U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Public Meeting: Regulatory Concepts for Integrated Low Level Radioactive Waste Disposal Rulemaking

May 17, 2023

ADAMS Accession No. ML23130A189

Purpose

- Describe the staff's preliminary direction on regulatory concepts associated with the Integrated Low Level Radioactive Waste Disposal rulemaking
- Obtain feedback from members of the public
- No formal comments collected during this meeting - rather we will describe future opportunities to submit comments

Agenda

- Welcome and logistics
- Opening remarks
- Rulemaking background
- Safety case and technical assessments
- Timeframes (compliance period)
- Waste acceptance
- [BREAK]
- Agreement State matters
- Operational safety and criticality for GTCC waste
- Exception criteria and significant quantities
- Implementation guidance
- Next steps
- Closing remarks

Logistics

- This meeting is being recorded
- When prompted for questions and discussion, please indicate your desire to speak by using the “Raise Hand” button in Teams (or press “*5” if participating by phone)
- Once your name has been called by the facilitator, you will need to unmute yourself (press “*6” if participating by phone)
- Chat feature is also enabled
- Presentation slides shown on the Microsoft Teams screen and in ADAMS at ML23130A189
- Phone attendees should e-mail george.tartal@nrc.gov for attendance record

Opening Remarks

Jeremy Groom

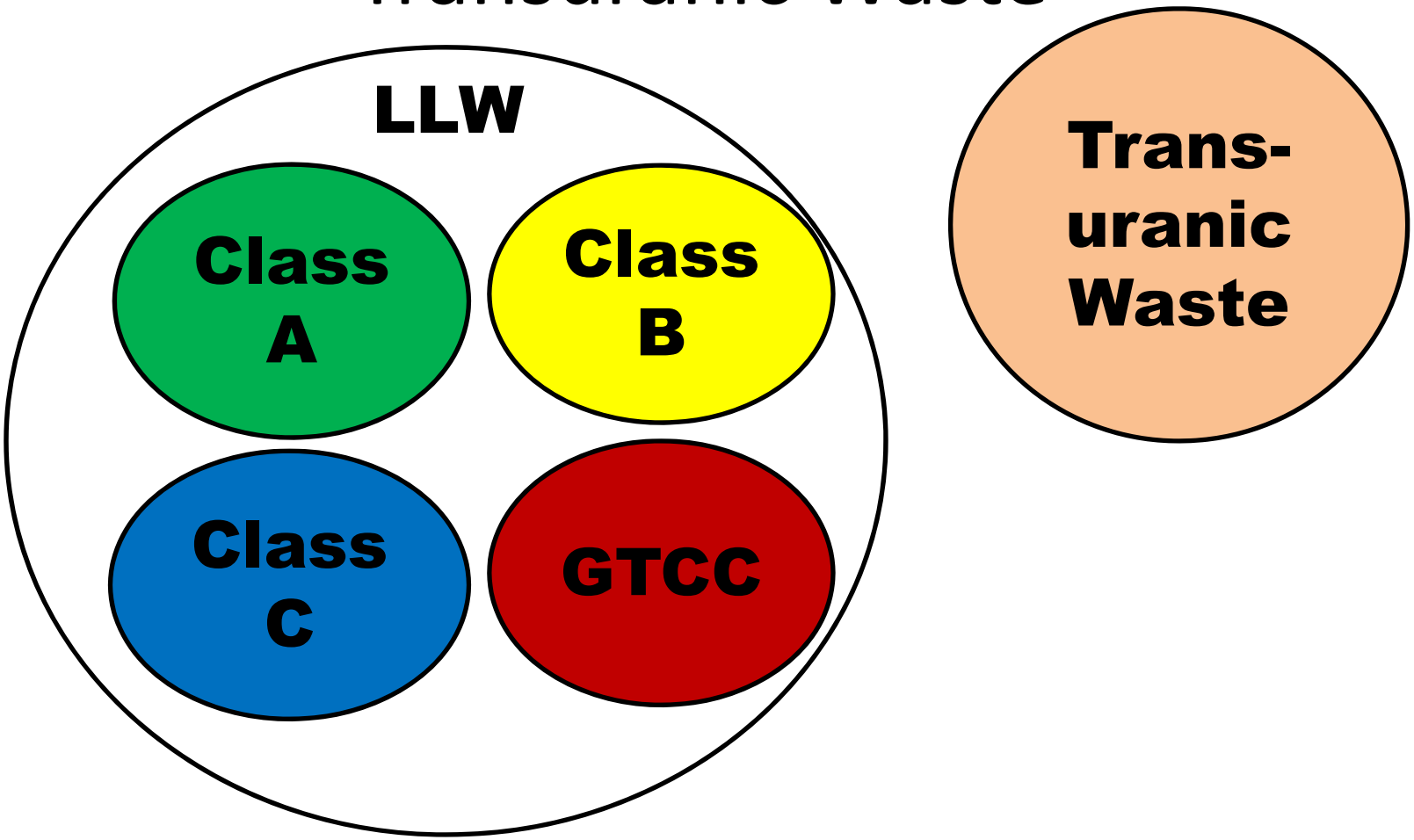
Deputy Director

Division of Decommissioning, Uranium Recovery,

and Waste Programs (DUWP)

Office of Nuclear Material Safety and Safeguards (NMSS)

Low-Level Waste and Transuranic Waste



Challenges to the Current Regulatory Framework in 10 CFR Part 61

1982 Assumption	Current Practice
Waste hazard to inadvertent intruder duration ❖ Class A and B: 100 years ❖ Class C: 500 years	Some defaulted Class A wastes are being disposed of in greater quantities than assumed and could cause hazards past these periods (e.g., Depleted Uranium (DU))
Only DOE enriches uranium ❖ DU only commercially available in small quantities	Private sector enrichment facilities
Average disposed waste concentration expected to be well below Class limit	Blended wastes create wastes much closer to Class limit and may be disposed in large amounts together
Greater-than-Class-C (GTCC) waste disposal in geologic repository or by Commission approval	Considering near-surface disposal (in top 30 m) for certain GTCC waste streams

Prior Rulemaking Efforts

- LLW Disposal rulemaking to address waste streams that differ significantly in quantity and concentration from what Part 61 originally assumed
  - SECY-16-0106 to the Commission as draft final rule
