely* constitute an ‘underground injection’ under the SDWA.” (emphasis added)
- To address this issue, EPA amended standards to provide protections consistent with SDWA – no final court ruling exists on this point



Alternative Provisions

40 CFR 191.16 (disposal) and 191.26 (ground water)

- Authorize EPA to substitute for provisions in subparts B and C if
 - (a) The alternative provisions have been proposed for public comment in the FEDERAL REGISTER, including:
 - information describing the costs, risks, and benefits of disposal in accordance with the alternative provisions;
 - reasons why compliance with the existing provisions appears inappropriate;
 - (b) A public comment period of at least 90 days has been completed, with opportunity for public hearings in affected areas of the country;
 - (c) The public comments received have been fully considered in developing the final version of such alternative provisions.



Questions Posed by Deep Borehole Disposal

Is a borehole used for disposal a repository?

What is the controlled area?

What is the accessible environment for purposes of determining compliance?

What constitutes the disposal system for a deep borehole?

How should we treat one borehole vs multiple boreholes?

How should intrusion be considered? Is it necessary? How to discern the probability of an intrusion?

Can you adequately characterize the disposal system at depth?



More Questions

What engineered barrier would be used? Special container? Special casing? Chemical barrier?

How can DOE ensure that the waste could be retrieved? Via what mechanism/approach? How could DOE demonstrate feasibility of retrieval?

Are there Underground Injection Control issues not addressed by Subpart C of 40 CFR part 191 (GW protection)?

Would it be appropriate to invoke the alternative standard provisions of §191.16 and §191.26 specifically for deep boreholes? Are new standards/provisions warranted given the nature of the waste?

If hazardous/mixed waste is disposed, would the waste require a RCRA No-migration variance? Congress waived this for WIPP mixed waste.



Summary

Deep boreholes used for disposal of nuclear waste are repositories as defined in the NWPA

40 CFR part 191 applies to disposal of nuclear waste in deep boreholes as currently written

We may want to consider whether 40 CFR part 191 would be best applied “as is” or if we should invoke the alternative provisions allowed in the rule to better address deep boreholes

If the deep borehole concept moves to implementation, then we would need address a number of regulatory questions

