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**ET BRIEFING  
ON  
THE INTERIM TECHNICAL ASSESSMENT  
OF SPENT FUEL POOL ACCIDENTS  
FOR DECOMMISSIONING PLANTS**

**June 3, 1999**

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# INTRODUCTION

- ◆ **Licensees are requesting exemptions from EP and other regulations to reduce unnecessary costs at decommissioned plants**
- ◆ **To date, the staff has reviewed the licensee's requests on a case-by-case basis**
- ◆ **Technical Working Group was formed to establish a predictable, risk-informed approach for addressing SFP accidents at these plants**
- ◆ **The staff considers that such an approach would contribute to safety and reduce unnecessary regulatory burden**
- ◆ **The staff is sensitive to the need to improve efficiency and effectiveness and increase public confidence**

# OVERVIEW

- ◆ **Deterministic evaluations and risk assessments were performed to establish criteria, methods, and approaches for exemption requests**
- ◆ **The staff's findings place SFP accidents in a different perspective than may be expected**
  - ◇ **Higher burnup of fuel than in the past**
  - ◇ **High density reracking**
  - ◇ **A significant reduction in SFP equipment available after permanent shutdown**

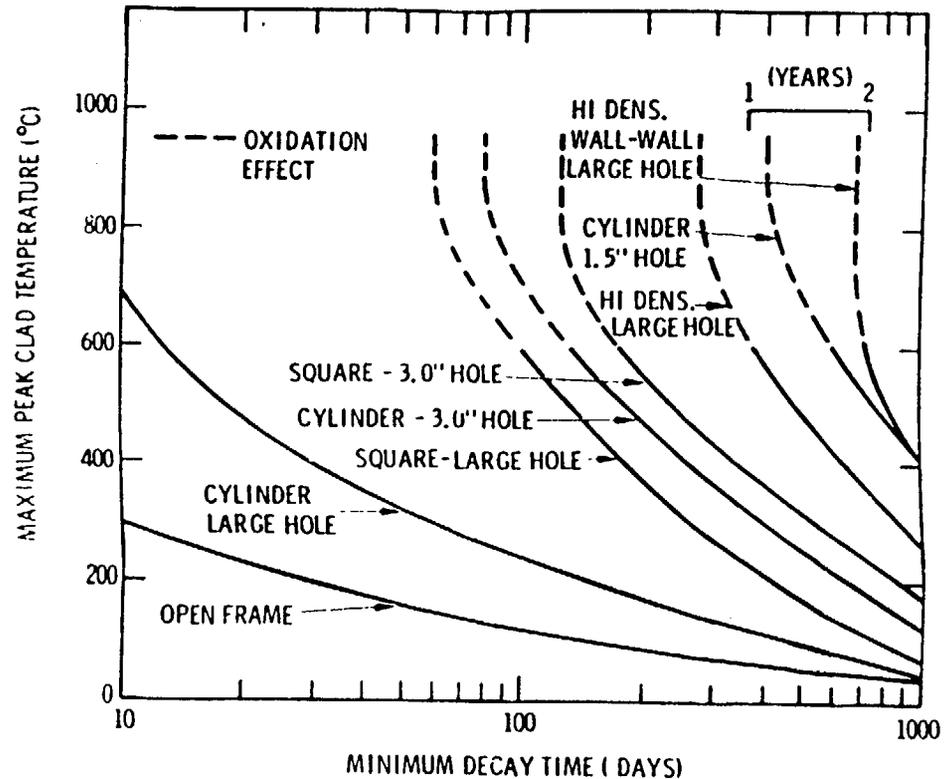
# DETERMINISTIC ASSESSMENT FINDINGS

- ◆ Existing generic studies identified that the likelihood of a zircaloy fire was extremely dependent on decay power and fuel storage configuration.

## SUMMARY OF HEATUP RESULTS FOR PWR SPENT FUEL

(Annotations give storage configuration and baseplate hole size)

from NUREG/CR-0649  
based on 33 GWD/MTU,  
17 x17 pin array, &  
well-ventilated room



- ◆ Changes in operating practices have effected both parameters non-conservatively. Previous studies underestimate the decay time required to preclude zircaloy oxidation for today's plants.

