MFFFNPEm Resource

From: Alex Murray
Sent: Wednesday, December 12, 2007 3:45 PM
To: Frank Gillespie; Allen Croff; Michael Ryan
Subject: FYI - MOX Facility - Waste Management and DPV/DPO
Attachments: MOX-ACRS-2004-Safety-Concerns.ppt; MOX-DPO-Waste-Management.wpd

All,

Hi there and FYI, I just found out from a recent staff meeting the ACNW&M is holding a meeting next week that, among other issues, discusses waste management at the MOX facility under construction in South Carolina.

I was the Lead Chemical Safety Reviewer for MOX during the Construction Phase and I raised many concerns about waste management at MOX. These were largely dismissed by the management system. You may recall that I wrote a DPV/DPO on waste management at MOX which the management system refused to consider - I have attached a copy of the DPV/DPO, FYI.

I also discussed waste management at MOX in ACRS meetings, including the meeting in December 2004 at which one or two ACNW&M members also attended (the presentation is attached - waste is briefly mentioned towards the end of the presentation). Many of these waste management concerns were highlighted in the ACRS Letter to the Commission on MOX, in February 2005.

I have been directed by management to work on programs other than MOX. However, from a quick glance at the MOX license application, it is not clear if these waste management concerns are being adequately addressed.

Please contact me if you have any questions,

Alex.

Hearing Identifier: MixedOxideFuelFabricationFacility_NonPublic
Email Number: 17

Mail Envelope Properties (Alex.Murray@nrc.gov20071212154505)

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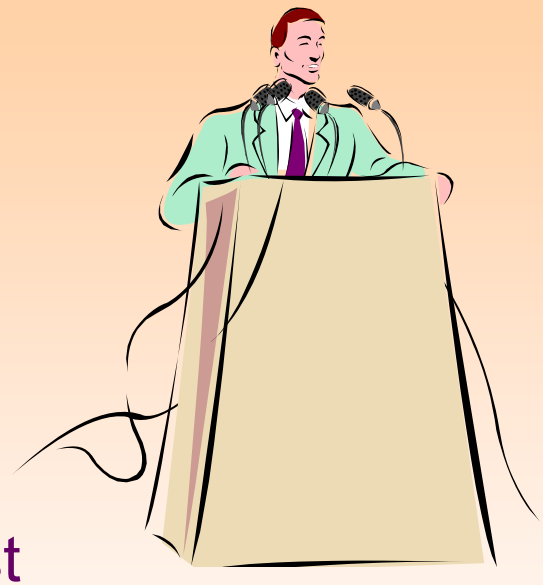
Safety Concerns and Differing Viewpoints and Opinions on MOX

Alex Murray
Lead Chemical Safety Reviewer
NMSS/FCSS/SPB/MOFLS

Overview

Provide feedback on:

- Safety Review Process
- Previously Open Items
- DPVs/DPOs



Note:

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

I am concerned some safety issues remain and need to be addressed now and not at the License Application stage.

Safety Review Process

Two Step Licensing:

- **Step 1:**
  - Construction Permit
  - Present
- **Step 2:**
  - Licensing – possession and use
  - Future (next year)
- Concern is the balance between the two and how much can be deferred and revisited later in the licensing stage, particularly for commitments

Safety Regulations

- Part 70.23(b): NRC approved when it has determined the DBs of the PSSCs, and QA plan, provide reasonable assurance of protection
- Part 70.61: Compliance with Performance requirements
- 70.64(a): Address the Baseline Design Criteria

Commitments are not mentioned

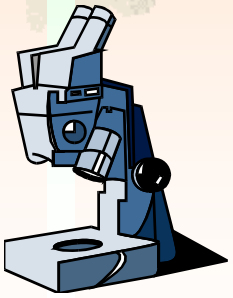
Safety Guidance

SRP:

- Chapter 8 for chemical safety
- Arranged for two-part licensing review
- Commitments may be acceptable

On MOX, accepted PSSCs and DBs that:

- In general, have less information than SRP mentions
- Are not RAGAGEP
- Rely on future efforts and experiments to define current PSSCs and DBs



