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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

Feb. 3, 2000

MEMORANDUM TO: ACRS Members and Staff

MEMORANDUM #: ~~AWC-101.2000~~

FROM: A. W. Cronenberg

SUBJECT: FY-2000 Efforts on Uncertainties in Spent Fuel Pool LOCA Analysis

Per discussions with Drs. Apostolakis and Kress at the February ACRS meeting, and prior input from Drs. Powers/Larkins/Savio, I have outlined expected FY-2000 efforts related to an assessment of the scope and nature of uncertainties in Spent Fuel Pool Accident Assessments, and the adequacy of agency understanding of such accidents in support of rule-making activities for plant decommissioning. It is anticipated that the bulk of my efforts for FY-00 will center on this subject. Both Dr. Apostolakis and Dr. Kress thought that a broad-scope assessment of uncertainties would best serve ACRS needs, as opposed to a focused effort to resolve any specific aspect of the problem. A preliminary listing of uncertainties to be evaluated include:

- A) Phenomena/Modeling Uncertainties
 - Fuel Assembly/Spent Pool Heat Transfer Modes
 - Zircaloy Ignition Temperature (Range: 1555-1870 K)
 - Decay heat (Q) for high bumup rods
- B) Accident/Risk Uncertainties
 - Spent fuel pool LOCAs initiated by human error
 - Seismic induced spent fuel LOCAs
 - Equipment failure induced spent fuel LOCAs
- C) Source Term Uncertainties
 - Zircaloy cladding failure behavior for air-oxidation conditions
 - Fission Product (FP) release from failed rods
 - FP transport (re-adsorption) from spent pool
 - Effects of reflood/mitigation (Zry-Ox; rod breakup)

Dr. Kress suggested that I might best focus my initial efforts on Item-B, which was agreed to. A copy of proposal slides, which I had prepared for the ACRS retreat, are attached.

Spent Fuel Pool Loss-of-Coolant Accidents and Zircaloy-Air Oxidation



**FY-2000 Project/Proposal
August W. Cronenberg**

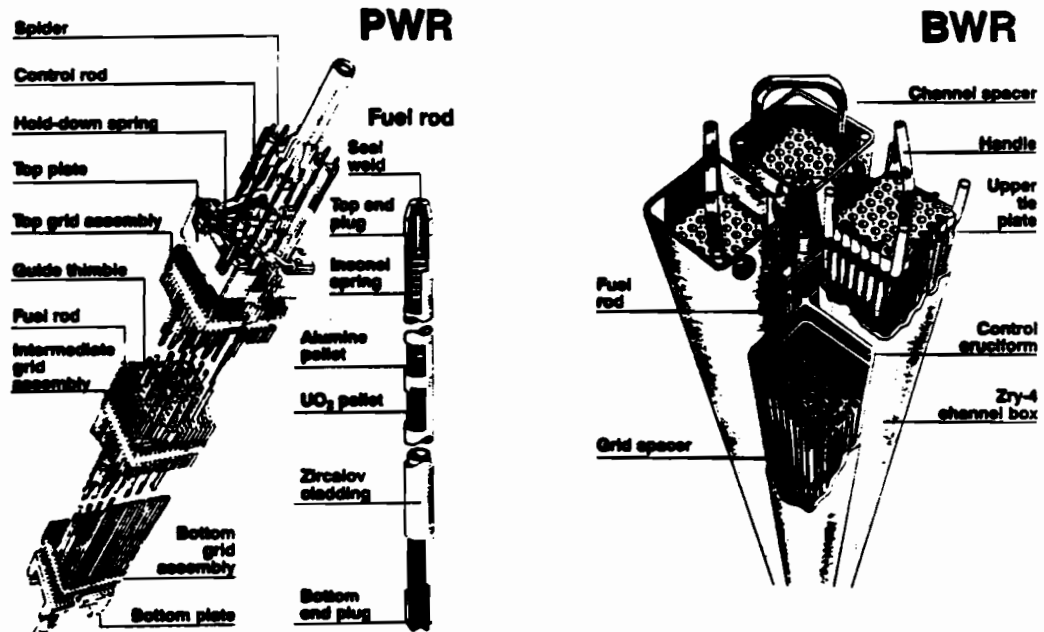
Slide-1

ACRS Fellow Projects

- Multiple Systems Response Program (MSRP):
Treatment in IPE/IPEEEs
 - PSA-96: Park City
- Insights into Generic Safety Issues (GSIs) Noted from
Licensee Events
 - ANS-98: Albuq
 - Safety of Operating Plants-98: San Fran
- Review of Reactor Power Uprates: Potential Synergistic
Safety Issues
 - ANS-2000: San Diego
 - Conference-??
- Spent Fuel Pool Accidents/Zry-Air Oxidation

