HOLTEC
INTERNATIONAL

HI-STAR 180
MODERATOR EXCLUSION

A Presentation to the SFST
USNRC Docket No. 72-9325
by
Dr. Stefan Anton
Holtec International

July 5, 2007

HOLTEC
INTERNATIONAL

Moderator Exclusion

- Moderator Exclusion is not the problem. The problem is a criticality concern for High Burnup fuel (HBF, Burnup >45 GWd/mtU) under accident conditions. Moderator Exclusion is one of the possible ways to address this problem

Attachment 6

HOLTEC INTERNATIONAL

Moderator Exclusion

- Moderator and Criticality: Presence of moderator (water) increases the reactivity
- Normal and Accident Conditions: Normal conditions already assume presence of water. However, accident conditions (after drop test) could result in changes to basket and fuel geometry, which could increase reactivity
- Basket and Fuel: Moderator exclusion only to address changes in fuel geometry.

HOLTEC INTERNATIONAL

Moderator Exclusion

- Moderate and High Burnup Fuel: Changes in fuel geometry only expected for HBF, due to lack of structural properties (material data) of the irradiated fuel
- Moderator Exclusion resolves the criticality concern, independent of the structural properties of the fuel
- Criticality and HBF: HBF is less reactive.

ISG-19 : Moderator Exclusion under Hypothetical Accident Conditions and Demonstrating Subcriticality of Spent Fuel under the Requirements of 10 CFR 71.55(e)

HOLTEC INTERNATIONAL

- Structural evaluation to determine reconfigured fuel geometries
  - Insufficient material property information for high burnup fuel to allow this type of evaluation.

OR

- Criticality evaluation of bounding reconfigured fuel geometries
  - Reconfigurations need to be judged to be credible or appropriately bounding

OR

- No water inleakage under accident conditions
  - Physical test of scaled bolt closure system as Part of Impact Limiter Testing. Objective is to provide added assurance of moderator exclusion under accident conditions.

HOLTEC INTERNATIONAL

HOLTEC Approach

- Analytical qualification of the system under drop accident conditions. Bolt closure is evaluated in the impact limiter analysis, using sophisticated state-of-the-art 3-dimensional transient models. Calculations show no unloading of the seals.

AND

- Redundant closure system (double lid). One lid tested to containment boundary criteria, the other lid tested to water tight criteria. NOT A DOUBLE CONTAINMENT SYSTEM.

AND

- Additional criticality calculations assuming credible damage of HBF under accident conditions (NRC suggestion). They show insignificant effect on reactivity.

HOLTEC INTERNATIONAL

HOLTEC Approach (cont'd)

- Holtec approach should meet or exceed the intent of ISG-19
  - Structural qualification in combination with double lid system should provide the "added assurance of moderator exclusion under accident condition".
  - Criticality analyses provide additional defense-in-depth
  - Analysis credits partial or no burnup of fuel. Therefore, high burnup of HBF provides even more assurance against a criticality concern.

HOLTEC INTERNATIONAL

Discussion