



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

December 16, 1999

ORGANIZATION: Nuclear Energy Institute

SUBJECT: SUMMARY OF NOVEMBER 19, 1999, MEETING WITH THE NUCLEAR ENERGY INSTITUTE (NEI) ON DECOMMISSIONING SPENT FUEL POOL RISK ASSESSMENT

Representatives of NEI, the nuclear industry, and the public stakeholders met with Nuclear Regulatory Commission staff on November 19, 1999, to obtain an update on the staff's progress in resolving industry and public stakeholder issues raised regarding the preliminary draft of the decommissioning spent fuel pool risk assessment. The agenda and list of attendees are provided as enclosures 1 and 2 to this summary.

Mr. Bill Huffman, of the NRC staff, opened the meeting with an overview of the agenda. In addition, he introduced into the meeting record a letter from the Union of Concerned Scientists dated November 12, 1999, providing its perspective on NEI statements made during a November 8<sup>th</sup> Commission meeting on reactor decommissioning issues. He also introduced a letter from NEI dated November 12, 1999, detailing commitments the industry is willing to make to ensure that risks associated with decommissioning spent fuel pools are acceptably low.

Mr. John Hannon, of the NRC staff, discussed heavy load drops, seismic, and criticality assessments. The presentation material is included in enclosure 3. In the heavy load discussions, the staff stated that NEI's commitment to Phase II of NUREG-0612 ("Control of Heavy Loads at Nuclear Power Plants") plus, additional commitments to administrative restrictions on heavy load movements near the spent fuel pool should result in reasonably low probabilities of a heavy load drop type event. In the seismic discussions, the staff stated that the seismic checklist developed by NEI is a potentially valid way to avoid a detailed seismic fragility analysis. However, some additional strengthening of the checklist is needed. In addition, there are some East Coast plants (with above ground pools with walls not backed by soil) and most plants west of the Rocky Mountains that would not be enveloped by the checklist. NEI questioned how the staff's comments on the checklist were going to be resolved. Mr. Hannon stated that it would likely be an open item in the report. NEI asked if the staff's comments or recommendations could be provided separately before the issuance of the report. The staff stated that it would determine a way to provide feedback to NEI and public stakeholders on the seismic checklist concerns. The staff suggested a separate meeting or telecom for resolution of seismic checklist issues. NEI also questioned the inclusion of seismically related loss of cooling or loss of power sequences into the overall seismic risk quantifications. NEI believes that it would be more appropriate to include this type of risk in the same category as loss of cooling sequences which involve other factors besides seismic such as human reliability. The staff agreed to revisit this area in the report and see if any changes would be appropriate considering the recent NEI commitments. The staff felt that there may be some improvements in the seismic risk scenarios considering the staff's revised view on human reliability analysis and human error probabilities.

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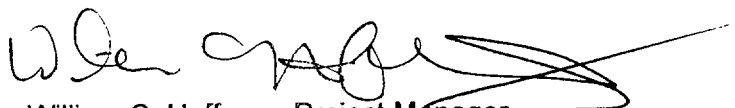
PDR REVGP NEI

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Mr. Richard Barrett, of the NRC staff, discussed the revised approach in the human reliability analysis and risk-informed decisionmaking. The presentation material is included in enclosure 3. Mr. Barrett noted that implementation of NEI commitments would significantly reduce the risk contributions of loss of decay heat removal or loss of inventory events. Risk criteria under consideration by the staff were also discussed. The staff is specifically considering a recent Advisory Committee on Reactor Safeguards suggestion on defining the start of fuel uncovering for decommissioning spent fuel pools as the equivalent of a large early release condition for an operating reactor. Using this approach, an acceptable base level of LERF (large early release frequency) would be less than  $1E-5$  and delta LERF less than  $1E-6$  as currently recommended in Regulatory Guide 1.174 ("An Approach For Using Probabilistic Risk Assessment in Risk Informed Decisions on Plant-Specific Changes to the Licensing Basis"). It was noted that for areas of industry regulatory interest for decommissioning plants, such as emergency planning (EP), reduction of EP requirements does not change the frequency of start of fuel uncovering in a spent fuel pool. The staff may have to look at changes in consequences when assessing the risk changes of a proposal. NEI had some concerns with this concept because of the much greater uncertainties involved in calculating consequences. NEI believed that this could also take away the incentive for making changes that could help mitigate an event once fuel uncovering had begun (e.g., a remote water addition system). In addition, NEI thought that some credit should be given for the time available between start of fuel uncovering and heatup to a zirconium fire condition. NEI stated that it would provide comments on the staff's proposed risk criteria.