- Regulatory basis for the disposal of Greater-than-Class-C (GTCC) waste through means other than deep geological disposal.
  - In 2019 the NRC issued the draft regulatory basis for public comment.
  - The regulatory basis concluded that most of the GTCC waste streams are potentially suitable for near-surface disposal.

Commission Directions

- Combine the Part 61 and GTCC efforts to address overlapping technical requirements, streamline stakeholder outreach, and gain efficiency in proceeding as one rulemaking activity (SECY-20-0098)
- Commission issued Staff Requirements Memorandum (SRM-SECY-20-0098) on April 5, 2022

Integrating the LLW Rulemakings

Integrated Low-Level Radioactive Waste Disposal Rulemaking

NRC is preparing an integrated rulemaking to:

- Consolidate and integrate criteria for GTCC and 10 CFR Part 61 rulemaking
- Conduct site-specific analyses for all waste streams including DU and GTCC waste
- Include graded approach for compliance period
- Include TRU waste in the definition of LLW
- Address physical protection and criticality concerns in GTCC waste streams
- Provide for Agreement State licensing of certain GTCC waste streams

Safety Case and Technical Assessments

- Safety Case
  - Widely recognized internationally
  - Original Part 61 has many elements
  - Useful to stakeholders to better understand basis for decisions
- Technical Analyses (61.13)
  - Performance assessment (not new – renamed)
  - Intruder assessment (new)
  - Site stability assessment (new for significant quantities of long-lived)
  - Operational safety assessment (for some types of GTCC waste)
  - Performance period analyses (for significant quantities of long-lived)

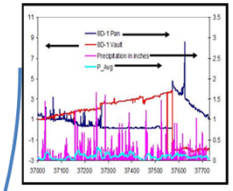
Safety Case

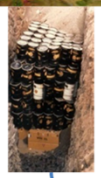
- A high-level summary of the information and analyses that support the demonstration that the land disposal facility will be constructed and operated safely – think executive summary.
- Provides reasonable assurance that the disposal site will be capable of isolating waste and limiting releases to the environment.
- Describes the strength and reliability of the technical analyses.

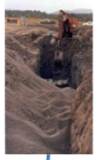
Performance Assessment

- The technical analyses completed for existing sites for the potential impacts to an offsite member of the public are considered synonymous with a modern performance assessment
- Understanding, tools, and capabilities have improved significantly since the early 1980's
- Significant guidance developed to support the proposed requirements for performance assessment (e.g., FEPs, uncertainty, model support)

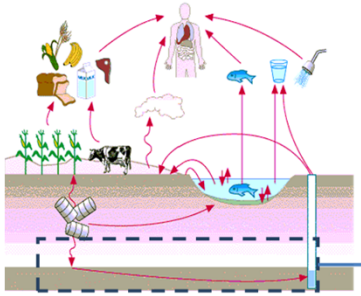
Performance Assessment – Guidance Example







