

July 27, 2007

MEMORANDUM TO: Luis Reyes
Executive Director for Operations

THRU: Renée M. Pedersen, Differing Professional
Opinions Program Manager
Office of Enforcement

FROM: Michael F. Weber, Director */RA/*
Office of Nuclear Material
Safety and Safeguards

SUBJECT: STATEMENT OF VIEWS ON THE DIFFERING PROFESSIONAL
OPINION DECISION INVOLVING RED OIL EVENTS AT THE
PROPOSED MIXED OXIDE FUEL FABRICATION FACILITY
(DPO-2005-002)

As requested in Ms. Pedersen's April 27, 2007 memorandum to me on the subject Differing Professional Opinion (DPO), I have reviewed the DPO Decision by the former Director, Office of Nuclear Material Safety and Safeguards (NMSS) in accordance with her memorandum and the guidance in Management Directive 10.159. My review took considerably longer than the 14 days included in the EDO-approved milestones and timeliness goals for DPO appeals due to scheduling constraints involving myself and the submitter. To conduct this review, I reviewed the Final Decision on DPO-2005-002, March 23, 2007; the DPO Panel Report, February 21, 2007; and several emails from the submitter. In addition, I met with the DPO Panel on July 12, 2007, and with the submitter on July 19, 2007. The briefing slides used in these two meetings are enclosed as Enclosures 1 and 2, respectively. Following my meeting with the submitter, I queried the Deputy Director for Special Projects and the Technical Support Directorate, Division of Fuel Cycle Safety and Safeguards, about the status of the chemical safety review of the Operating License application for the proposed mixed oxide fuel fabrication facility. Based on my review, I have not identified substantially new information that warrants revision to the NMSS Director's decision on DPO-2005-002.

It is significant to point out that the documents that I reviewed and the people with whom I met agree on the safety significance of red oil events and the importance of ensuring proper safety controls, both engineered and administrative, are effective in preventing such events. The submitter served as the Lead Chemical Safety Reviewer during the review of the Construction Authorization review for the proposed facility. Based on our meeting, I understand that his principal concern is that NRC has not been sufficiently proactive in reviewing this issue and ensuring that the applicant is implementing appropriate controls to resolve the issue. The line manager responsible for the MOX facility review assured me that the staff is reviewing the applicant's assessments and controls to prevent red oil events as part of the broader chemical safety review in accordance with the requirements in 10 CFR Part 70. Consequently, it would not be unreasonable to issue a ticket to track the resolution of the red oil issue (see pp. 18 and 24 of the submitter's briefing slides).

Another concern expressed by the submitter is the need to make the documents associated with his DPO publicly available. I understand that the documents associated with the DPO, including the Center for Nuclear Waste Regulatory Analysis report, will be made publicly available after you act on the DPO appeal and the documents have been screened and redacted in accordance with the Sensitive Unclassified Non-Safeguards Information guidelines. Consequently, I would expect most of the documents related to this DPO will be publicly available.

Finally, the submitter in his discussion with me, identified concerns that his DPO was provided to his colleagues in the Division of Fuel Cycle Safety and Safeguards and that his line management has copies of the DPO. However, sharing this information with the staff and managers currently involved in the review of the MOX application is consistent with the NMSS Director's final decision on the DPO.

If you have any questions about my review or need additional information, please advise.

Enclosures:

1. DPO Panel briefing slides
2. DPO Submitter briefing slides

L. Reyes

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- 2. DPO Submitter briefing slides

DOCUMENT NAME: a:\Office Director's Statement of Views on Contested Issues

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MOX Red Oil DPO Panel Report