Mr. Peter James Atherton, a public stakeholder, was concerned about the aging of spent fuel pools beyond their licensed 40-year period. The staff stated that there would be some discussion on aging considerations in its report but that accumulated experience with reactor spent fuel pools indicated that this is not an issue that needs further evaluation. Mr. Atherton was also concerned about the lack of any defense-in-depth mechanisms (such as containment) around a spent fuel pool and questioned if the probability numbers used in the probabilistic risk assessment sequences could be validated without any data relating to a major spent fuel pool accident. The staff responded that the entire focus of its study has been to characterize the risks involved as accurately as possible using the best information available.

A transcript was made of the discussions during this meeting and is available upon request and has been posted on NRC Internet Web page <[www.nrc.gov/OPA/reports/dcmmsng.htm](http://www.nrc.gov/OPA/reports/dcmmsng.htm)>.



William C. Huffman, Project Manager  
Decommissioning Section  
Project Directorate IV & Decommissioning  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Project No. 689

Enclosures: 1. Agenda  
2. List of Attendees  
3. NRC Presentation Material

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Nuclear Energy Institute

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cc:

Mr. Ralph Beedle  
Senior Vice President  
and Chief Nuclear Officer  
Nuclear Energy Institute  
1776 I Street, NW, Suite 400  
Washington, DC 20006-3708

Mr. Alex Marion, Director  
Programs  
Nuclear Energy Institute  
1776 I Street, Suite 400  
Washington, DC 20006-3708

Mr. David Modeen, Director  
Engineering  
Nuclear Energy Institute  
1776 I Street, NW, Suite 400  
Washington, DC 20006-3708

Mr. Anthony Pietrangelo, Director  
Licensing  
Nuclear Energy Institute  
1776 I Street, NW, Suite 400  
Washington, DC 20006-3708

Mr. Jim Davis, Director  
Operations  
Nuclear Energy Institute  
1776 I Street, NW, Suite 400  
Washington, DC 20006-3708

Ms. Lynnette Hendricks, Director  
Plant Support  
Nuclear Energy Institute  
1776 I Street, NW, Suite 400  
Washington, DC 20006-3708

Mr. H. A. Sepp, Manager  
Regulatory and Licensing Engineering  
Westinghouse Electric Company  
P.O. Box 355  
Pittsburgh, PA 15230-0355

Mr. Charles B. Brinkman, Director  
Washington Operations  
ABB-Combustion Engineering, Inc.  
12300 Twinbrook Parkway, Suite 330  
Rockville, MD 20852

Mr. Michael Meisner  
Maine Yankee Atomic Power Co.  
321 Old Ferry Road  
Wiscasset, ME 04578-4922

Mr. Paul Blanch  
Energy Consultant  
135 Hyde Road  
West Hartford, CT 06117

New England Coalition on Nuclear  
Pollution  
P. O. Box 545  
Brattleboro, VT 05302

Mr. Ray Shadis  
Friends of the Coast  
P. O. Box 98  
Edgecomb, ME 04556

Mr. David Lochbaum  
Union of Concerned Scientists  
1616 P St. NW, Suite 310  
Washington, DC 20036

Mr. Paul Gunter  
Nuclear Information Resource Service  
1424 16<sup>th</sup> St. NW, Suite 404  
Washington, DC 20036

Mr. Peter James Atherton  
P.O. Box 2337  
Washington, DC 20013

Mr. H. G. Brack  
Center for Biological Monitoring  
P.O. Box 144  
Hull's Cove, ME 04644

Ms. Deborah B. Katz  
Citizen's Awareness Network  
P. O. Box 3023  
Charlemont, MA 01339-3023

Mr. Robert Holden  
National Congress of American Indians  
Suite 200  
1301 Connecticut Ave, NW  
Washington DC, 20036

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FOR SUMMARY OF 11/19/99 MEETING WITH NEI ON  
DECOMMISSIONING SPENT FUEL POOL RISK ASSESSMENT

DATE:

12/16/99

E-MAIL

JZwolinski/SBlack  
SRichards  
MMasnik  
RDudley  
PRay  
CJamerson  
GHolahan  
GHubbard  
RBarrett  
JHannon  
DJackson  
JBirmingham  
DLange  
GParry  
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- 2 -

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DATE	12/14/99		12/13/99	12/14/99	12/15/99	12/16/99	