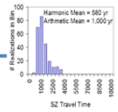
Site characterization data and other information



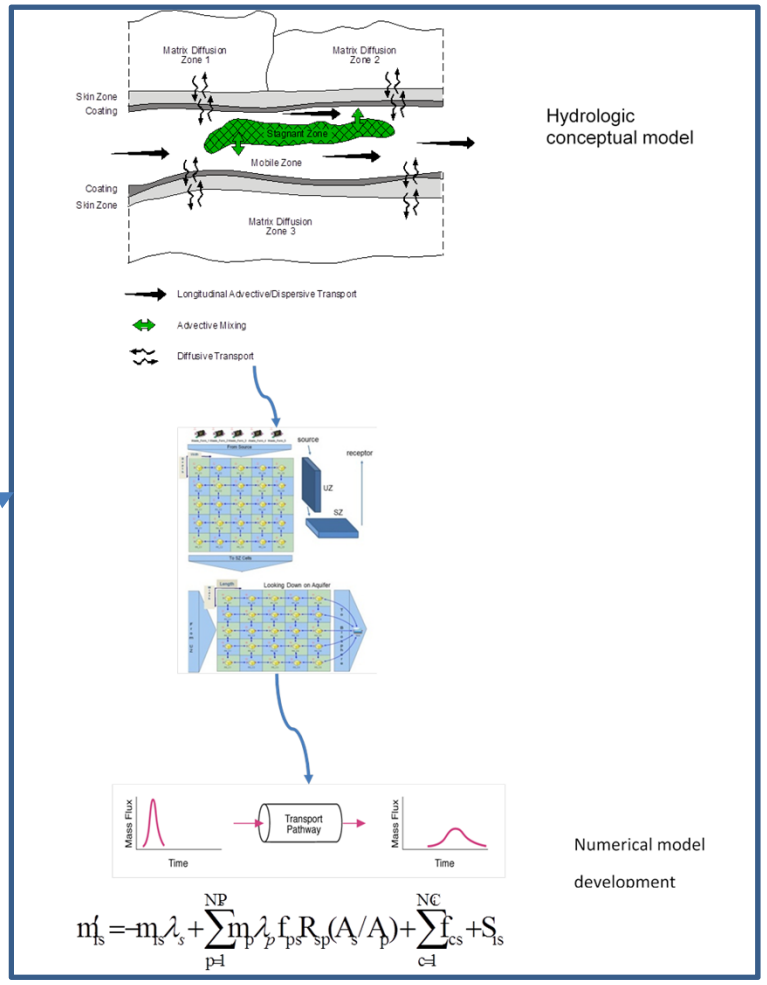
Performance assessment conceptual model development

Hydrologic conceptual model development (see next figure)

Estimated system performance



Abstracted hydrologic model



$$m'_{ts} = -m_{ts}\lambda_s + \sum_{p=1}^{NP} m_p \lambda_p f_{ps} R_{sp} (A_s/A_p) + \sum_{c=1}^{NC} f_{cs} + S_{ts}$$

Intruder Assessment

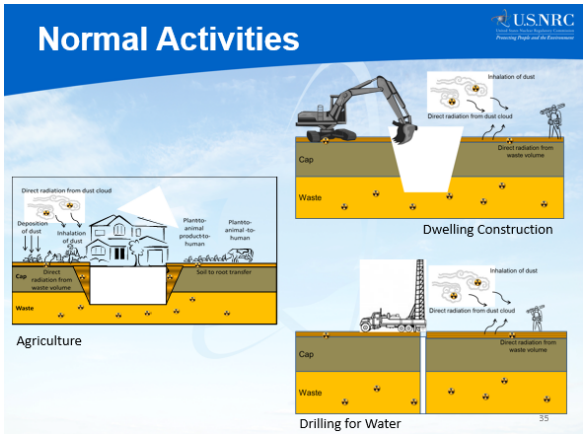
- The basis for 61.55 in the current regulation is an NRC intruder assessment
- Revised requirements would allow for a site-specific intruder assessment

This is a flexible and risk-informed approach

Table 1

Radionuclide	Concentration curies per cubic meter
C–14	8
C–14 in activated metal	80
Ni–59 in activated metal	220
Nb–94 in activated metal	0.2
Tc–99	3
I–129	0.08
Alpha emitting transuranic nuclides with half-life greater than 5 years	[1] 100
Pu–241	[1] 3,500
Cm–242	[1] 20,000

[1] Units are nanocuries per gram.