July 2007

DPO Panel:
Ruland/Davis/Schwink

1

Overview

- MOX Construction Approval Request docketed for NRC review/approval under 10 CFR Part 70.23 (b), which is intended to prevent substantial back-fitting requisite for NRC approval of a future license application to possess and use nuclear material at the MOX site
 - 70.23(b) The Commission will approve construction of the principal structures, systems, and components of a plutonium processing and fuel fabrication plant on the basis of information filed pursuant to § 70.22(f) when the Commission has determined that the design bases of the principal structures, systems, and components, and the quality assurance program provide reasonable assurance of protection against natural phenomena and the consequences of potential accidents. Failure to obtain Commission approval prior to beginning of such construction may be grounds for denial of a license to possess and use special nuclear material in a plutonium processing and fuel fabrication plant.
- DPO Submitter differing opinion:
 - Inadequate justification docketed for NRC safety determination about plutonium processing related red oil initiated explosions in closed systems potentially resulting in significant consequences for the public, workers, environment and national security interest (plant asset for converting weapons plutonium to reactor fuel)
 - Reverse management decision to accept applicant strategy for red oil related safety and reopen CS-01, red oil reactions issue
- DPO Panel:
 - Agreed: inadequate justification docketed for applicant's red oil related safety strategy
 - Recommended inspection of red oil safety strategy implementation during detailed design/construction at MOX site and resolution of red oil related safety issues during licensing of MOX site.

DPO Submitter Concerns

1. Unexplained contradictions with DOE/DNFSB RAGAGEP for closed systems safety (Panel agreed)
2. Inadequate margin in design basis temperature (Panel agreed)
3. Insufficient venting to avoid choked flow and pressurization capable of raising temperature (Panel agreed)

DPO Submitter Concerns

(Continued)

4. Inadequate controls on organic compounds (Panel agreed)
5. No controls on acid or solvent concentrations (Panel agreed)
6. Evaporators high aspect ratio favorable for red oil reactions potentially causing pressure excursions (Panel agreed)

DPO Submitter Concerns

(Continued)

7. Management acceptance of applicant's proposal is based on voting process (not consensus) involving unqualified reviewers (Panel concluded red oil safety concerns were appropriately raised to management consideration processes but did not consider appropriateness of processes)
8. Efficiency arguments (not mentioned in regulations or SRP) were used by management as part of the rationale for accepting the applicants proposal (Panel concluded that efficiency is an appropriate goal)

DPO Submitter Concerns

(Continued)

9. A significant portion of the management decision relies upon future commitments, efforts, and experiments to define/refine current PSSCs and design bases that are not RAGAGEP – “technically, we have approved the plant” (Panel disagreed that plant is approved – a licensing application review/approval of the safety basis is required prior to receiving nuclear material at the plant site)

10. Overall, safety concerns from the NRC staff’s Revised Draft Safety Evaluation Report are not addressed – supporting information for the applicant’s assertions and prevailing staff opinion are non-existent or inadequate (Panel agreed and concluded the technical need to be resolved at the license application stage)

DPO Submitter Requests

1. Reverse management acceptance of applicant's safety related strategy for red oil events in closed systems
2. Reopen Issue CS-01 for red oil reactions
3. Applicant docket adequate justification for red oil in closed systems safety approach or NRC impose DOE/DNFSB accepted safety strategy

DPO Submitter Offered Remedies

1. Communicate risk significant safety concerns about functionality and operability of red oil controls to the applicant ASAP
2. Impose DOE/DNFSB RAGAGEP as a permit condition or amendment (Construction Authorization)
3. Inspect test program and results on a routine basis
4. Inspect red oil control strategy evolution (from system to component basis) during detailed design and construction

DPO Panel Recommendations

1. Construction Authorization should not be revisited
2. Staff should review Panel's Report (particularly attached CNWRA Report to Panel) for technical issues during license application review
3. Staff should ensure CNWRA reported technical insights are factored into the inspection program
4. Staff should review CNWRA hazard analysis for application during license application review



SAFETY CONCERNS: Mixed Oxide (MOX) Fuel Fabrication Facility – Red Oil Explosion Hazards NMSS OD Discussion

Alex Murray
NMSS/FCSS/SPB



Former Lead Chemical Safety Reviewer
for MOX

July 19th, 2007



Summary Of Red Oil Concern



- Open Item CS-01 in CAR review
 - High risk of explosion and high consequence
 - Applicant approach – not RAGAGEP, and no calcs, experience, or other supporting information
 - No consensus on controls - closed via Mgmt decision
 - ACRS agreement on issue – “technical basis not clear”
 - DPO submitted
 - Construction Permit issued anyway - no red oil requirement, condition, or action plan
- DPO Panel and Contractor Reports agree there is a safety issue (validates DPO), but limited actions
- Likely Unresolved Safety Question (USQ)
- Outrageous that Panel Report and OD decision recommend limited action on red oil safety issues



Note:

I am impartial – neither for nor against the proposed facility.