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DATE	12/13/99		12/13/99	12/14/99			

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EXCEL #134

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NAME	W.Huffman:sp		CJamerson cl	JHannon	RBarrett	MMasnik	
DATE	12/13/99		12/13/99				

NRC, NEI, PUBLIC STAKEHOLDER MEETING  
TO DISCUSS STAFF ACTIVITIES IN ASSESSING THE RISKS  
OF DECOMMISSIONING REACTOR SPENT FUEL POOLS

Friday, November 1999

1:30 to 3:30 In Conference Room 0-10 B4

AGENDA

- I      Introductions (5 Minutes)
- II     Discussion of Meeting Objectives (5 Minutes)
- Provide update on the staff's progress in resolving industry and public stakeholder issues raised regarding the preliminary draft decommission spent fuel pool risk assessment
  - Provide public stakeholders an opportunity to question or comment on associated resolution process
- III    NRC Staff Presentations (60 Minutes)
- John Hannon (30 Minutes)   -Heavy Load Drops Risks  
Plant Systems Branch      ▶      General Assessment  
   ▶      NUREG 0612 Commitments
- Seismic Risks  
   ▶      General Assessment  
   ▶      Seismic Checklists  
   ▶      Items still under consideration
- Criticality  
   ▶      General Assessment  
   ▶      Items still under consideration
- Rich Barrett (30 Minutes)   -Human Reliability Analysis  
Probabilistic Safety     ▶      Background  
Assessment Branch     ▶      Status  
   ▶      Commitments
- Risk-Informed Decision Making  
   ▶      LERF similar criteria  
   ▶      Risk-Informed vs Risk-Based  
   ▶      Defense-in-Depth and Margins
- IV    NEI Comments or Discussions (15 Minutes)
- V     Public (15 Minutes)
- VI    Summary/Conclusions/Action Items (15 Minutes)



NRC / NEI  
DECOMMISSIONING PUBLIC MEETING  
ATTENDANCE LIST

November 19, 1999

NUCLEAR ENERGY INSTITUTE

Lynnette Hendricks  
Alan Nelson

Maine Yankee

Bill Henries

GPU Nuclear Corp

Ken Canavan

Sciencetech

Kim Green

NRC

Suzanne Black  
Rich Barrett  
John Hannon  
Stuart Richards  
Bill Huffman  
Diane Jackson  
Gareth Parry  
Glenn Kelly  
Mark Rubin  
Brian Thomas  
Ed Thom  
Larry Kopp

Richard Dudley  
George Hubbard  
Mike Masnik  
Tony Markley  
Mike Cheok  
Tony Ulses  
Joe Staudenmeier  
Goutam Bagchi  
Tanya Eaton

Public

Sidney Crawford  
P.J. Atherton  
Amy Shollenberg

**NRC Presentation Material**

**At**

**NRC/NEI/STAKEHOLDER Meeting**

**on**

**Decommissioning Reactor**

**Spent Fuel Pool Risks**

## HEAVY LOAD DROP ANALYSIS

- ✓ ANALYSIS ASSUMPTIONS AND BASES
  - ✓ employs more recent Navy data
  - ✓ includes human error evaluation for improper rigging
    - Refines analysis in NUREG - 0612
  - ✓ will include mean value estimate for compatibility with RG 1.174
- ✓ CURRENT ESTIMATE OF FREQUENCY
  - ✓ SFP Loss of Inventory per year for 100 lifts for single failure proof system
    - 2.8 E - 8/ry (low)      2.1 E - 6/ry (high)
  - ✓ for non-single failure proof system (based on NUREG - 0612)
    - 1.0 E -7/ry (low)      7.5 E - 5/ry (high)
- ✓ NEI INCIDENT RATE DATA
  - ✓ used to requantify the fault tree
    - Minimal change in the resulting frequency estimate
    - 1.5 E - 8/ry (low)      2.9 E - 6/ry (high)
- ✓ NEI COMMITMENT TO PHASE II OF NUREG - 0612
  - ✓ Administrative restrictions on heavy load movements
    - Procedures to control operations near SFP
    - Cask drop analyses for non-single failure proof cranes
- ✓ COMMITMENT TO PHASE II PROVIDES LOW PROBABILITY AND A DIVERSE MEANS OF PROTECTION WHICH INDICATES THERE IS REASONABLE ASSURANCE THAT RISK IS ACCEPTABLE
- ✓ FINAL RESULTS SUBJECT TO INDEPENDENT REVIEW

