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Regulatory Perspective on Confirmatory Burnup Measurements for Burnup Credit in Spent Nuclear Fuel Transportation Packages

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Overview

- Background
  - Regulations
- Current Staff Guidance
  - ISG 8, Rev. 2
- Guidance Revision Considerations
  - Alternatives to quantitative burnup confirmation measurement

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Background: Regulations

- 10 CFR Part 71, "Packaging and Transportation of Radioactive Material"
  - 71.55(b): subcritical with water leakage
- No U.S. regulation requiring measurement
- 10 CFR Part 72 allows loading of dry storage casks without associated transport package

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Current Staff Guidance

Interim Staff Guidance (ISG-8), Revision 2 published in 2002

(http://www.nrc.gov/reading-rm/doc-collections/isg/isg-8R2.pdf)

- "Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transport and Storage Casks"
- Actinide-only based on available validation data
- Fission products to provide additional margin
- Confirmatory burnup measurement consistent with IAEA TS-R-1

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Need for Alternative to Measurement

- Applicants and licensees reluctant to include measurement provision in package operating procedures:
  - Additional time at pool = more personnel exposure
  - More fuel movement = higher probability of fuel handling incident
  - Additional costs
- Approximately 1200 dry storage casks already loaded in U.S.

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Considerations for Revision 3 – Burnup Measurements

- NUREG/CR-6955, "Criticality Analysis of Assembly Misload in a PWR Burnup Credit Cask"
- Draft NUREG on information related to spent fuel burnup confirmation
- NRC Office of Research evaluating misload probability

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Considerations for Revision 3 – Misload Analysis

- Potential for misload analysis in lieu of measurement is being considered
  - Sensitivity of a package design can indicate how the package reactivity will respond to a misload
  - Package should be adequately subcritical under scenarios involving a single severely underburned assembly, or multiple moderately underburned assemblies
  - Should include any related code biases and uncertainties, as well as an appropriate administrative margin

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Considerations for Revision 3 – Misload Analysis

- Should be based on the discharged population intended to be shipped
- Misload analyses would be expected to be coupled with applicable administrative procedures to reduce probability of misload
- Ideally the misload analysis would be generalized for a fuel population, but could be site-specific

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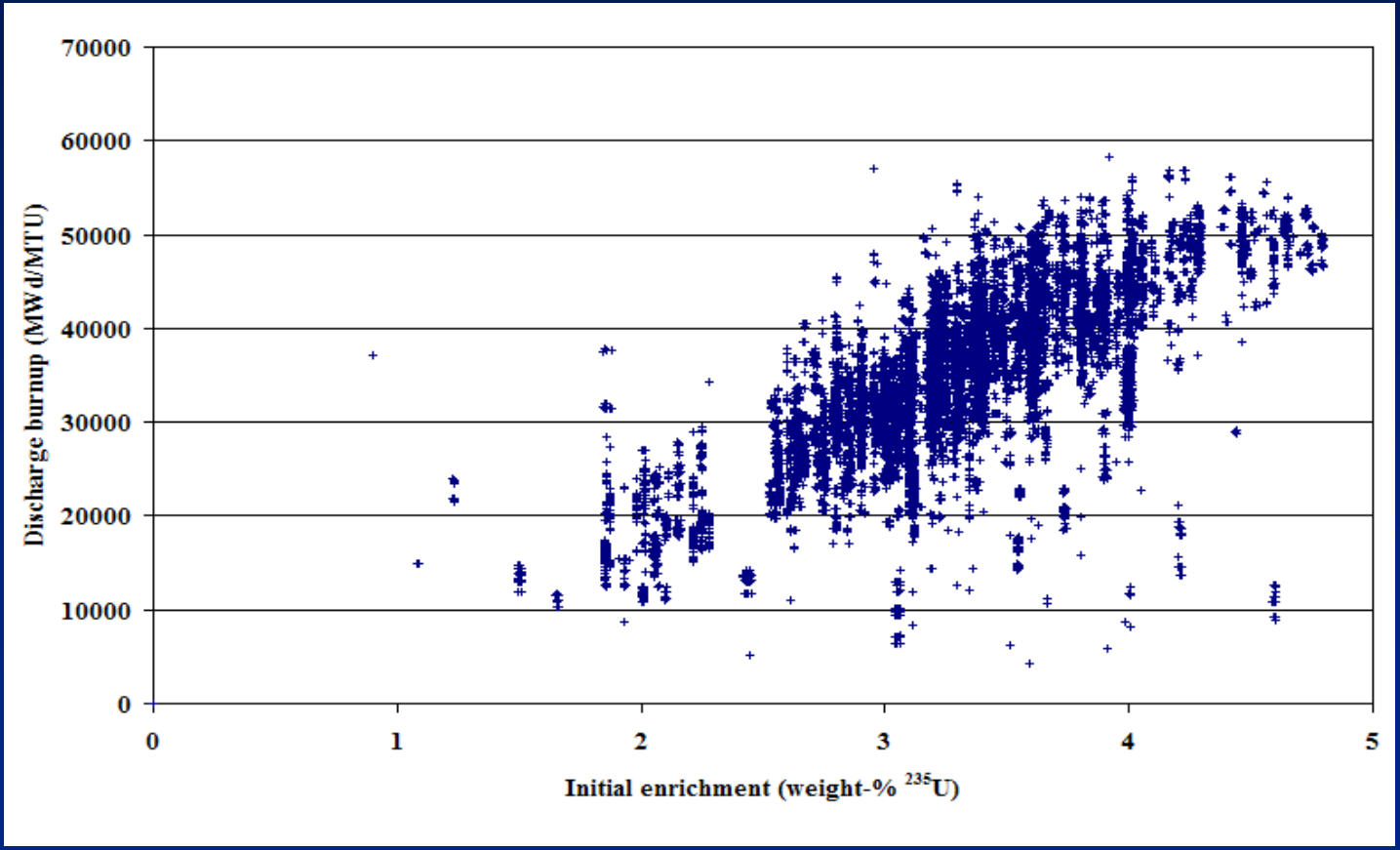
Discharged Fuel Population: All U.S. 15x15s (as of 2002)