I am concerned red oil safety issues remain and need to be addressed more proactively and not deferred to a later stage.

Outline



- The Red Oil Issue
- FSER
- ACRS Conclusion/Letter
- CP – Construction Permit
- DPO and DPO Reports
- Prior OD Decision
- Recent developments and USQ
- Bottom line



Red Oil Issue

- Concern for all solvent extraction systems contacting nitric acid, particularly TBP
- Reactions occur continuously, faster at higher temperatures (exponential effect)
- Organics nitrate and can explosively decompose
- Phenomena not well understood
- Many incidents; five accidents
- Address via robust controls (RAGAGEP exists – DOE/DNFSB)

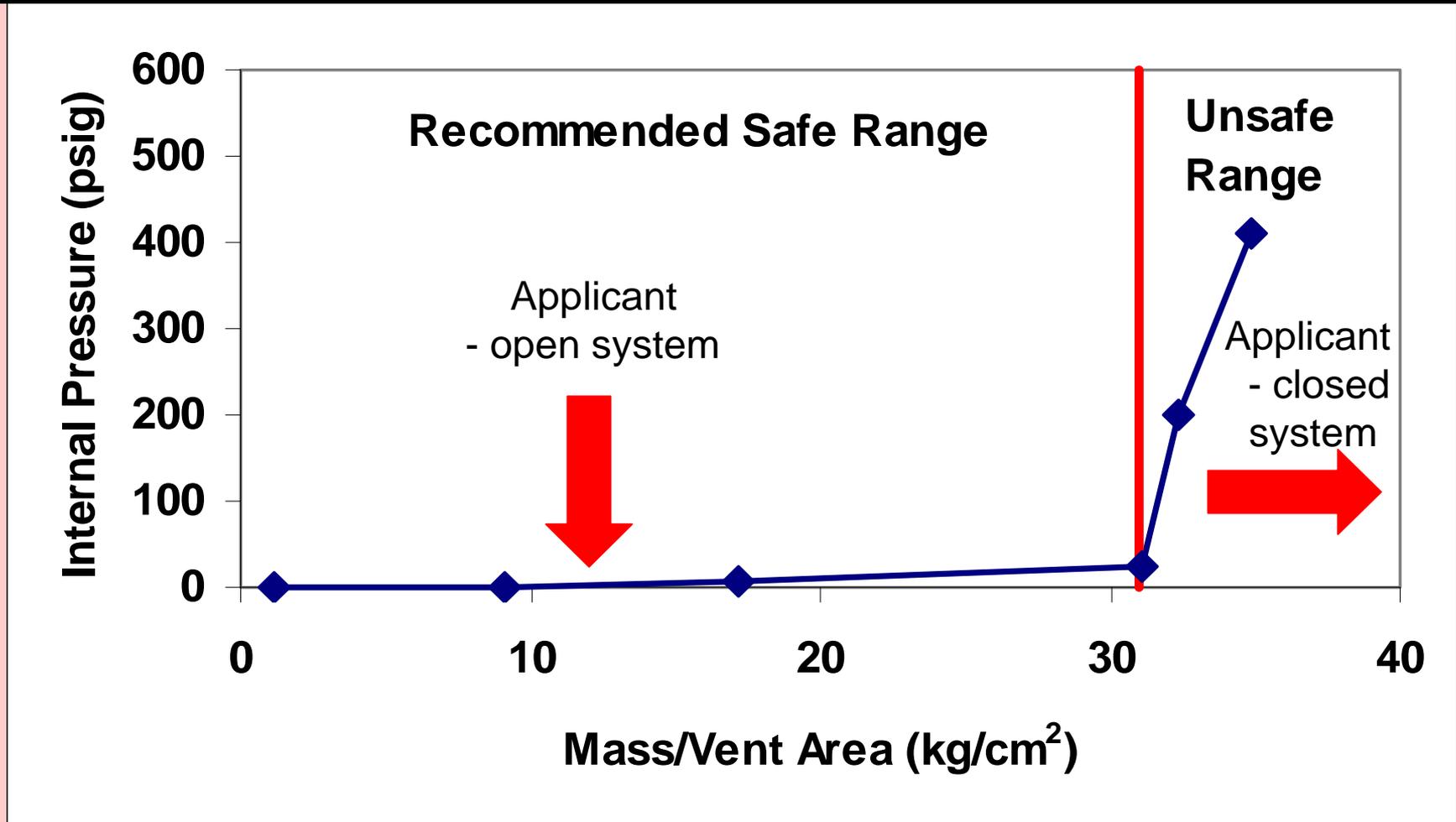
MOX Issue CS-01: Red Oil



- Nitrated TBP/organic compound mixtures
- Potential for significant damage and release of materials
- Applicant provided no supporting calculations, experience/history, logic – an assertion
- Applicant committed to testing – in CA FSER, not in License Application
- **Open Systems:**
 - Limited information provided by applicant
 - Acceptable because clearly agrees with DOE test data
- **Closed Systems:**
 - Limited information provided by applicant
 - Clearly contradicts DOE/DNFSB RAGAGEP
 - In range identified by DOE as “unsafe”
 - Commitment to unspecified testing



