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Spent Fuel Transportation Risk Assessment (SFTRA) Draft NUREG Rev. 2.3

Overview for SFAS

2/22/2012

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Purpose of Briefing

- Overview of SFTRA and related activities
  - Project and review teams
  - Purpose and goals
  - Basic Methodology
  - Improvements relative to previous studies
  - Structure and format
  - A few key results
  - Findings and conclusions
  - Schedule
  - Challenges

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SFTRA Project and Review Teams

- Sandia National Laboratory
  - Doug Ammerman – principal investigator and structural
  - Carlos Lopez – thermal
  - Ruth Weiner – RADTRAN
- SFST's SFTRA Review Team
  - Gordon Bjorkman – structural
  - Chris Bajwa – thermal and overall message
  - Bob Einziger – fuels, source term
  - Anita Gray – health physics
- Review team member comments have been incorporated in Rev. 2.3, and all review team members concur in publishing Rev. 2.3 for Public Comment
- Oak Ridge External Peer Review Team
  - Matt Feldman
  - Cecil Parks
  - Other technical staff
- All ORNL comments also incorporated in Rev 2.3

Rev 1.0 - May 2010

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SFTRA Purpose and goals

- Continuing review
  - FEIS (NUREG-0170, 1977)
  - "Modal Study" (NUREG/CR-4829, 1987). Urban
  - "Reexamination..." (NUREG/CR-6672, 2000)
- NRC's safety mission
  - Considering public comment, provide updated basis for conclusion that NRC's regulations applicable to spent fuel transportation provide adequate public health and safety
- Outreach responsibilities
  - Reassure public regarding spent fuel shipments
    - Basic message: Risks are low so safety is high
    - Improve public understanding and acceptance of spent fuel shipments
- Update benchmark for environmental assessments
- Potential shipments
  - Significant issue when study began (2006) – much less so now (post Yucca Mtn shutdown)
  - Nevertheless applicable to future shipments

Generic
no pending commitments

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SFTRA Basic Methodology

- Perform finite element analysis of cask response to impact and thermal accident conditions
- Use DOT "event trees" to estimate probabilities of accident conditions
- Use RADTRAN to calculate routine doses and accident dose risks for representative truck and rail shipments
- Approach similar to that in NUREG-0170 and NUREG/CR-6672

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SFTRA improvements over previous NRC spent fuel risk studies

- New rail and truck event trees
- RADTRAN new Version 6:
  - Elevated releases
  - New loss of shielding analysis
- Updated population data (2000 Census; trying to revise to 2010 Census pending TRAGIS update)
- Updated traffic density and accident data for truck and rail
- Hi-fidelity HI-STAR 100 and NAC-STC cask finite element models, including impact limiters
- Direct loaded fuel and welded inner canister fuel
- More precise structural (e.g., bolt model) and thermal (e.g., 3-D) analyses
  - better estimate of cask-to-environment release fractions

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SFTRA Report Structure and Format

before results

- Audience
  - Public, media, industry, states, elected officials, federal agencies
- Graded structure and content
  - MD 3.7 and NUREG-0650
- Executive Summary and Public Summary [All audiences] 2 pg 11 pg
- Main body text [informed public, states, science media]
- Appendices [industry, other federal agencies] equations, etc
- Electronic and printed versions of Final SFTRA NUREG planned (latter may be limited)

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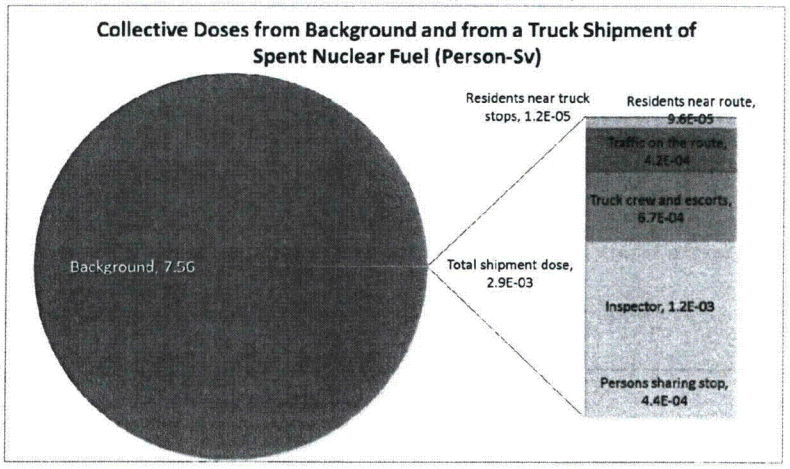
SFTRA Results: Routine conditions

Collective doses from background and from Maine Yankee to ORNL truck shipments of spent nuclear fuel (person-Sv).