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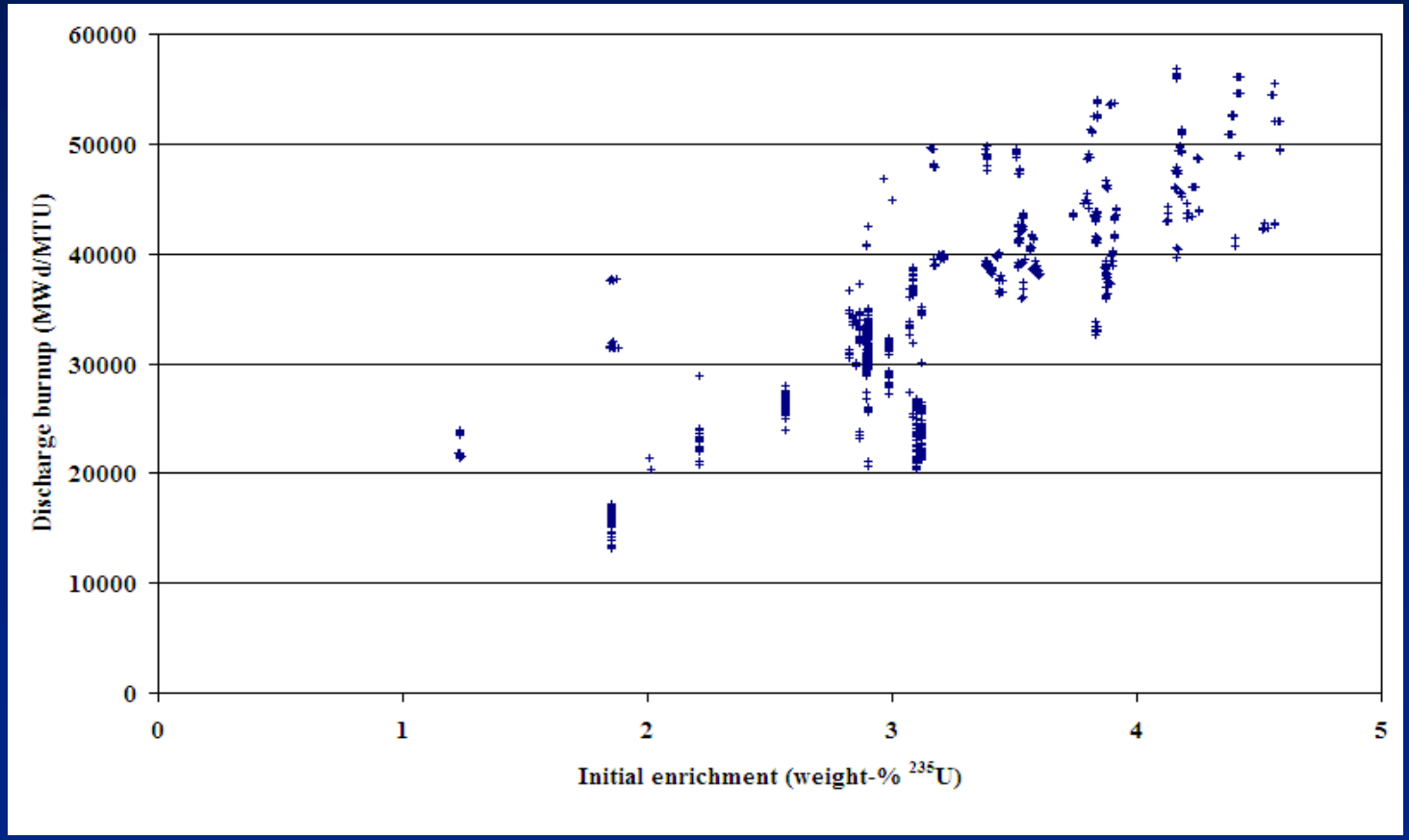
Discharged Fuel Population: Single Pool 15x15s (as of 2002)



