

U.S. EPA's High-level Waste Standards: Form of the Standard and the Protected Individual

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Background

- In 1992, the Waste Isolation Pilot Plant Land Withdrawal Act exempted Yucca Mountain from EPA's generic standards (40 CFR Part 191)
- Also in 1992, the Energy Policy Act (EnPA) directed EPA to:
 - set an individual-protection standard for Yucca Mountain
 - contract with the National Academy of Sciences to provide technical input

A Limit on Dose or Risk?

- The Energy Policy Act directed EPA to set a dose limit to protect individuals from releases from Yucca Mountain
- The NAS recommended a limit stated as a risk level
- In the end, EPA established a limit on individual dose

NAS Recommended a Risk Limit

- NAS recommended a limit on risk because:
 - it would not have to be revised if the dose-to-risk ratio changes; and
 - makes the public's comparison with other risks easier

EPA Established a Limit on Dose

- Congress specified a limit on dose
- National and international guidelines have recommended dose
- Most standards are in dose
- Would not allow a convenient comparison with most existing radiation protection standards

The Individual-Protection Dose Limit

- 150 μSv committed effective dose equivalent per year
- Based upon a risk of 5.75 in 100 per Sv
- This level of risk was judged to be acceptable
- Therefore, even though the limit is a dose it is based upon risk

Who is Protected?

- NAS recommended using a critical group (CG)
- Standards should not be driven by a small group with unusual habits or sensitivities
- Avoid extreme cases and unreasonable assumptions while protecting the vast majority of the public
- Discussed two possibilities
 - Probabilistic
 - Subsistence farmers

NAS Probabilistic CG

- Uses Monte Carlo method/parameters based upon today's biosphere
- Project the most likely areas of habitation
- Project the location of the contamination plume
- Combine the two sets of projections and average the risk among the groups

Why Did EPA Not Use the Probabilistic CG?

- No relevant experience in applying the concept
- Approach is very complex and difficult to assure that the CG would be consistent with the CG concept
- Does not clearly identify who is protected

Why Did EPA Not Use the Probabilistic CG?

- Would likely average a large number of subgroups receiving no dose which is inconsistent with the CG concept
- Most public comments opposed this approach

NAS Subsistence-Farmer CG

- Habits and response to radiation
average value of current conditions
- All water comes from contaminated aquifer
- Grows all consumed food

NAS Subsistence-Farmer CG

- Water is withdrawn at location of highest concentration outside of the repository footprint
 - pumping effects may be considered
 - geologic features precluding drilling may be considered
- CG risk would be about $\frac{1}{2}$ that of the most exposed subsistence farmer

Why Did EPA Not Use the Subsistence-Farmer CG?

- Not a reasonable scenario for Yucca Mountain using current conditions
- No one showed EPA and EPA could not identify anyone fitting the definition in the downgradient direction

EPA's Protected Individual

- Reasonably maximally exposed individual (RMEI)
- Represents a rural-residential life style (lives downgradient but works elsewhere and brings in part of the diet from outside the area)
- Based upon current downgradient residents (location and characteristics)

EPA's Protected Individual

- One or a few of the parameters critical to the dose projection are valued at their maximum value(s)
- All others are set at their mean value
- Intent is to avoid unreasonable assumptions and project doses as reasonably expected values rather than the theoretically highest values

Why Did EPA Choose the RMEI Approach?

- Up until the Yucca Mountain standards, EPA has used the maximally exposed individual (highest theoretical dose)
- As a result of the NAS recommendation, decided to explore another approach

Why Did EPA Choose the RMEI Approach?

- Sufficiently conservative to protect the the general public
- Consistent with widely accepted procedure to project doses incurred by individuals over long periods
- Provides protection similar to the CG approach

Why Did EPA Choose the RMEI Approach?

- Conservatism is up to the implementing agency, but the parties must use site-specific data to keep parameter values reasonable
- More straightforward than the CG approach (especially probabilistic)
- Has used the RMEI in non-radiation regulations (hazardous waste)