To: Sproger, ADM for approp. action
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OFFICE OF THE SECRETARY

RULEMAKINGS AND ADJUDICATIONS STAFF CONTROL TICKET

TICKET NUMBER: DSB-01-161 **DISTRIBUTION DATE:** Monday, November 05, 2001

UTILITY/FACILITY:

DOCKET NUMBER: PR-50

DOCUMENT TITLE OR DESCRIPTION: 10 CFR 50.46 - ACCEPTANCE CRITERIA FOR EMERGENCY CORE COOLING SYSTEM FOR LIGHT-WATER NUCLEAR POWER REACTORS. PETITIONER REQUESTS REVISION OF REGULATIONS TO INCLUDE IMPACT OF CRUD DEPOSITS ON FUEL BUNDLES DURING NORMAL OPERATION OF A LIGHT-WATER REACTOR

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AUTHOR AFFILIATION:

REPRESENTING:

RECIPIENT: SECRETARY

SUBJECT:

DOCUMENT DATE: 11/05/2001

DOCKET DATE:

CROSS-REFERENCE:

ACTION OFFICE: EDO

ACTION: APPROPRIATE

ACTION DUE:

COMMISSION ACTION EXPIRATION DATE:

DISTRIBUTION: EDO, LESAR, VIETTI-COOK

NOTES: RECEIVED IN SECY ON 11/05/2001

SPECIAL HANDLING:

ID NUMBER: 42

Template - Secy 017

E-Rids Secy-01

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C., 20555-0001
Attn: Rulemakings and Adjudications Staff

November 5, 2001

Petition

1. Specification of the regulation that is to be amended:

§50.46 Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors.

Appendix K to Part 50 -- ECCS Evaluation Models

2. Petitioner's grounds for and interest in the action requested:

Petitioner is aware that Part 50.46 and Appendix K do not address the impact of severe crud deposits on fuel bundle coolability during normal operation of a light water reactor (LWR)..

3. Petitioner's statement of the specific issues involved; views with respect to those issues; relevant technical, scientific, or other data involved:

The specific issue is that 50.46 and Appendix K and perhaps other regulations do not address the impact of severe crud deposits on fuel bundle coolability during normal operation of a light water reactor at power within its Licensing Basis and Technical Specifications. A licensed power reactor has operated with unusually heavy crud deposits within several fuel bundles. These deposits were found and at least partially classified during a refueling outage. If the deposits had continued to build during normal reactor operation at power, the unusually heavy crud deposits would have become severe crud deposits. Blockage of the flow channels within the fuel bundles would likely have developed. Severe crud deposits within the fuel bundles can lead to a loss of coolability with consequent overheating of zirconium cladding within fuel bundles, autocatalytic zirconium-water reactions of the fuel cladding, chemical reactions between the fuel cladding and the uranium oxide fuel pellets, initiation of zirconium water reactions involving zirconium core structures such as fuel bundle spacer grids and channel boxes, melting of certain control element materials, melting of braze materials in certain fuel bundle spacer grids, metallurgical reactions between certain fuel bundle spacer grid springs and the zirconium cladding on the fuel pins, and, very likely, additional sources of structural degradation . These factors can initiate substantial and rapid localized core melting while the LWR is at power. Even if the LWR is then shut down, the core meltdown may rapidly propagate among the fuel bundles and core structures with sequential and parallel destruction of the barriers that constitute defense in

depth. Thus, the single entity, unusually heavy crud deposits on the fuel pins, might be only one step before the unusually heavy crud deposits thicken and become severe crud deposits. Severe crud deposits then threaten the integrity of all of the barriers that in total constitute the defense in depth.

Performance-based experience reveals that when unusually heavy crud deposition on fuel bundles occurs during normal operation of an LWR, there are likely to be indications of fuel element cladding defects by increases in the offgas activity. However, this increase in the offgas activity is not regarded as an indicator of a possible heavy crud deposition. Thus, an LWR may be operated within its Licensing Basis and the Technical Specifications until the transition from unusually heavy crud deposition to severe crud deposition is effected. At this point it is likely that rapid localized core melting will be initiated while the LWR is at power. There will likely be delays (several seconds) before the LWR is shut down. However, by then the rapid propagation of the meltdown will likely be well underway and it will likely continue even though the LWR is shut down.

Elements of 50.46 and K that must be revised to include the impact of crud deposits on the fuel bundles during normal operation include <u>at least</u> the following items that are directly copied from 50.46 and K. These are listed in the order that they appear in 50.46 and K. The lettering or numbering or the lack thereof are as the items were copied from 50.46 and K.

Item from 50.46:

Comparisons to applicable experimental data must be made...

Items from K:

B. Swelling and Rupture of the Cladding and Fuel Rod Thermal Parameters.

2. Frictional Pressure Drops. The frictional losses in pipes and other components including the reactor core shall be calculated...

4. Critical Heat Flux.

5. Post-CHF Heat Transfer Correlations.

7. Core Flow Distribution During Blowdown.

3. Calculation of Reflood Rate for Pressurized Water Reactors.

5. Refill and Reflood Heat Transfer for Pressurized Water Reactors.

6. Convective Heat Transfer Coefficients for Boiling Water Reactor Fuel Rods Under Spray Cooling.

7. The Boiling Water Reactor Channel Box Under Spray Cooling.

II. Required Documentation
1. a. A description of each evaluation model shall be furnished.

Submitted by:

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