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Sent: Tuesday, September 27, 2011 10:35 AM
To: Tiktinsky, David
Subject: ANS Paper
Attachments: ANS Winter 2011 US MOX NCSD Summary R2 .pdf

Hearing Identifier: MixedOxideFuelFabricationFacility_Public
Email Number: 198

Mail Envelope Properties (67D173A90CF7A5469AE7A645828044D1034F3B41)

Subject: ANS Paper
Sent Date: 9/27/2011 10:34:48 AM
Received Date: 9/27/2011 10:34:59 AM
From: Gwyn, Dealis W.

Created By: DWGwyn@moxproject.com

Recipients:
"Tiktinsky, David" <David.Tiktinsky@nrc.gov>
Tracking Status: None

Post Office: cltexchg.dcsmox.com

Files	Size	Date & Time
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ANS Winter 2011 US MOX NCSD Summary R2 .pdf		306102

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Priority: Standard
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Sensitivity: Normal
Expiration Date:
Recipients Received:

US MOX IROFS Risk Ranking for Enhanced Criticality Safety

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INTRODUCTION

The United States and the former USSR signed a bilateral agreement in the early 1990s which committed each country to Nuclear Non-Proliferation by reducing their stockpile of strategic arms. In March 1999, the US Department of Energy (DOE) initiated the US program to convert nearly half of the US weapons grade plutonium into Mixed Oxide (MOX) fuel assemblies over a twenty year period. Shaw AREVA MOX Services (MOX Services) was selected to design and operate the Mixed Oxide Fuel Fabrication Facility (MFFF). (Ref. 1)

In addition to Items Relied On For Safety (IROFS) established in Nuclear Criticality Safety Evaluations (NCSEs), postulated credible high consequence events (e.g., criticality) are made highly unlikely based on applying the following items:

(1) Application of the single-failure criteria or double contingency,
(2) Application of 10 CFR 50 Appendix B and NQA-1 quality assurance (QA) requirements,
(3) Application of Industry Codes and Standards, and
(4) Management Measures, including periodic surveillance of IROFS. (Ref. 2)

The Risk Ranking process helps us to identify those IROFS most critical to the implementation of the MOX Criticality Safety Strategies. Emphasizing these higher risk IROFS results in enhanced criticality safety of the MOX systems, structures and components.

NUREG-1718 (Ref. 3), pg. 5.0-20 describes the grading of management measures:

"The [Likelihood Evaluation] method has objective criteria for evaluating, at least qualitatively, the likelihood of failure of individual IROFS. Such likelihood criteria should include the following when applicable: means to limit potential failure modes, the magnitude of safety margins, the type of engineered equipment (active or passive) or human action that constitutes the IROFS, and the types and grading, if any, of the management measures applied to the IROFS."

NUREG-1718 (Ref. 3), pg. 5.0-33 also describes the grading of management measures:

"The reliability required for an IROFS is proportionate to the amount of risk reduction relied on. Thus the quality of the management measures applied to an IROFS may be graded commensurate with the reliability required."

RISK RANKING METHODOLOGY

Step 1 - Identify groups of IROFS components to be evaluated. Examples include:

- Gloveboxes in powder areas grouped together because they perform similar confinement functions.
- Components grouped together that isolate a particular tank on high level alarm.

Step 2 - Review safety evaluations (explosion or confinement hazards) and NCSEs (criticality hazard) to understand the importance of the IROFS.
Step 3 - The safety disciplines apply a score to each risk ranking criteria described in the next section.
Step 4 - Add up the scores from the risk ranking criteria and assign an overall risk ranking category, such as high, medium, or low. If multiple disciplines risk rank a component, then the highest risk ranking score is conservatively assigned.
Step 5 - Apply a standard set of QA controls and management measures based on the IROFS Risk Ranking.

RISK RANKING CRITERIA

Risk Ranking Criteria are grouped into two categories:

1) Probability of the event sequence.
2) Consequences of the accident.

Criteria related to the probability of the event sequence:

1a) Is failure detection provided for the IROFS? For example, an IROFS continuously verified by automatic system controls, such as channel checks between programmable logic controllers (PLC), would have a lower risk of undetected failure than an IROFS with only a monthly surveillance check.
1b) What is the likelihood of the initiating event?

1c) What is the complexity of the IROFS design? For example, a simple and reliable control, such double-walled piping controlling geometry, is less complex than an active engineered control using a sensor, transmitter, PLC, valve, etc.
1d) How much safety margin is there between the process upset and high consequence event?

Criteria related to the accident consequence:
2a) Does the IROFS control or monitor the process? For example, an IROFS providing a high level alarm in a drip tray under process tanks monitors the process. Failure of the high level alarm does not mean a high level event has occurred.
2b) What is the severity of the event consequence? For example, a breach in a glovebox processing liquids has less severe radiological consequences than a breach in a glovebox processing powder. This criteria does not apply to criticality safety IROFS because a criticality accident is considered a high consequence event.
2c) Is the event a slow acting event? A slowly developing event provides more time for operator response.
2d) Are other systems, either normal or IROFS systems, available to provide additional safety? For example, if the IROFS failed, would other controls be immediately available to provide backup?

OVERALL RISK RANKING SCORE

The event probability score and event potential consequences score are added together to determine an overall risk ranking score. After a significant number or IROFS have been scored, the IROFS will be binned into risk groups. Then a standard set of QA procedures, design criteria, and management measures can be applied to each risk group commensurate with its safety significance.

CONCLUSION

Risk ranking IROFS helps to focus our attention on those IROFS which are ranked to be the most important to the implementation of the Criticality Safety Strategy of the US MOX Project while meeting the QA requirements, such as 10 CFR 50 Appendix B and NQA-1.

REFERENCES

1. B. MATTHEWS, "A Criticality Safety Approach to the US MOX Fuel Fabrication Facility," *Proc. Integrating Criticality Safety into the Resurgence of Nuclear Power*, Knoxville, Tennessee, September 19–22, 2005, American Nuclear Society (2005) (CD-ROM).

2. M. SHEA/A. BRYSON/R. FOSTER, "Criticality Safety Design Challenges at the MOX Fuel Fabrication Facility," *Proc. American Nuclear Society: ANS 2010 Summer Meeting*, San Diego, CA, June 13–17, 2010, American Nuclear Society (2010) (CD-ROM).

3. NUREG-1718, Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication.