



T3 – Environmental Health Physics: Risk Communication and the Use of Dose Assessment at Operating and Decommissioning Reactor Sites

NRC’s Dose Modeling for Decommissioning

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Outline

- Regulations
- Graded Modeling Approach
- Parameterization
- Surveys
- Impacts of Survey Techniques
- Other Considerations

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Regulations

- 10 CFR Part 20 Subpart E (20.1401 – 20.1406)
- Time of Compliance: 1000 years
- Dose Limits (in TEDE not to exceed):
 - Unrestricted Use (20.1402): 25 mrem/y (0.25 mSv/y)
 - Restricted Release (20.1403):
 - 25 mrem/y (0.25 mSv/y) with institutional controls in place
 - If institutional controls are no longer in effect:
 - 100 mrem/y (1 mSv/y)
 - 500 mrem/y (5 mSv/y) & licensee satisfying 20.1403(e)(2)
 - Alternate Criteria (20.1404)

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Graded Approach to Modeling



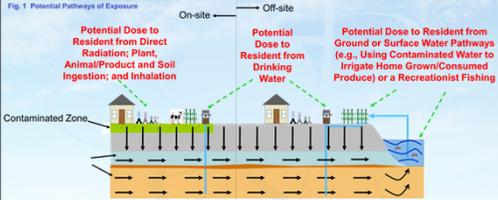
- NRC Guidance: NUREG-1757, Vol 2, Rev. 1
"Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria"
- NRC Screening Tables (Appendix H)
 - Look up tables for Building Surface Contamination
 - Look up tables for Soil Contamination
- Site-Specific Modeling (Appendix I-M)

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Generic Conceptual Model



Fig. 1 Potential Pathways of Exposure



On-site

Potential Dose to Resident from Direct Radiation; Plant, Animal Product and Soil Ingestion; and Inhalation

Off-site

Potential Dose to Resident from Drinking Water

Potential Dose to Resident from Ground or Surface Water Pathways (e.g., Using Contaminated Water to Irrigate Home Grown/Consumed Produce) or a Recreationalist Fishing

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Model Selection



- Models need to be fit for purpose
- Screening tables based on DandD v. 2.0
- Majority of Site-Specific Modeling use RESRAD or RESRAD-Build
- Alternate models have included hand/spreadsheet calculations, groundwater models, MicroShield®, etc

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Parameterization 

- Licensee must justify parameters used
- NRC Guidance:
 - Start with a probabilistic approach (e.g., RESRAD using the NONNUC.TEM template)
 - Identify parameters most affecting results
 - Focus justification on these parameters
- Several licensees have developed a deterministic data set from probabilistic sensitivity analyses to simplify derived concentration guideline level (DCGLs) development

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Surveys 

- Survey results compared to DCGLs
- Appendix A of NUREG-1757 uses MARSSIM (NUREG-1575)
- Uses full surface scan coupled with random sampling
- Uses statistical methods to determine minimum number of samples
- If your estimated residual levels are close to the DCGLs → more samples required

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Impacts of Survey Techniques 

- Survey technique reduces upper bound on dose estimates
- DCGLs assume site average contamination = 25 mrem/y (0.25 mSv/y)
- However, due to uncertainty in survey measurement, actual average has to be lower than DCGL value

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Other Considerations 

- Restricted Release
- National Environmental Policy Act (10 CFR Part 51)
- Memorandum of Understanding on Decommissioning with the U.S. Environmental Protection Agency

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Summary 

- Licensees can use screening values or site-specific analyses for deriving acceptable residual radioactivity levels.
- Unrestricted release generally assumes unrestricted access by humans immediately after license termination.
- Survey techniques tend to result in final concentrations lower than the calculated acceptable residual radioactivity levels.

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