RAGAGEP = Reasonable And Generally Accepted Good Engineering Practice

Diverse Viewpoints

Part of NRC strategic plan – safety and effectiveness goals

- Staff/management discussions
- Nonconcurrences
- Differing Professional Views and Opinions (DPVs and DPOs)

Some Observations

- A voting - not a consensus - process
- Nonconcurrences written – but not accessible by the public
- DPV/DPO only practical route to upper management and public
- Prevailing staff/management and MOX management often involved in DPV/DPO process – objectivity and independence unclear
- Unclear if staff have adequately followed QA and documentation needs

- A number of workshops are being conducted to address some of these issues

Public Comment

"The NRC needs to act as a regulator and conduct thorough safety reviews [of the MOX facility]"

(public comment during August 2002 public meeting on MOX, North Augusta, South Carolina)

Comments on Previous Open Items

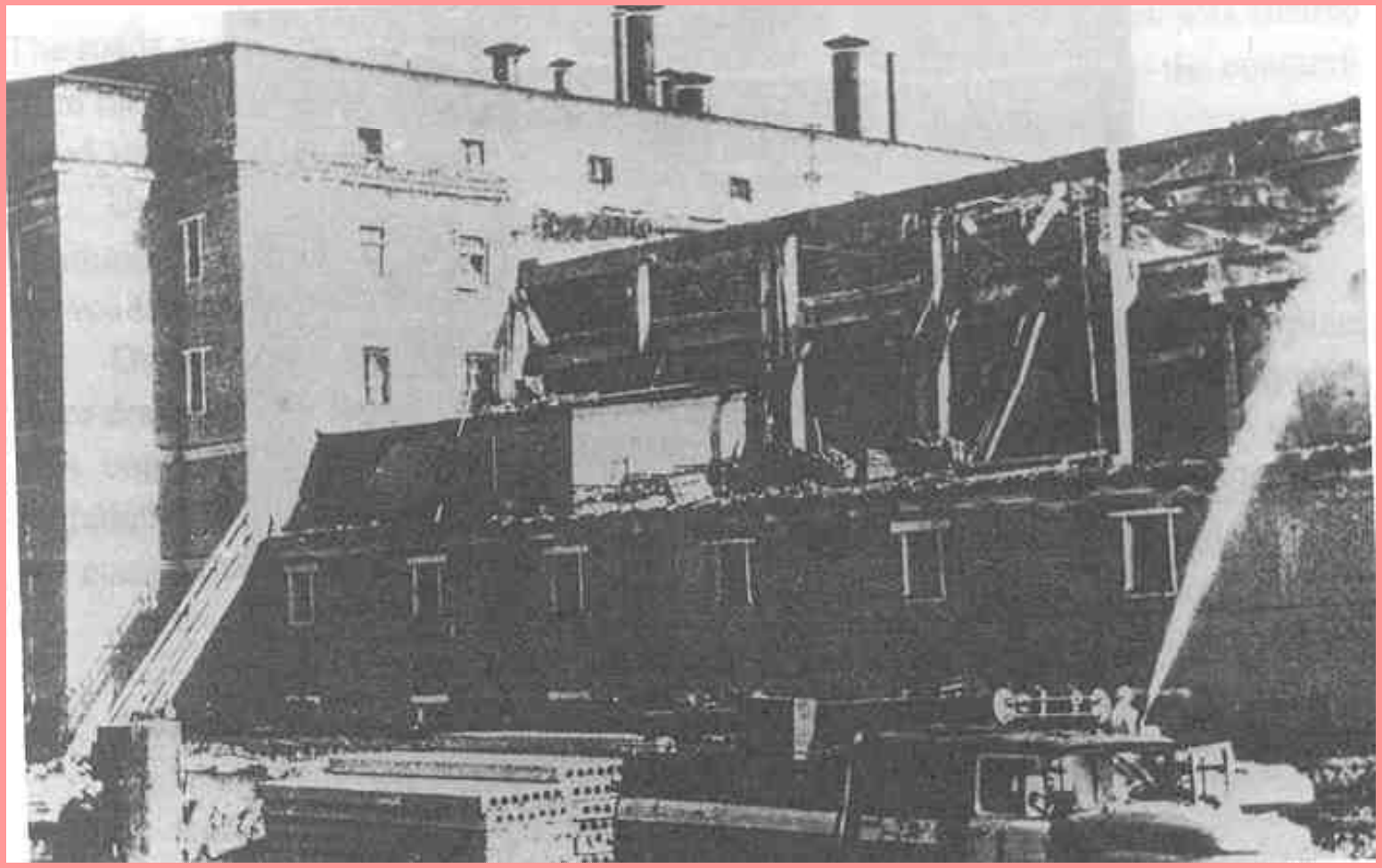
FSER Issues discussed earlier today and at November 2003 ACRS meeting