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Administrative Procedures

- No fresh fuel in pool at time of loading
- Full pool audit within 1 year prior to loading
- Qualitative verification that loaded assembly is burned (visual or gross measurement)
- Identification of high reactivity fuel in pool both prior to and after loading
- Assemblies without visible ID must have quantitative measurement
- Others?

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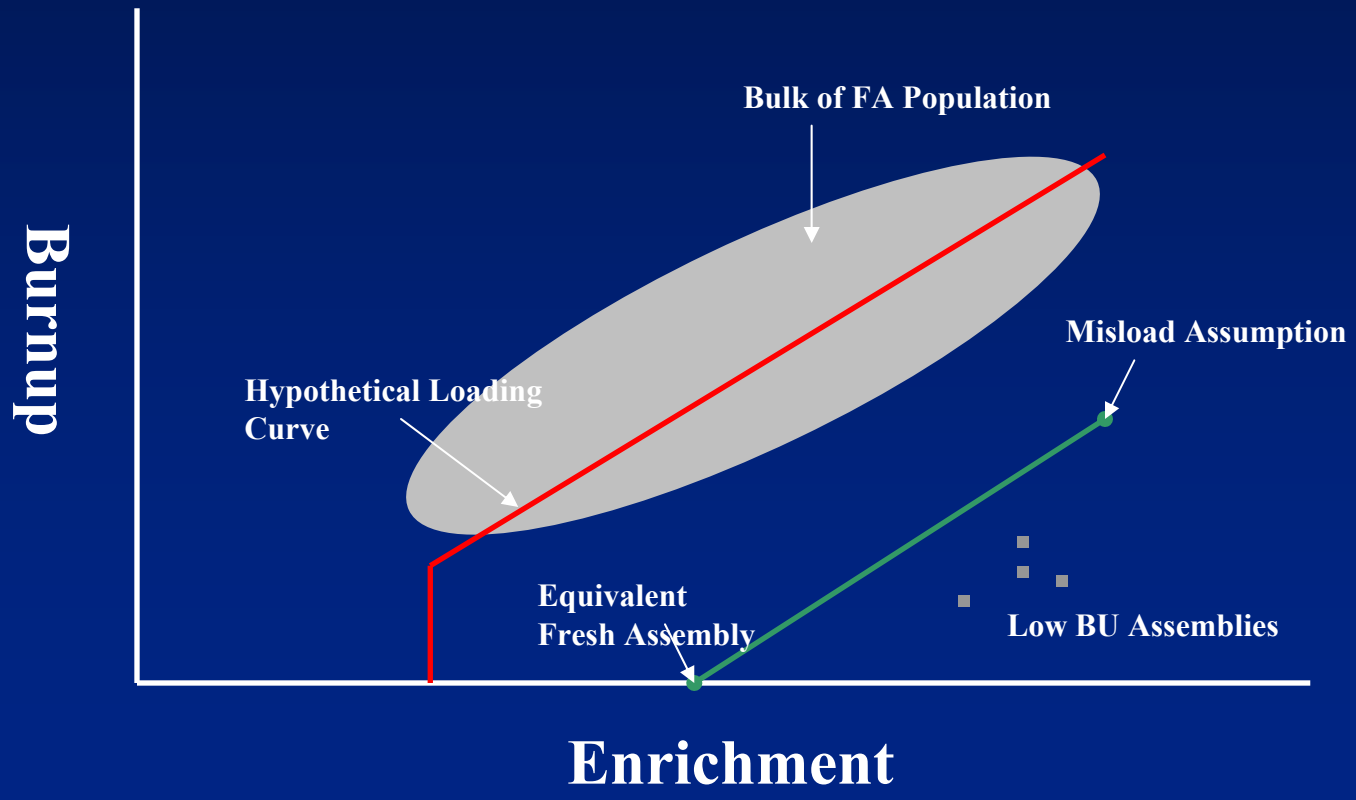
Administrative Procedures

- Based on Discharged Fuel and Misload Analysis Assumptions



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Summary

NRC working to expand the technical basis for burnup credit to provide alternatives to confirmatory burnup measurements

- Will be seeking feedback from industry and other public stakeholders prior to publishing a revision to ISG-8.

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Questions?