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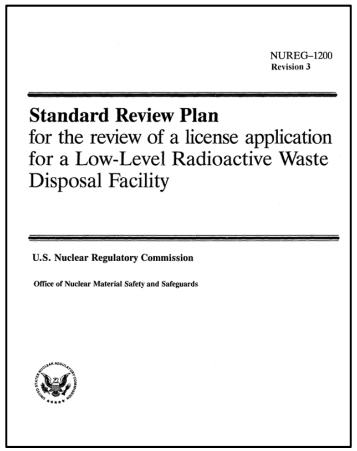
Site Stability Assessment

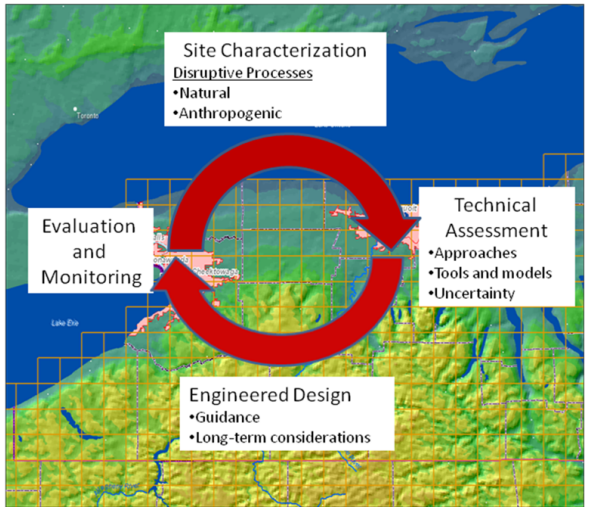
- Most problems with early disposal sites arose from short-term stability issues
- Those problems were addressed through design and site characteristic requirements
- Disposal of significant quantities of long-lived radionuclides may require long-term stability assessment
  - Addressed in the context of 61.41 and 61.42


NUREG–1200
Revision 3

Standard Review Plan
for the review of a license application for a Low-Level Radioactive Waste Disposal Facility

U.S. Nuclear Regulatory Commission

Office of Nuclear Material Safety and Safeguards



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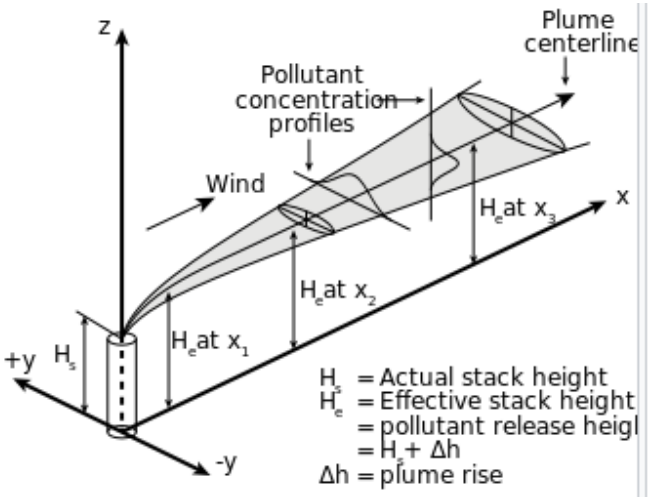
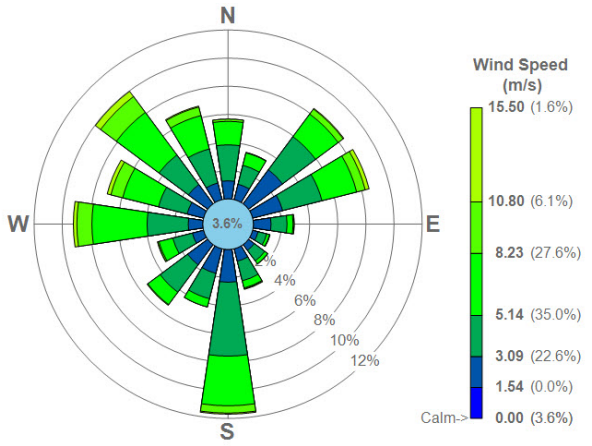
Operational Safety Assessment

- Operational safety (61.43) is typically achieved through a combination of systems, procedures, controls, and training
- Accidents scenarios were evaluated by NRC when 10 CFR 61 was developed
- Some GTCC waste may contain sufficient radioactivity that an operational safety assessment may be necessary