- CS-01: Red Oil
- CS-02: HAN/Hydrazine
- AP-03: Electrolyzer /Titanium Fire
- MP-01: Uranium Burnback
- CS-05b: Chemical Limits/TEELs
- CS-10: Control Room Habitability
- CS-09, AP-02, AP-08, and AP-09: Flammability

CS-01: Red Oil

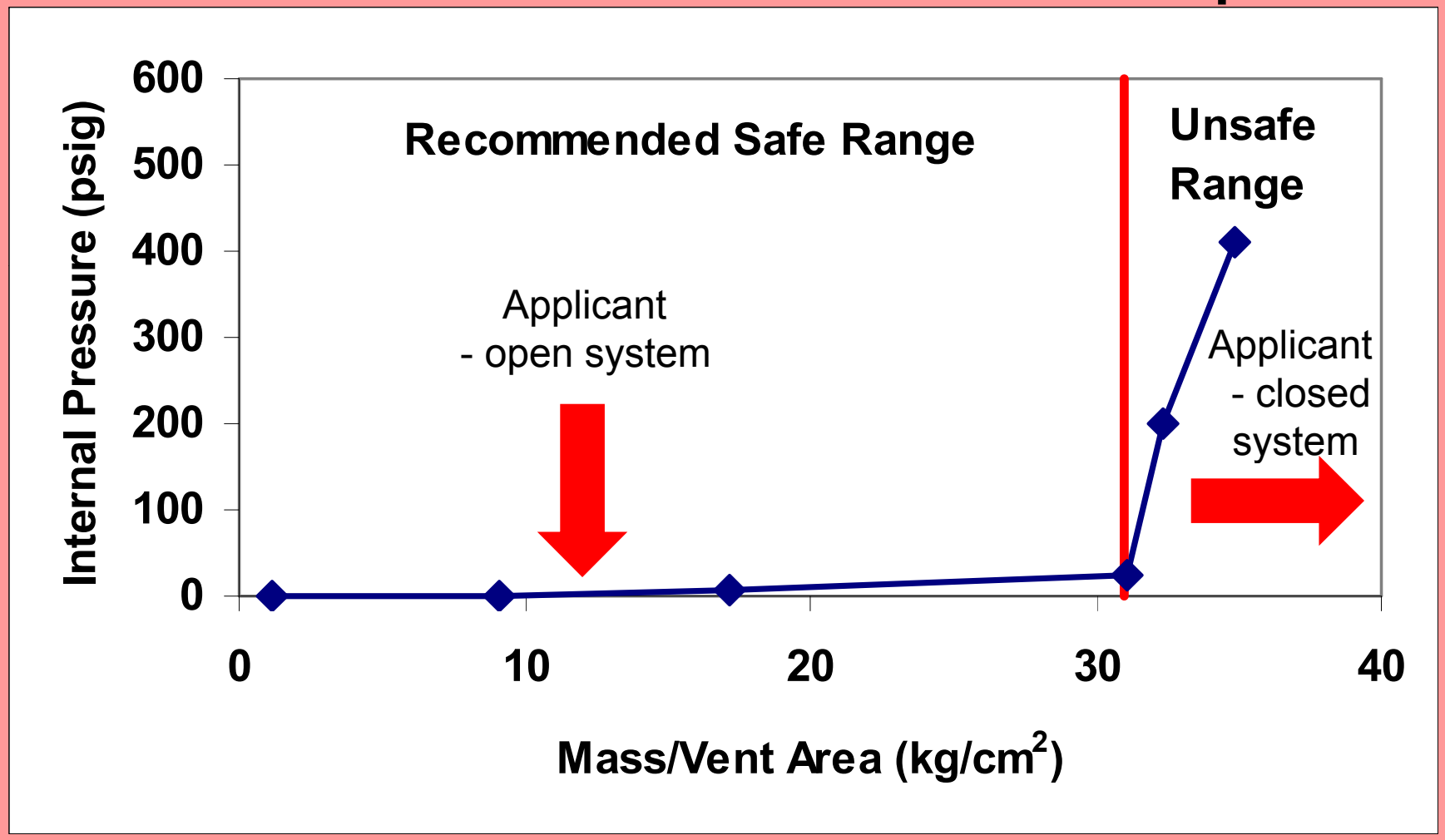
- Nitrated TBP/organic compound mixtures
- Potential for significant damage and release of materials
- Open Systems:
  - Limited information provided by applicant
  - Acceptable because clearly based on test data
- Closed Systems:
  - Limited information provided by applicant
  - Clearly contradicts DOE/DNFSB RAGAGEP
  - In range identified as “unsafe”

