## HLWYM HEmails

**From:** Oleg Povetko
**Sent:** Friday, June 23, 2006 5:54 PM
**To:** James Winterle
**Cc:** Asadul Chowdhury; Amitava Ghosh
**Subject:** Criticality burnup credit OR office visit brief
**Attachments:** 2006 Burnup Credit OR Visit Topics Draft - 2006-04-25 060806.wpd

O. Povetko participated in two-day OR office interaction betwenn NRC and DOE on burnup credit criticality. J. Durham attended first day of the meeting, D.Galvin and A.Barto (SFPO) represented NRC. DOE team had about 15 people in course of two days including representatives from YMP, SNL, Bechtel, Areva and independent consultants. This was the first OR office interaction on criticality over several years. This gap in communication led to some miscommunications when, for example, two key DOE non-public reports documenting technical bases for presentations, were not available for NRC to examine prior to the meeting and, actually, their very existence were unknown to NRC before the presentation. DOE considered that the Isotopic Database report was at LSO and has been previously examined by NRC. The discussion centered on DOE burnup credit methodology validation, specifically, on isotopic model validation and cross-section uncertainties model validation. The DOE methodology is beyond state of the art, at variance with the current ANS/ANSI standards, NRC guidance documents (ISGs), ORNL NUREGs on the subject and significantly differs from burnup credit cask applications currently under review by NRC SFPO. The methodology as it was presented is expected to be very challengable to review. Some preliminary information on the burnup credit and related topic follows.

It is expected about 10-20% of total bare CSNF assemblies will be treated at surface facilities using pool (i.e. outside TAD canisters). It's not decided yet whether the pool water will be borated or not. Burnup credit is not currently in TAD draft perfomance specifications. If burnup credit is not taken for transportation there will be no burnup credit taken for preclosure. For postclosure, burnup credit is taken for seismic and igneous scenarios, not for nominal and rockfall scenarios. Potential assembly misloads is one of the major contributing factors for probability of postclosure criticality. (Misloads here refer to the events of placing underburned assemblies into WP which would increase system reactivity beyond design basis reactivity which in turn is controlled by a loading curve). DOE considers different options for neutron absorber plates since the "new"
Ni-Gd alloy did not perform well as it was expected in direct experimental comparisions with the "old" borated steel based material Neutronit. One of options is to improve corrosion perfomance by applying an amorphous metal layer over Neutronit plates. No discussions were held on such potentially controversial issues like burnup credit measurements and reactor burnup records and their verification.

DOE has about 20-people strong team working on criticality topics. There are
8 DOE criticality reports completed and ready to be signed off waiting for resolution of generic QA issues unrelated to the reports. There are 19 reports to be issued next fiscal year on criticality. DOE expressed their expectation to have similar OR office exchange on preclosure criticality involving different team of experts, for example, PCSA risk analysts.

I attached list of technical topics discussed during the meeting.

Oleg.

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**Draft List of Topics for NRC OR Visit: Burnup Credit Validation**
Tentative Dates: June 20-21 (or June 21-22), 2006

- Introduction by DOE

- Introduction by NRC
  - Status with other applicants
  - Optimism regarding granting burnup credit

- Quick Overview of Commercial Spent Nuclear Fuel (CSNF) Disposal Strategy and Where Burnup Credit Fits In
  - Defense-in-Depth for Preclosure
  - Loading Curves
  - Probabilistic screening for postclosure
  - Topical report chart
  - Critical limit equation

- Overview of Burnup Credit Methodology
  - Isotopic Model
  - Range of applicability

- Major Methodology Issues
  - Relevance of nominal parameters given (ANS 8.17, 4.10)
  - Applicability of CRCs
    - Similarity in CRCs, including physical compositions, configurations, and nuclear characteristics (including reflectors) (ANS 8.17, 5.1: $k_c$)
    - Sensitivity of benchmarks to included isotopes (ANS 8.17, 5.1: $k_c$)
    - Uncertainties in the CRCs being used as critical experiments (ANS 8.17, 5.1: $\Delta k_c$; ANS 8.1, 4.3.3; and NUREG/CR-6698)
    - Evaluation of Trends in CRCs, appropriate trending parameters (ANS 8.1, 4.3.1, 4.3.2)
  - Determination of bounding irradiation parameters
    - assuring that each fuel unit has a reactivity no greater than the maximum established reactivity (ANS 8.17, 4.10; NUREG/CR-6665 Section 6.1)
  - BWR Fuel:
    - Need for burnup credit for BWR fuel
    - Applicability of the isotopic model to actual fuel models
    - Limited existing regulatory technical basis compared to PWR
  - Isotopic Biases and Uncertainties
    - Grouping of samples with different included isotopes
    - Minimum number of samples for meaningful statistics
    - Evaluation of potential Trends
    - Applicability of bias and uncertainty with radioactive decay

- Depletion Parameter Sensitivity Analysis
  - Description of the parameters (boron let down curve, control rod/blade history, moderator density, fuel temperature, specific power, etc.)

- Axial Burnup Profiles

- Bounding Profile for PWR SNF
- End effects for various assemblies
- Coupled Burnup/Density for BWR SNF

- Horizontal Burnup Gradients
  - Treatment of various types of IBAs
  - Effects of preferential cask loading

- Burnup Credit Methodology Validation
  - CRC Benchmarking
  - RCA Benchmarking
  - Cross section uncertainty Alan's (Wells) Chart
  - General criticality benchmarking needs (Ni-Cr-Mo-Gd Alloy)
  - Treatment of correlating parameters having potentially compensating effects
  - Qualification criteria for benchmarking experiments included in validation

- Continuing Work to Reduce Uncertainty

- Brief Description of PWR and BWR Isotopic Databases

- Source of Burnup Values, Record Versus Measurement

- Outliers
  - Assemblies with unknown records
  - Batch Averages
  - Consolidated SNF
  - SNF outside the range of applicability