## **DETERMINISTIC ASSESSMENT FINDINGS (cont.)**

- ◆ **Staff evaluated generic, near-bounding thermal hydraulic spent fuel heatup calculations and determined that 3 to 5 years are needed to preclude a zircaloy fire for today's plants.**
- ◆ **For spent fuel heatup analyses, the maximum allowable temperature could be as high as 800 °C, rather than 565 °C, if certain conditions are complied with.**
- ◆ **Two previous EP exemptions were granted based on the finding that 10 hours was sufficient time to take ad hoc offsite protective measures.**

**Staff performed generic, bounding calculations to correlate decay time since final shutdown (decay power) to heatup time (time available for ad hoc actions). The calculations were based on adiabatic conditions involving one fuel rod heating up from 30 to 900 °C.**

**Generically, to ensure at least 10 hours are available for ad hoc measures, 2 years of decay time since final shutdown is needed for a BWR and 2.5 years for a PWR.**

## **SFP RISK AT DECOMMISSIONED PLANTS**

- ◆ **It is commonly believed that the risk at decommissioned reactors must be very low compared to operating reactors**
- ◆ **The staff performed a broad analysis of the risk that spent fuel pools at decommissioned plants represent to the public. The analysis considered a wide range of initiating events**
- ◆ **We found that previous analyses had underestimated the effect of denser spent fuel pool reracking, higher burnup, and equipment removal/abandonment under the 50.59 process.**

## **SFP RISK AT DECOMMISSIONED PLANTS (Cont.)**

- ◆ **Risks from spent fuel pool accidents are comparable to those in operating reactors for the first three to five years after last fuel transfer, while operating reactors are at risk for 40 to 60 years.**
- ◆ **Risk is driven by lack of redundancy and diversity of spent fuel pool cooling capability at spent fuel pools.**

## **SCENARIOS EVALUATED IN RISK ANALYSIS**

**Case 1 - The spent fuel pool and its cooling system are configured and operated in a manner similar to that found by the staff in its site visits. Last fuel transferred one year previously.**

**Case 2 - Same configuration as Case 1, but the last fuel was transferred one month previously.**

**Case 3 - The spent fuel pool and its cooling system are configured slightly better than the minimal allowed by NRC regulations. Last fuel transferred one year previously.**

## SFP RISK

	<u>CASE 1</u>	<u>CASE 2</u>	<u>CASE 3</u>
<b>Risk Totals</b>			
Early Fatalities	1.0E-5	8.1E-5	2.1E-4
Latent Cancers	3.3E-2	1.9E-1	6.8E-1
<b>Initiator</b>	<b>% of Risk from initiator</b>	<b>% of Risk from initiator</b>	<b>% of Risk from initiator</b>
Loss of Offsite Power - Plant centered and grid related events	9	5	26
Loss of Offsite Power - Events initiated by severe weather	9	11	5
Internal Fire	28	6	15
Loss of Pool Cooling	1	0.3	7
Loss of Coolant Inventory	19	71	42
Seismic Event	13	2	0.6
Cask Drop	17	3	5
Aircraft Impact	0.3	0.05	0.01
Tornado Missile	4	0.7	0.2

# **RISK ASSESSMENT FINDINGS**

- ◆ **The interim risk assessment shows spent fuel pool risk at decommissioned plants to be comparable to operating reactor risk for the first 3 - 5 years**
- ◆ **The interim results are driven by modeling assumptions on initiating event characteristics, plant configuration, and operator recovery actions. A more detailed investigation of a “generic” plant would be driven by similar assumptions**
- ◆ **Land interdiction costs as a result of any zircaloy cladding fire in the spent fuel pool would be high. This does not affect Emergency Preparedness (EP), but does affect indemnity insurance.**

## **RISK ASSESSMENT FINDINGS (Cont.)**

- ◆ **There appears to be sufficient time to respond to most initiators so that the existence or non-existence of EP planning would make little difference to the population.**
- ◆ **This is not necessarily true for heavy load drops, aircraft crash, and very large seismic events that have the potential to rapidly drain the SFP and uncover the fuel. If one of these initiators were to occur during the first year or two after the last fuel was transferred from the reactor to the spent fuel pool, it appears that there would be only five to seven hours available for ad hoc emergency response. This might be too short for effective ad hoc evacuation.**

## **STAFF'S CURRENT PLAN**

- ◆ **Developing interim criteria and recommendations based on the findings to have a more uniform exemption process for decommissioned SFP requirements.**
- ◆ **Requesting independent, quality reviews on the interim assessment from the following groups or organizations:**
  - ◇ **Advisory Committee on Reactor Safeguards (ACRS)**
  - ◇ **Committee to Review Generic Requirements (CRGR)**
  - ◇ **Nuclear Energy Institute (NEI)**
  - ◇ **Idaho National Engineering and Environmental Laboratory (INEEL)**
  - ◇ **Solicit comments from the Stakeholders (public, licensees, etc.)**

## **CURRENT SCHEDULE**

- ◆ **Staff's interim response to the SRM with plans and schedules to the Commission - 6/18/99**
- ◆ **Staff's interim technical assessment paper issued for independent review in parallel to the groups or organizations listed above - 7/30/99**
- ◆ **Independent, quality reviews to be completed - 12/31/99**
- ◆ **Staff to complete final technical assessment - 3/31/00**