Why I am concerned - Tomsk Red Oil Explosion



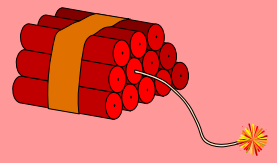
CS-01: Red Oil

Pressure Vent Relationship



My Conclusions:

- Approach for closed systems does not provide adequate assurances of safety:
  - Corresponds to 1 control parameter (T)
  - 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

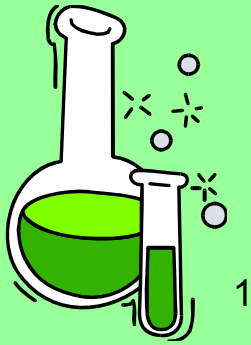


My Recommendation

- Impose DOE/DNFSB RAGAGEP as permit condition
- Give applicant the opportunity to provide assurances about their strategy in the license application

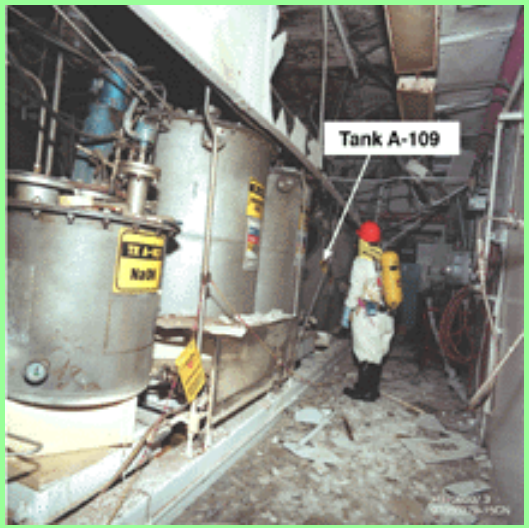
CS-02: HAN/Hydrazine

- Potential for rapid pressurization
- Two cases:
  - Case 1 – without NO_X
  - Case 2 – with NO_X addition
- Case 1 modeled as a system of PDEs to identify regions of stability and margin.



PRF Room Prior to Accident

Why I am concerned - PRF Accident Scene



My Conclusions

- Case 1: no NO_X
  - Have only checked the mathematics
  - NRC model/software guidance for making a safety decision not followed
  - Contradictory design bases with hydrazoic acid
- Case 2: with NO_X
  - Applicant removed flow control
  - Cited standards accommodate flow design not flow control
- No assurance of meeting Part 70 criteria for construction permit