DOE RAGAGEP (IN NRC FSER): Pressure Vent Relationship

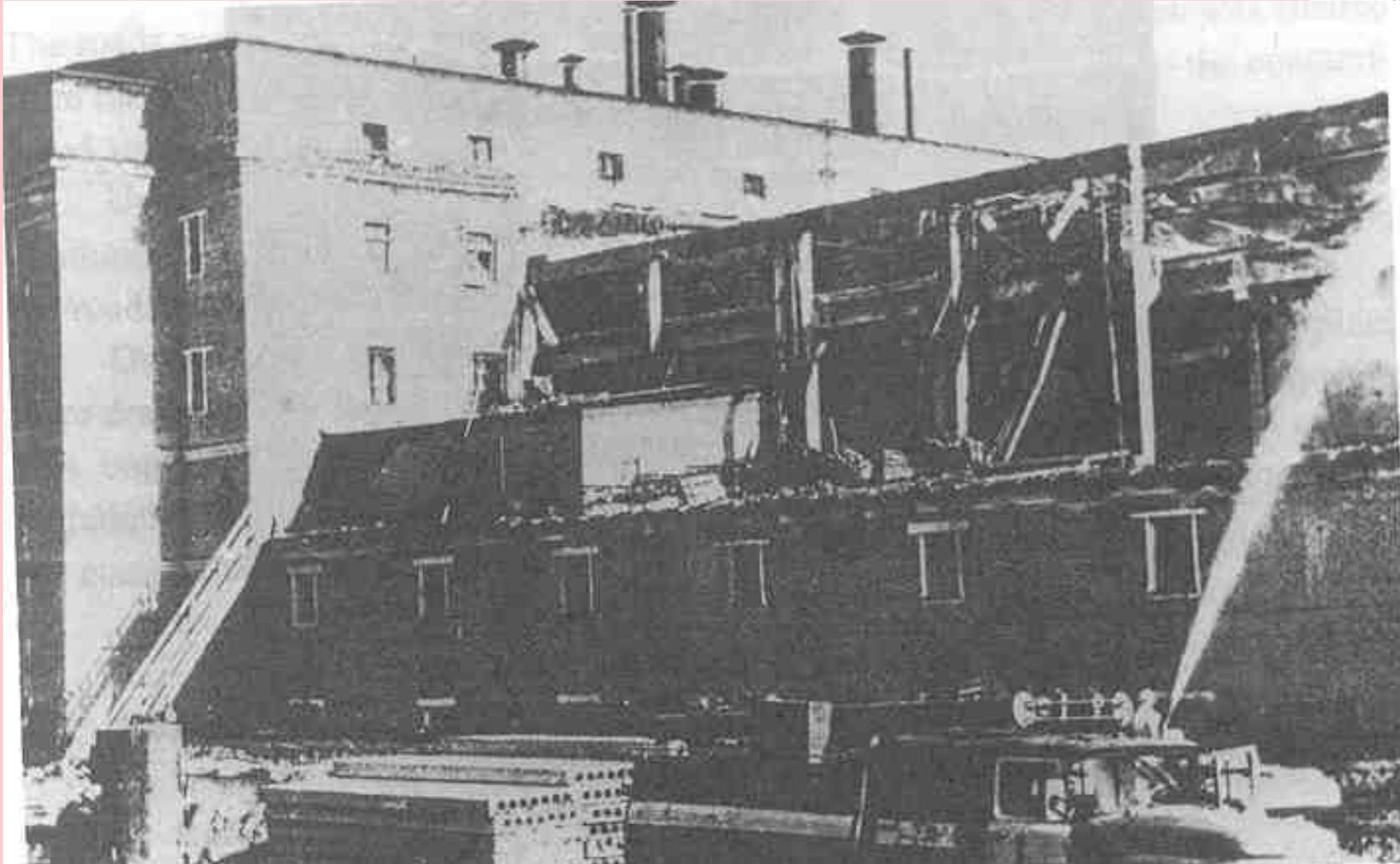




Explosive Incidents

- United States
 - Hanford 1953: Evaporator heated with low pressure steam (135 to 140 °C)
 - Savannah River 1953: Evaporator heated with low pressure steam (135 to 140 °C)
 - Savannah River 1975: Denitrator (> 150 °C)
- Tomsk-7 (1993)
 - Tank at a nominal temperature of 50 °C (Organic layer was estimated to start ~ 90 °C)
 - Two explosions – blew out canyon shield plug

Why I am concerned - Tomsk Red Oil Explosion



July 2007

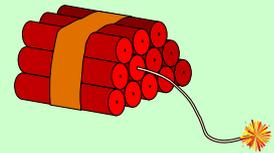
NMSS OD Meeting On Red Oil
DPO

10



My Conclusions:

- Approach for closed systems does not provide adequate assurances of safety:
 - No logic for contradicting RAGAGEP (T, vent, Mass, C)
 - Corresponds to 1 control parameter (Temperature)
 - Common mode failure – heat transfer and vent
 - Inadequate margin
 - Uncertainties not adequately considered
 - High aspect ratio design will likely result in higher pressures and temperatures, and phase separation
 - No assurance quench system and 125 C limit will prevent red oil reactions
- No assurance approach can meet Part 70 requirements for a Construction Permit



NUREG-1821 (March 2005): FSER On Red Oil



- Page 8-51: staff concludes “... sufficient DID provisions ...” including
 - Multiple, independent temperature controls
 - Aqueous phase evaporative cooling via vent
 - Exclusion of alicyclics
 - Commitment to additional research on temperature and impurity effects (i.e., confirmatory testing)
- Paragraph 3 very positive – “sufficient controls and margin” and “... beyond the safety requirements at DOE facilities ... French MOX facility.”
- Staff found approach acceptable