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7.5E03 No shipment

7.5E03 Shipment

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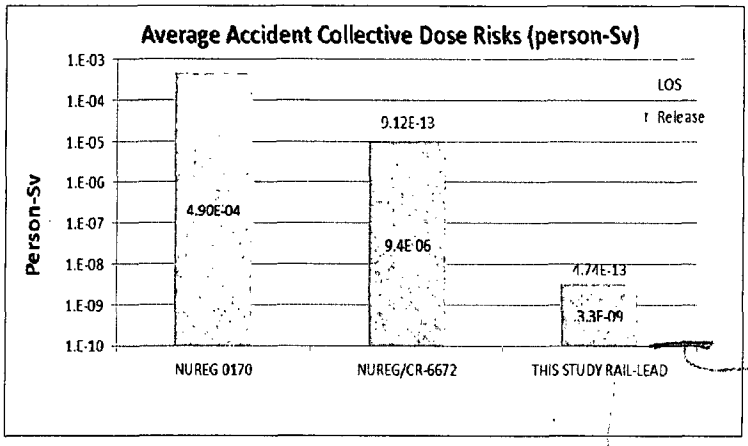
SFTRA Results: Accident conditions

Accident collective dose risks from release and loss of gamma shielding (LOS) accidents. The LOS bars are not to scale.



This study Rail steel (combined)

Direct loaded

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SFTRA Findings

- The collective dose risks from routine transportation are vanishingly small. **Theses doses are about four to five orders of magnitude less than collective background radiation dose.**
- The routes selected for this study adequately represent the routes for spent nuclear fuel transport, and there was relatively little variation in the risks per kilometer over these routes.
- **Radioactive material would not be released in an accident if the fuel is contained in an inner welded canister inside the cask.**
- Only rail casks without inner welded canisters would release radioactive material, and only then in exceptionally severe accidents.
- If there were an accident during a spent fuel shipment, there is only about one in a billion chance the accident would result in a release of radioactive material.
- **If there were a release of radioactive material in a spent fuel shipment accident, the dose to the maximum exposed individual would be less than 2 Sv, about the dose given in a single radiotherapy treatment to cancer patients.**

Avg. per shipment acc. rate 10^{-9} so 1 in a million, and then must use NRC dis. canisters

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SFTRA Findings cont'd

- **The collective dose risks for the two types of extra-regulatory accidents (accidents involving a release of radioactive material and loss of lead shielding accidents) are negligible compared to the risk from a no-release, no-loss of shielding accident.**
- The risk of loss of shielding from a fire is negligible.
- **None of the fire accidents investigated in this study resulted in a release of radioactive material.**

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SFTRA Conclusion

- Based on these findings, **this study reconfirms that radiological impacts from spent fuel transportation *conducted in compliance* with NRC regulations are low**, in fact generally less than previous, already low, estimates.

  Accordingly, with respect to spent fuel transportation, the previous NRC conclusion that the **regulations for transportation of radioactive material are adequate to protect the public against unreasonable risk is also reconfirmed by this study**.

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SFTRA Current Schedule

Milestone	Date
1. Submit Rev 2.3 to publications for NRC edit	2/15/2012 (completed)
2. Publications returns edited copy	3/15/2012
3. Publish for comment in Fed Reg	4/15/2012
4. Public comments due	6/15/2012
5. Sandia response to public comments (Rev 3.0)	7/15/2012
6. ACRS subcommittee review	8-9/15/2012 (unscheduled)
7. Sandia delivers final Draft NUREG (Rev. 4.0)	9/30/2012 (contract expires)
8. NRC publishes Final NUREG	By 12/31/2012

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SFTRA Challenges

- External:
  - Possible post-Fukushima public apprehension over nuclear activities
  - Policy-based opposition by certain environmental groups
- Internal:
  - Extent/response effort for public comments may exceed that planned
  - Placeholder to update population data to 2010 Census
  - ACRS review schedule not under our control
  - Sandia contract expires 9/30/2012

contract made

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