Recommendation

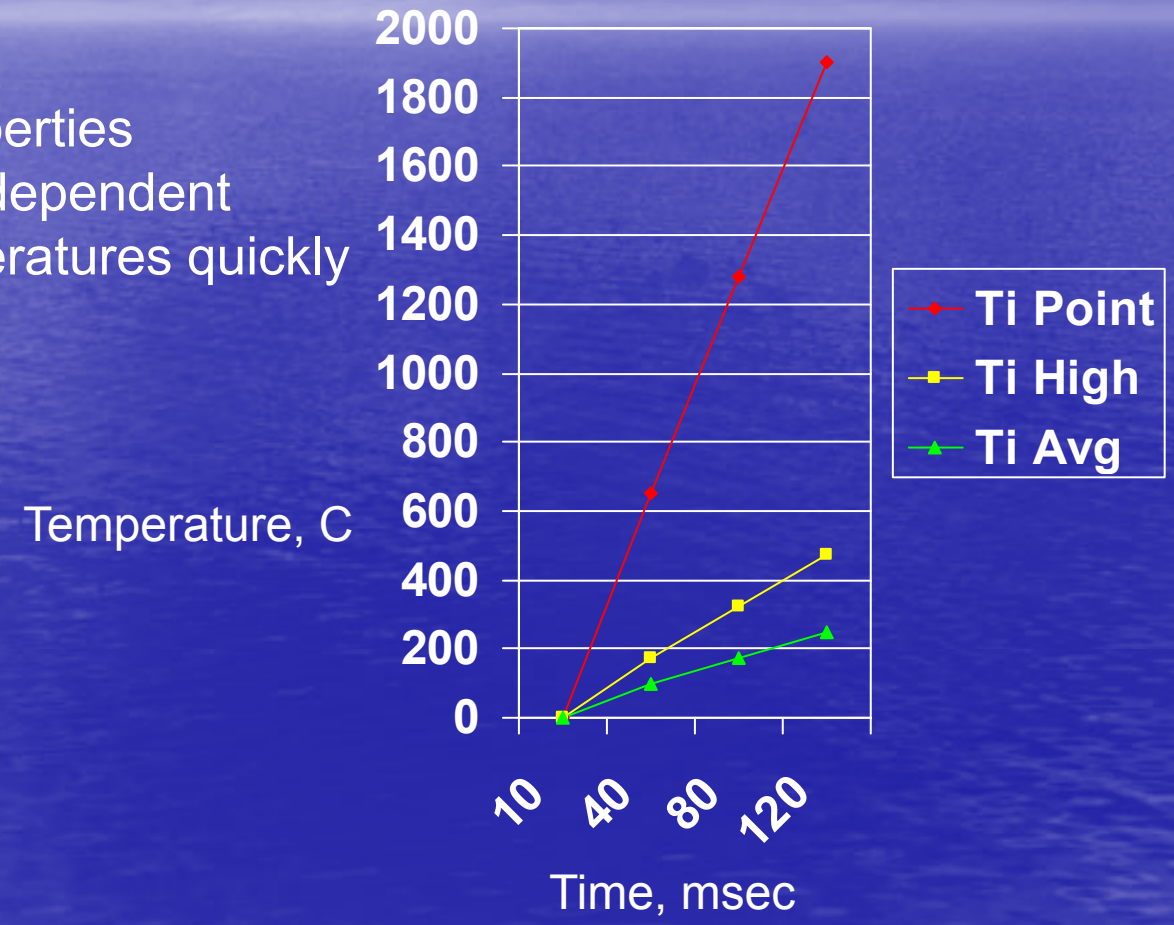
- Case 1: no NO_X
  - Have applicant commit to schedule to resolve DB conflict early after CAR/permit
- Case 2: with NO_X
  - Propose applicant's original flow control as permit condition
  - Give applicant the opportunity to provide assurances about their strategy in the license application

AP-03: Electrolyzer/ Titanium Issues

- Potential for titanium interactions and fires
- Applicant's strategy using RAGAGEPs
- Active and passive engineered controls (AECs and PECs)
- Active control terminates power, which removes the initiator for the event
- Find the approach of AECs and PECs meets Part 70 requirements

AP-03: Electrolyzer/Titanium Issues – Rapid Heating Possible

Assumed constant properties
Geometry and system dependent
Potential for high temperatures quickly



MP-01: UO_2 Burnback

- UO_2 Burnback reactions can damage HEPA filters directly or indirectly (igniting fibers/dust on the filters)
- Strong function of particle size
- Use of applicant UO_2 values produces higher loadings than staff calculations
  - Exceed threshold for one HEPA unit
  - 50-80% of threshold if distributed over C4 HEPAs
  - Contribution from other material on HEPAs not included

Burnback

- One or more features need to be identified as PSSCs and credited for safety
- Recommendation:
  - Propose permit condition that elevates intermediate HEPA filters to PSSCs for this event