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Performance Period Analyses

- Performance period only applies if significant quantities of long-lived radionuclides will be disposed
- Expected proposed standard is to reduce exposures to the extent reasonably achievable
- Provide transparency to stakeholders on the expected long-term performance of the disposal system
- Long-term results not a measure of projected human health impacts

Safety and Compliance

- Safety can be achieved through different means:
  - Disposal concept
  - Prescriptive design
  - Technical analyses
- Proposed approach leans more heavily on technical analyses to afford greater flexibility

Timeframes (Compliance Period)

- Commission direction has two options
  - Peak dose or
  - Use different compliance periods depending on the long-lived component of the waste
- Staff is considering the latter option – flexible and site-specific
- Compliance period of 1,000 years without significant quantities of long-lived radionuclides otherwise 10,000 years and performance period

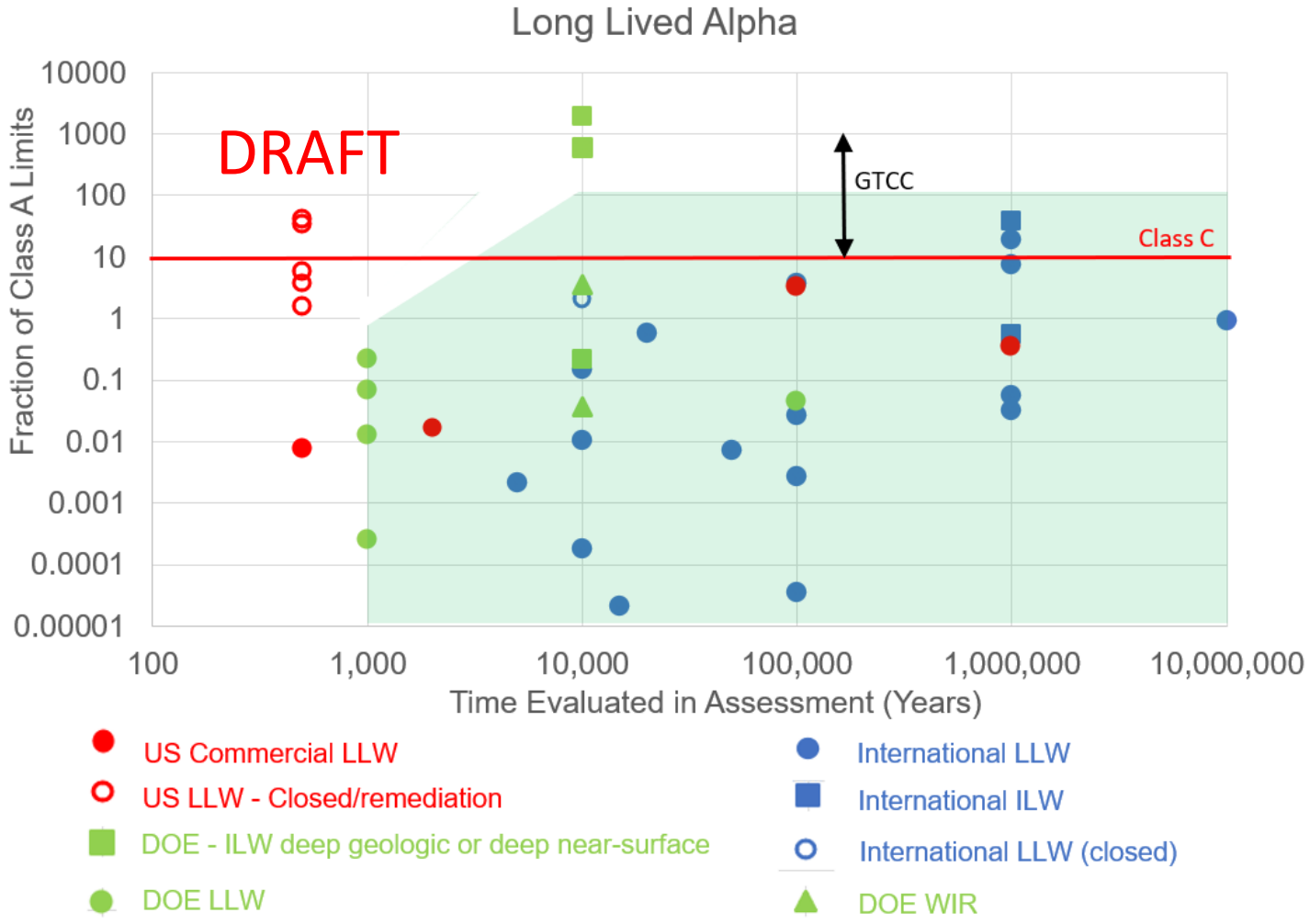
Timeframes (Compliance Period)