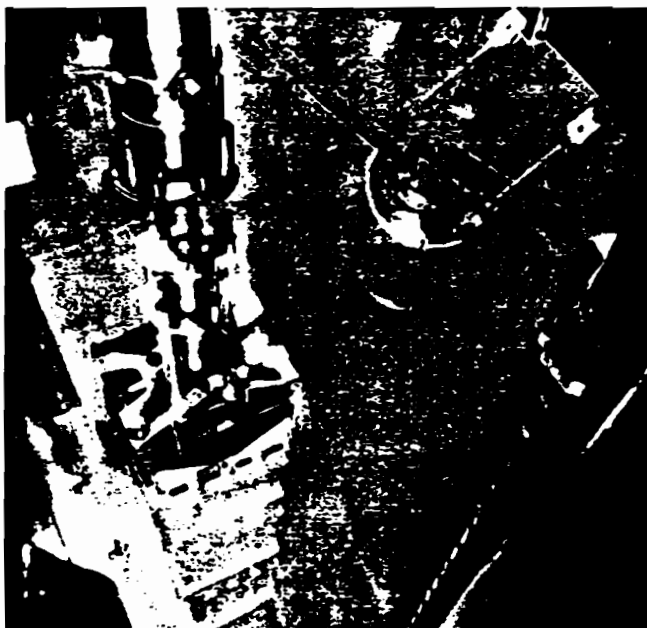
Slide-2

Typical PWR and BWR Fuel Assemblies



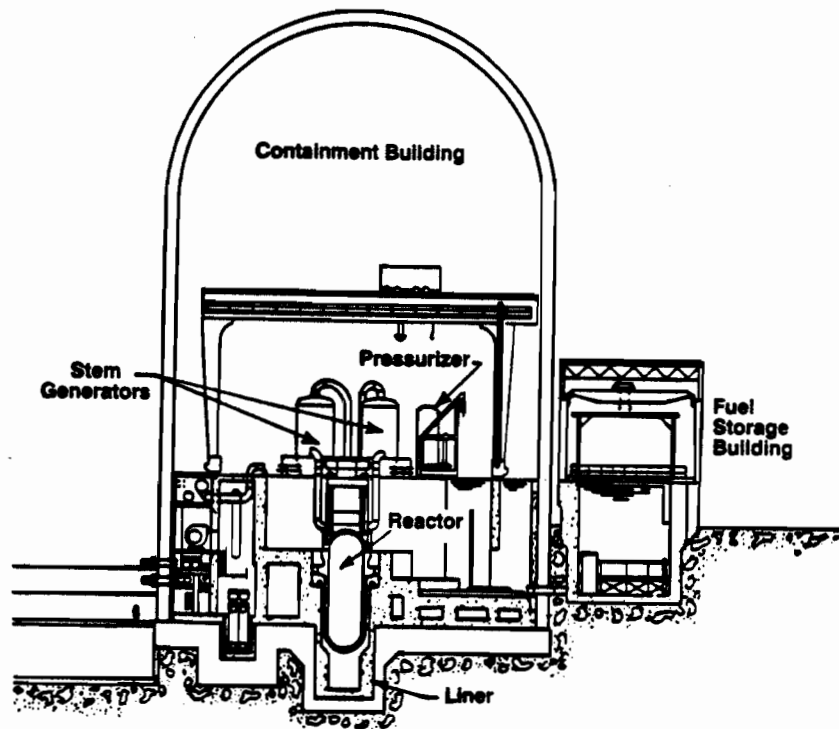
Slide-3

Typical Spent Fuel Pool Storage Facility



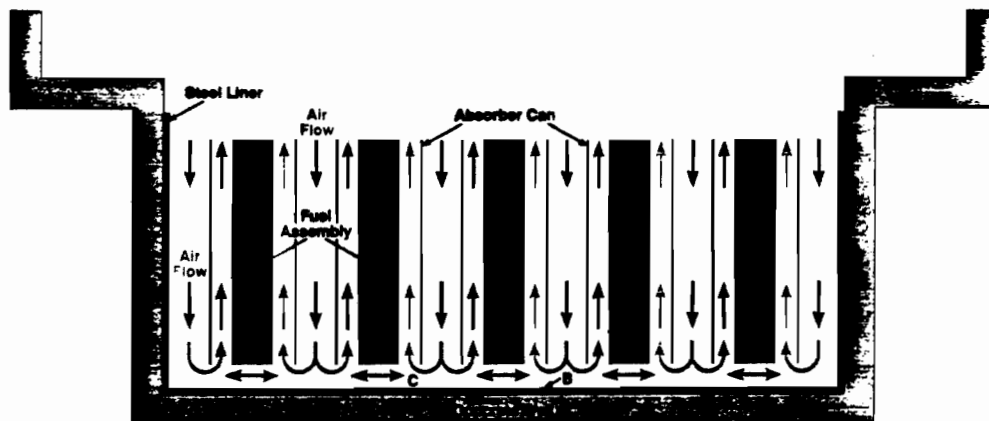
Slide-4

Cross Section of a Typical PWR Plant



Slide-5

Spent Fuel Storage Configuration Heat Transfer Modes



Heat Transfer Modes

- | | | | |
|--------------|---|--------------|---|
| q_{dec} | = Decay Heat in Fuel Rods | $q_{cov, c}$ | = Convection from Air Stream Absorber Can |
| q_{cond} | = Conduction in Fuel Rod | $q_{cov, l}$ | = Convection to Steel Liner |