CS-05b: Chemical Limits

Four Issues:

- Chemical releases – discussed as DPV/DPO later
- Modeling:
  - Dispersion Modeling – discussed as DPV/DPO
  - Phenomenological Modeling – addressed in FSER
- Chemical Limits – this discussion

Chemical Limit Concerns

- Findings from RDSER not addressed:
  - TEELs not independent, peer/public reviewed
  - TEELs not endorsed by a regulator
  - Certain TEEL values have increased substantially during review of the CAR
- Procedural Issues:
  - Policy decision – qualified staff not involved
  - Prior staff evaluations of limits not considered
  - Public not involved
  - Other regulators not consulted

Chemical Limit Concerns (cont.)

- Safety Issues not addressed:
  - Why are significantly higher values acceptable?
  - Why are values that frequently change acceptable?
  - What is appropriate for determining PSSCs and DBs?
- Recommendation: NRC needs a task force of qualified staff to address chemical limits

CS-10: Habitability

- Safety function of ECR HVAC is to maintain habitability
- Applicant's limits do not correspond to habitability
- Proposed permit condition applies habitability limits

Flammability Issues

- Applicant proposed NFPA 69 as design basis
- Applicant identified PSSCs for various areas
- Some PSSCs may not function as interlocks for NFPA 69 exception
- Staff has accepted NFPA 69 and expressed need for clear calculational basis for any exception with interlocks, for the license application

DPVs/DPOs

- 5 DPVs filed
- MD 10.159 DPV/DPO process changed in May 2004
- 2 DPVs went through full process
- 2 Management appointed panels agreed essentially 100% with the DPVs
- Actions and response did not address safety issues
- Both pursued as DPOs

DPV/DPO Process Changed

- Process has DPO and DPO Appeal, no DPV
- Authority delegated to NMSS for DPOs on MOX
- NMSS has signature authority for MOX
- Consolidation of MOX issues mentioned

DPV/DPO on Chemical Consequences

- DPV expressed concerns about chemical releases regulated by NRC
- Applicant has stated:
  - Not unlikely event
  - Radiation dose received (10s of mrem to 5-10 rem)
  - Not regulated because below 70.61
- Event has the potential for multiple fatalities, perhaps all operators outside the ECRs

NRC Assessment

- Management/staff
  - 1,500 mg/m^3 at 100 meters for N_2O_4 (in EIS)
  - "Immediately lethal"
- My assessment:
  - Estimated concentrations could be higher
  - Facility design exacerbates hazard
  - Safe havens not PSSCs
  - Unlikely operators could reach safe havens or exits

N_2O_4 Release Example

DPV Panel Findings

- DPV Panel agreed essentially 100%
  - Recommended the issue be re-opened or a new open issue established
  - Also recommended more guidance and review of safety evaluation process
- NRC Office/Division not in alignment with Panel report and decided:
  - Enough information on the docket, no need for the open item
  - Some guidance provided
- Review of safety evaluation process resulted in a chilling effect

Draft DPO Report

- No further action needed as safety issue is addressed
- Applicant has made blanket commitments without exception to:
  - Codes and standards with habitability requirements
  - 70.64 BDC for chemical safety – habitability implied as part of BDC
- Therefore, applicant is required to maintain habitability in all structures at the proposed facility

Summary of DPV/DPO on Chemical Modeling (I)

- Multiple codes available for dispersion and consequence estimation
- Applicant initially selected ARCON96, MACCS2, and ALOHA codes
- Applicant subsequently used only ARCON96 code

ARCON96 (coincidentally) produces lowest consequence results

Summary of DPV/DPO on Chemical Modeling (II)

- Applicant provided input meteorology info
- No verification and validation info provided
- No QA/qualification info provided

Fundamentally, no data
On docket to support
Site specific safety code
Use at SRS MOX site

Summary of DPV/DPO on Chemical Modeling (III)

Authored DPV/DPO because:

- Matter closed – no reconsideration by local mgmt
- Safety significant:
  - potentially underestimate consequences by 1-2 orders of magnitude
  - Safety controls may be unidentified
- Submitted December 2002

Model/Data Comparisons (I)