- Carefully examined comments on this issue
- Primary consideration is current practices by Agreement States (AS)
  - Compatibility class will likely allow the AS to be more restrictive
- Considered what has been done in the US and internationally

Timeframes (Compliance Period)

- Uncertainties in societal and environmental conditions will increase over time
- Regulatory approval to allow disposal needs to evaluate impacts, recognizing the uncertainty – not stop the analysis
- Other approaches could be used to mitigate uncertainties:
  - Require deep geologic disposal (i.e., Germany)
  - Place restrictions on long-lived radionuclides appropriate for near-surface disposal
  - Use design requirements (e.g., 10+ m disposal depth for large quantities of depleted uranium)

Timeframes (Compliance Period)



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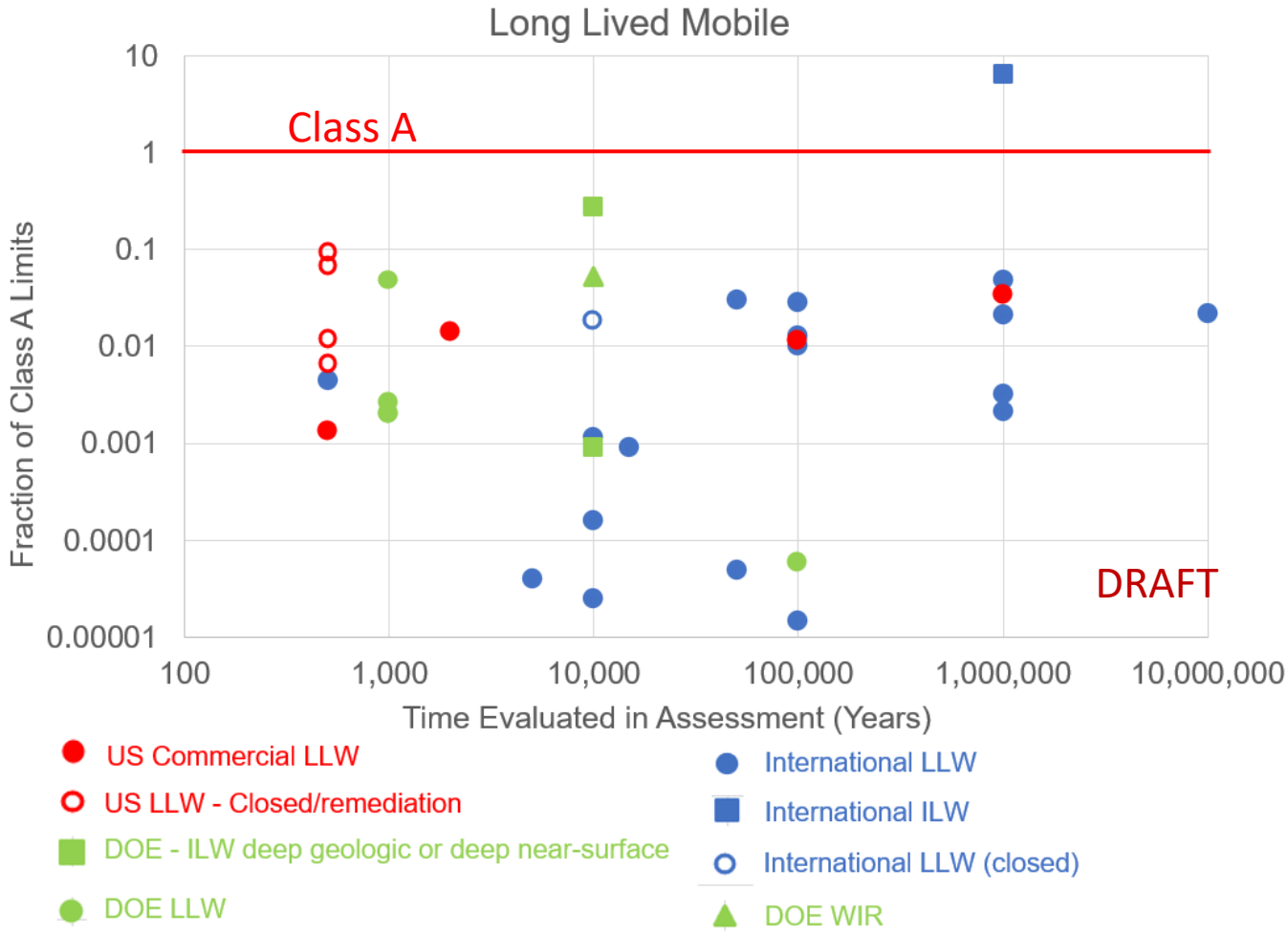
Timeframes (Compliance Period)