## SEISMIC ANALYSIS

- ✓ JUNE 1999 DRAFT TECHNICAL STUDY
  - ✓ 3 x SSE (.4 - .5 g range) est. =  $2E-5$ /yr
    - Challenge pool integrity (5%) =  $1E-6$ /yr
    - Total seismic contribution at most CEUS sites:  $2E-6$ /yr
  
- ✓ AUGUST 1999 NEI CHECKLIST
  - ✓ 7 checklist items
  - ✓ excellent start
  
- ✓ ITQR
  - ✓ adequate checklist can be developed
    - Use mean EPRI & LLNL93 hazard estimates
    - Envelope seismic risk <  $3E-6$  (.5 PGA or 1.2 PSA)
  - ✓ avoid detailed fragility review for most CEUS sites
  
- ✓ ADDITIONAL CONSIDERATIONS
  - ✓ strengthen checklist
    - Out-of-plane flexural and shear failure modes
    - Level 2 screening requirements for in-plane flexure and shear
  - ✓ detail fragility for 6 CEUS sites (above ground pools with walls not backed by soil backfill)
  - ✓ sites west of Rocky Mountains
  
- ✓ NEXT STEPS
  - ✓ NEI actions
  - ✓ Staff actions

## CRITICALITY ANALYSIS

### ✓ PUBLIC STAKEHOLDERS RAISED CONCERN

#### ✓ June 1999 DRAFT Technical Study

Considered several possible mechanisms

Closer spacing of stored assemblies  
Loss of fixed poison (boral/boraflex cover plates)  
Loss of cladding integrity  
Personnel actions in response to an accident

Incredible or highly unlikely

### ✓ ITQR

#### ✓ additional mechanisms proposed

Zirc fire induced fuel pellet reconstitution

Rack deformation (seismic event, heavy load drop, melting of boral plates)

### ✓ FUTURE ACTIONS

✓ assess potential for criticality

✓ evaluate consequences

✓ assess likelihood

**NRC /NEI / Stakeholder Meeting**

**on**

**Risk From Spent Fuel Pools at Decommissioning Reactors**

**November 19, 1999**

**Richard J. Barrett  
NRC/NRR/DSSA/SPSB**

## **Human Reliability Analysis**

- **June analysis identified human errors related to identification of abnormal conditions, restoration of failed functions, and initiation of mitigating actions.**
- **Human error probabilities for these events were based on generic values taking little credit for the long durations.**
- **This approach identified the important operator activities.**
- **In August, revised staff approach highlighted design and operational features that could result in high operator reliability in responding to upset conditions.**
- **This report was reviewed and endorsed by two HRA experts, and has been revised to take into account the comments.**
- **Implementation of NEI commitments would significantly reduce the risk contribution of loss of decay heat removal or loss of inventory events.**

## **Attributes of Revised Approach**

- **Based on analysis of conditions needed to accomplish three functions:**
  - **detection and recognition of deterioration of fuel pool cooling function**
  - **interpretation of the indications and formulation of a response strategy**
  - **execution of the strategy**
  
- **Acknowledges the unique conditions for decommissioning fuel pool**
  - **slow developing scenarios**
  - **in principle, simple systems and mitigating actions**
  - **little competition for operator attention**
  
- **Features addressed include:**
  - **alarms and indications**
  - **walkdown practices**
  - **response procedures / contingency plans**
  - **equipment availability**



## **Requantification of HRA**

- The revised staff approach is being applied to a revised PRA model, and will be used to demonstrate the value of adopting the NEI commitments.**
- Preliminary results support qualitative conclusions from the August draft**
- Staff has not reviewed preliminary requantification results.**

## **Risk Informed Decision Making**

- **Risk criteria of Reg Guide 1.174**
  - **ACRS suggestion of defining fuel uncoverly as LERF**
  - **Base level of LERF < 1E-5**

**Risk results tend to support this conclusion**

- **Delta LERF < 1E-6**

**EP exemptions do not change LERF**

- **Margins of safety**
  - **Low temperature, low pressure, thermal inertia**
  - **Source term without Iodines**

## **Risk Informed Decision Making (Continued)**

- **Defense in depth**

- **Rationalist approach: DID compensates for uncertainties**

**Seismic hazard curves**

- **Defense in depth commensurate with safety margins**

**Time available for response**

- **Recognize compatibility with operating reactor situation**

- **Performance monitoring**

- **Risk analysis determines performance measures important to controlling risk**

- **Licensee monitoring and NRC inspection**