| q_{chem} | = Chemical Heat Input to Fuel Rods from Clad-Ox | $q_{r, l}$ | = Radiation to Steel Liner |
| q_{rc} | = Radiation from Rods to Absorber Can | $q_{r, w}$ | = Radiation to Concrete Wall |
| $q_{cov, a}$ | = Convection from Rods to Air Stream | | |

Slide-6

Key Uncertainties

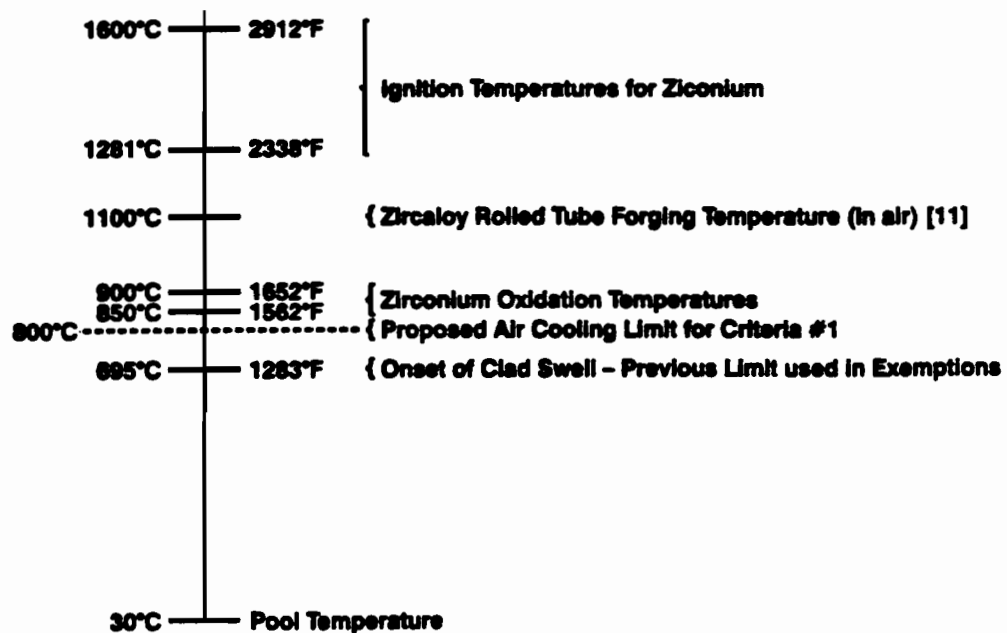
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Fellow Project (4 man-months):

- Evaluate Uncertainties
- Assess Impact of Uncertainties on NRC Policy

Slide-7

Key Temperatures in the Assessment of Zirconium Ignition and Runaway Oxidation



Slide-8