



**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS BRIEFING**

**ON**

**Draft Final Technical Study of Spent Fuel Pool Accident Risk  
at Decommissioning Nuclear Power Plants**

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**April 5, 2000**

5/10

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### RES

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## **BACKGROUND AND STATUS**

- **June 1999 preliminary draft report concluded that:**
  - **Zirconium fires can occur for several years after shutdown**
  - **The offsite consequences are very high**
  - **Frequency about  $2E-5$  per year. Dominated by human error**

- **Extensive scrutiny by industry and other stakeholders; NRC sponsored technical review of preliminary draft**
- **Industry committed to design and operational actions, and proposed a seismic checklist**
- **Risk has been requantified and draft report prepared**
- **Draft-for-comment issued 2/15/00**

## **TECHNICAL RESULTS**

- **In current draft report, risk is reduced significantly due primarily to industry commitments**
  - **Human-error driven sequences reduced to about 2E-7 per year**
  - **Heavy load sequences reduced to about 2E-7 per year**

# TECHNICAL RESULTS

(Cont.)

- Seismic failure frequency bounded by  $3E-6$  per year, but not fully quantified due to seismic checklist approach
- Overall risk estimate reduced by about an order of magnitude
- Criticality issue and most stakeholder comments addressed

T. Kress \* 1.174 is based on S.T. from a steam environment and the prompt fatalities.  
from that S.T.

# **TECHNICAL RESULTS**

**(Cont.)**

- **NRC analysis to date shows that zirconium fires will generally not be possible after 5 years. Acceptance of shorter times would require plant-specific analysis**



## COMPARISON WITH OTHER RISK MEASURES AND RESULTS

- Decommissioning reactor  
large release frequency:  $<3E-6$
- RG 1.174 large early release (LERF)  
baseline guideline (below which  
only a small increase in risk will  
be allowed):  $1E-5$
- Range of IPE LERF estimates:  $2E-6$  to  $2E-5$
- Pool Performance Guideline:  $1E-5$

# THREE PHASES OF A SPENT FUEL POOL

- **IMMEDIATELY AFTER PLANT SHUT DOWN:**

Large early <sup>Several hours</sup> offsite release due to zirconium fire possible.

Design basis systems and operating practices retained. Full requirements for EP, indemnification, and security in place

- **EARLY DECOMMISSIONING PHASE**

Large late releases possible. Relaxation of EP requirements justified technically.

Meeting industry commitments, seismic checklist, and staff assumptions required.

**Frequency of large releases within RG 1.174 guidance that allows for small increases in risk. NRC might consider insurance relief.**

**Staff analyzed pools with one year of cool down, but shorter times might be justified.**

- **ZIRCONIUM FIRES NO LONGER POSSIBLE:**

**Report justifies 5 years. Shorter times might be justified plant-specifically**

**There may be technical justification for elimination of Offsite EP and insurance requirements in this phase**

# **RISK INFORMED-DECISION MAKING**

- **Baseline risk and changes to risk**

**The results of the risk assessment show that the estimated risk from operating decommissioning spent fuel pools is within the PPG guidelines that are based on RG 1.174.**

- **Margin**

**Thermal inertia of fuel and SFP volume give significant time for heat up to a zirconium fire.**

- **Defense in Depth (DID)**

**Given the margin in SFPs, DID is not a major issue. However, given risk analysis findings including uncertainties, the technical results provide justification for retaining a baseline level of EP, including procedure to classify accidents and notify offsite authorities.**

**In the late decommissioning phase, there is no technical basis for retaining EP.**

- **Monitoring performance**

**Licensees should monitor characteristics important to controlling risk, including industry commitments, staff assumptions, and seismic checklist.**

## IMPACT ON RULE MAKING

- **Slow evolution of release justifies reduction in EP requirements. Risk insights and defense-in-depth considerations indicate need for retaining a baseline EP capability.**
- **Risk analysis does not justify reduction in security function. Reduction of requirements might be justified on the basis of reduced complexity**
- **Current report does not take a position on indemnification. The frequency of zirconium fire is not “incredible,” but may be low enough for the commission to conclude that licensees could be relieved from insurance requirements. However, some operating plants have comparably low frequencies of large releases.**

*D Powers: Less than  $10^{-6}$  / year is considered incredible.*

- **Rule making should include requirement to monitor performance in areas important to risk.**
- **In the late decommissioning phase, there is no technical basis for retaining EP. The draft report did not directly address indemnification issues.**