ACRS And ACRS Letter



- ACRS very critical of applicant's approach to red oil and staff review/acceptance
 - Saw no technical basis for closed systems
 - See 11/2003 and 12/2004 transcripts
- ACRS Letter (2/24/2005) recommended issuing CP and FSER but:
 - Identified issues that should be followed
 - Red oil – **“The applicant's technical basis for these conclusions [safety strategy] are not clear to us”**
- Recommended staff develop adequate confidence in the strategy for closed systems
- My assessment: ACRS wanted a CP condition and active tracking/following of the issue

CAMOX-001: Construction Permit (CP) NMSS Notice of Sig. Lic. Act. 3/24/2005



- CP Issued March 30th, 2005
 - Two conditions (ECR habitability and criticality)
 - No red oil conditions or FSER link; unclear if CAR link
- Notice - mentioned one DPO existed, on red oil
 - Stated other equipment existed
 - But no safety analysis/evaluation
- My assessment:
 - More than one DPO actually existed (four total)
 - CP statement represented staff designing for applicant
 - No information from applicant that stated other equipment could perform red oil safety function
 - Applicant had stated numerous times before other equipment could not be used for red oil safety functions
 - Breakdown of normal safety review process

DPO On Red Oil

DPO-2005-002



- Submitted January 14th, 2005
- Ten main concerns identified
- Inadequate design basis information and justification, margin, control etc. and significant differences with RAGAGEP (e.g., Slide 11)
- Requested re-opening issue and obtain information on the docket - or use permit (CP) conditions - and actively track and inspect the issue

DPO Panel Report On Red Oil (received March 5th, 2007)