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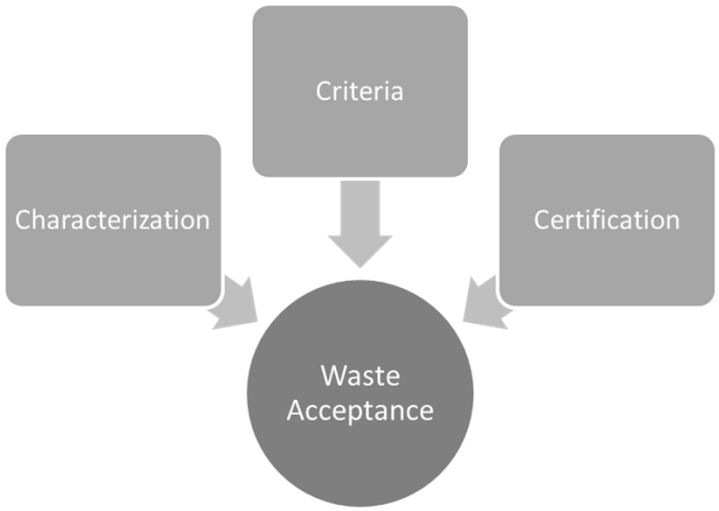
Waste Acceptance



- Site-Specific Waste Acceptance Criteria (WAC) (§ 61.58)
- Use §61.55 limits or results of §61.13 technical analyses
- Licensees review their waste acceptance program annually
- If approved, incorporated into license

Preliminary Regulatory Concepts and Requirements

- Physical protection under Part 73
- Quantities greater than critical mass
- Long-lived transuranic (>10,000 pCi/g)
- GTCC-like waste (government owned or generated)
  - DOE has authority for disposal in federal or commercial facility
  - Agreement State licensed facility subject to some regulations appropriate to other waste

Criticality Protection

- Critical mass quantity (prior to disposal)
  - Waste in concentrations of fissile material that cannot go critical
  - Exemption from fissile material classification specified at 10 CFR 71.15(c)
- Significant amount of fissile material in a disposal unit (after disposal)
  - Identify design features for limiting potential for reconcentration of fissile material, as appropriate

Physical Protection

- 10 CFR Part 73.67 – physical protection requirements for a fixed site (prior to disposal) disposing special strategic nuclear material
  - Account for very dilute waste not mechanically separable (i.e., limited attractiveness)
  - Exemption for waste at a low-level waste disposal facility specified at 10 CFR 73.67(b)
  - Consistent with IAEA and DOE approaches
- Physical protection requirements for radioactive waste material under 10 CFR Parts 20 and 37 remain unchanged
  - Part 20 Subpart I Storage and Control of Licensed Material
  - Part 37 Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material (16 specific radionuclides)

Exception Criteria

- § 61.1 (b) (Purpose and scope)
  - Exception criteria
    - the land disposal facility license was originally issued before the effective date of this rule
    - the licensee does not accept a significant quantity of long-lived radionuclides after the effective date of this rule
- Licensees who meet these exceptions do not need to comply with revised Technical Analyses (§ 61.13), revised Performance Objectives (§ 61.41 and § 61.42), and WAC (§61.58)

What are Significant Quantities?

- Definition in § 61.2
  - Significant quantities of long-lived radionuclides means an amount (volume or mass) and concentration accepted for disposal after the [effective date of this rule] that could, if released, result in the performance objectives of subpart C of this part not being met.
- Amount for selection of compliance period (1,000 or 10,000 years)
- Amount for demonstrating meeting exception criteria
- For the purposes of this paragraph, less than 10 metric tons of depleted uranium is not considered a significant quantity of long-lived radionuclides.

Significant Quantities

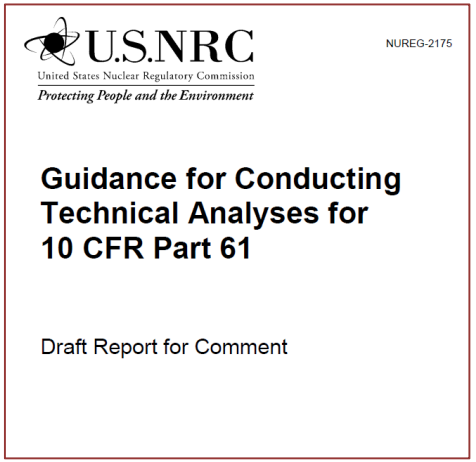
- Site-specific calculations to determine what amounts are significant
  - Though a simple approach is preferred, to properly account for the multiple key factors a more complex approach could be needed
  - Determined by licensee and approved by regulators
- Example approaches included in NUREG-2175
  - Table of concentrations of long-lived radionuclides for potential use as generic screening values

Implementation Guidance

- NUREG-2175 (Guidance for Conducting Technical Analyses for 10 CFR Part 61) provides:
  - Flowcharts, NRC staff recommendations, and examples for how licensees can develop high-quality technical analyses
  - Guidelines for what licensees or applicants should include and what regulators should review for each type of analysis
  - Suggested references, screening tools, and case studies

Implementation Guidance

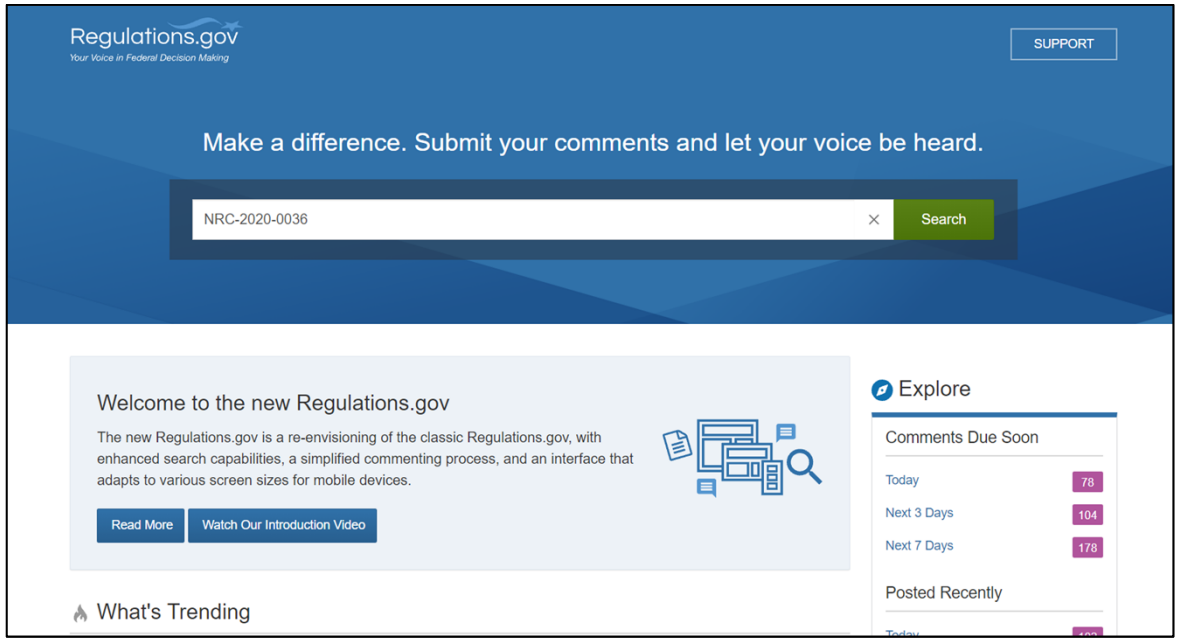
- Draft in 2015 for public comment
- Draft final version of guidance published in 2016 on NRC Part 61 website
- Updates for Revision 1
  - Appendix for GTCC waste disposal considerations
  - Appendix for approach to calculate significant quantities of long-lived radionuclides
  - Revisions based on proposed rule language



Next Steps

- Deliver proposed rule to the Commission
  - Public comment period after Commission approval
- Other conferences/symposia/etc.
- Deliver final rule to the Commission

Where to Find Information



Go to https://www.regulations.gov and search for docket ID NRC-2011-0012

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Abbreviations, Acronyms and Initialisms

ADAMS	Agencywide Documents Access and Management System
AS	Agreement States
CFR	Code of Federal Regulations
DOE	Department of Energy
DU	Depleted Uranium
FEP	Features, Events and Processes
FRN	Federal Register Notice
GTCC	Greater Than Class C
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste
LLW	Low Level Waste
MD	Management Directive
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
PRM	Petition for Rulemaking
SECY	Document from the NRC staff to inform or seek decision from the Commission
SRM	Staff Requirements Memorandum
TRU	Transuranic Waste
WAC	Waste Acceptance Criteria

How did we do?

- The public meeting feedback form can be accessed on the meeting details page:

  https://www.nrc.gov/pmns/mtg?do=details&Code=20230463