- Cover letter downplays issue
 - No basis to change decision, general inaction
 - No mention of agreement/validating DPO issues
- Report found merit with the DPO concerns - **unanimity**, recommended:
 - Don't revisit permit – defer to LA stage
 - Staff should use Panel Report for issues in LA review
 - Staff should use Panel Report for inspection insights
 - Staff use CNWRA analysis for possible use in LA review
- DPO Panel/NMSS/FCSS interactions and FCSS/NMSS memo neither cited nor provided (i.e., non-independent DPO process)

DPO Panel And CNWRA/Contractor Reports



- All parties generally agree safety issues remain
 - I note prevailing staff opinion seems to have evolved to less acceptance of applicant's approach
 - Beyond confirmatory testing
- Very inflective phrasing, for example ...
 - **“Significant unanswered questions”**
 - **“Unclear technical bases”**
 - **“...unclear how the design bases will provide adequate protection”**
 - **“... safety margin ... not supported”**
 - **“... controls ... may not be available and reliable ...”**
- But only limited recommendations!

My Assessment

(March 19th, 2007 E-mail)



- Comments
 - Outrageous – USQ likely exists - why wait?
 - Conclusions of reports incompatible and inconsistent with findings of safety issues and inflective language
 - Design bases, margin etc. all CP (permit) issues
 - Panel implies concern with regulation, but no action
- Demanded:
 - **More proactive steps, tracking, RAI/DFI now**
 - **Make CNWRA report public (currently OOU – “a cover up”)**
 - **Make FCSS memo, everything else public**
 - **Panel report acknowledge submittal by LCSR**
 - **7 general and 23 specific comments on errors, misstatements, review process etc.**

Previous OD Decision (Received March 28th, 2007)



- Appeared rushed - no meeting with me nor consideration of my comments
- Letter states all "... concluded significant technical questions remain unanswered" but
 - No need to revisit CP (permit)
 - Staff should review Panel and CNWRA report for issues as part of LA process, and request applicant provide safety basis to support review
 - Document disposition of issues in LA SER (i.e., 3-4 years from now)
 - Ensure inspection program for construction and operation verifies design and operating features in SER as necessary to prevent or mitigate red oil runaway reactions
- My assessment:
 - This is **insufficiently proactive and timely** for a high consequence, not unlikely event with significant technical questions unanswered
 - **What do you inspect against?** It's more than confirmatory testing.

Some Recent Developments



- BNL Report BNL-MOX-2007-001
 - Identifies reliability concerns of red oil approach (unlikely to meet the regulation)
 - No analyses of design and safety bases
- New Employee E-mail on Red Oil
 - Red oil neither understood nor well defined
 - Red oil by other paths, lower temperatures, accumulation, localized heating, Pu acceleration
- Continuing DPO Process Breakdown
 - Management system gave new employee copy of red oil DPO (confirmed 6/8/2007)
 - Line management possession and distribution of DPO violates DPO process and independence

Red Oil Is A USQ – Unresolved Safety Question



- USQ means:
 - Consequence or probability could increase
 - Possibility of a different type of accident or accident sequence
 - Safety margin could be reduced
 - Documented safety analysis may be inadequate
- Panel, CNWRA, and BNL reports, new employee imply all four apply
- **Hence, it's a USQ.**



Bottom Line

- The event is **big, bad, and ugly**
- NRC now has consensus – **unanimity** - of significant unanswered questions – it's beyond confirmatory testing
- Many changes
 - Staff prevailing position
 - Applicant's LA strategy
 - CNWRA, BNL reports
 - Likely USQ
- Changes give the NRC opportunity to **proactively address** the issue now

Current MOX LA Review



- Focus of current Chemical Safety activities
 - Dechlorination process/hazards
 - Plutonium dissolution
- Nothing about other significant chemical safety issues from FSER, ACRS etc.
 - Red oil
 - HAN/hydrazine
 - Fire
 - Waste
 - Hazardous chemical releases

I don't mean to put you on the spot but ...



- Points from E-mail need to be addressed, particularly the proactive approach and public availability of all documents
- Assuming MOX continues, I want to be involved in their discussions, analyses, and resolutions
 - (I am currently largely excluded – gives the impression of retaliation for raising safety issues and DPOs)



Attachments

- FSER section on red oil
- ACRS letter
- NMSS notice of significant licensing action
- Construction permit
- March 19th and 28th E-mails on MOX Red Oil DPO
- April 30th E-mails