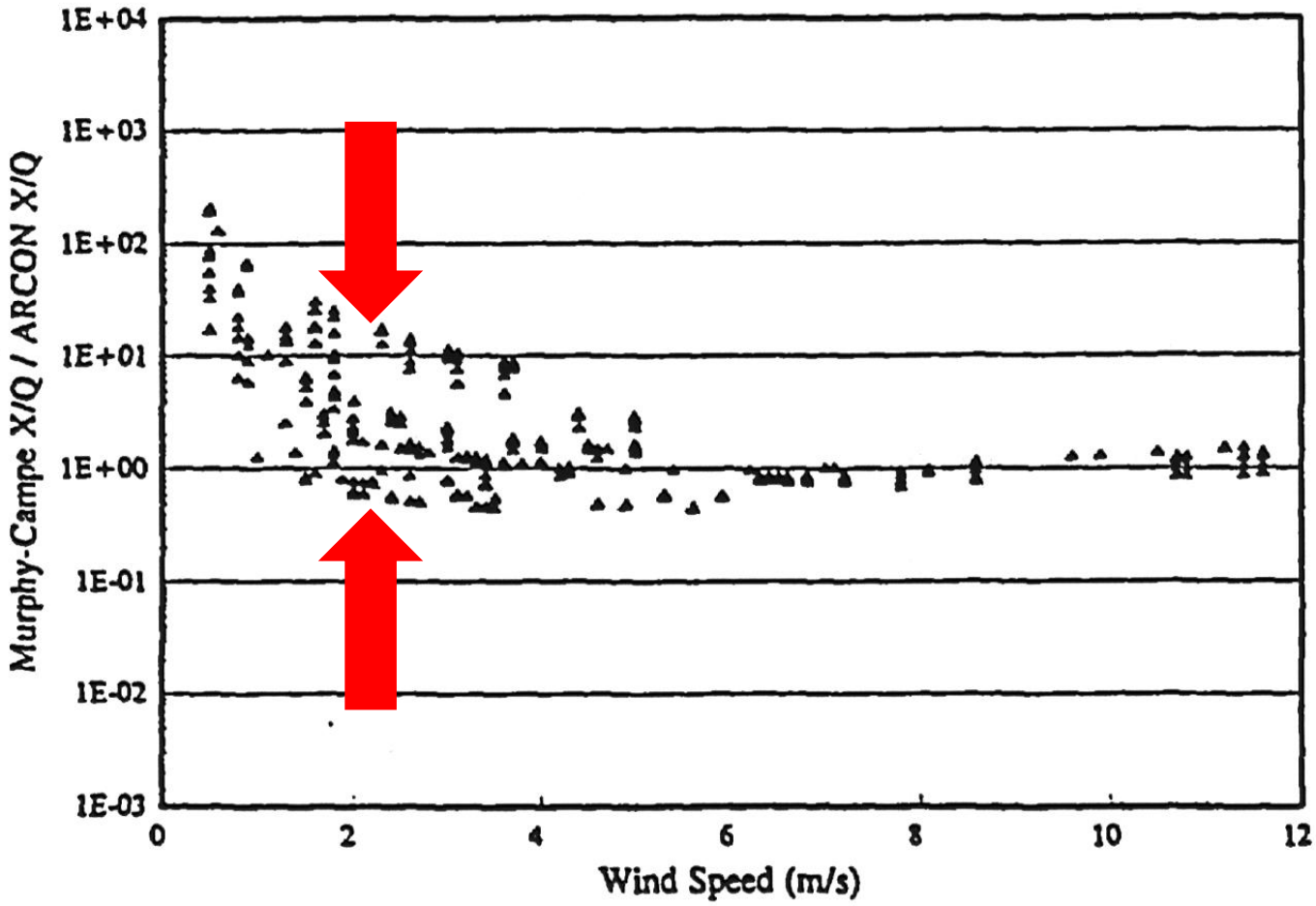


Figure 27 Murphy-Campe / ARCON concentration ratios by wind speed
(based upon data from 7 reactor sites in NUREG/CR-6331 on ARCON96)

- **Applicant Using SRS Wind speed Of 2.2 m/sec**
- **Which value to use?**

Model/Data Comparisons (II)

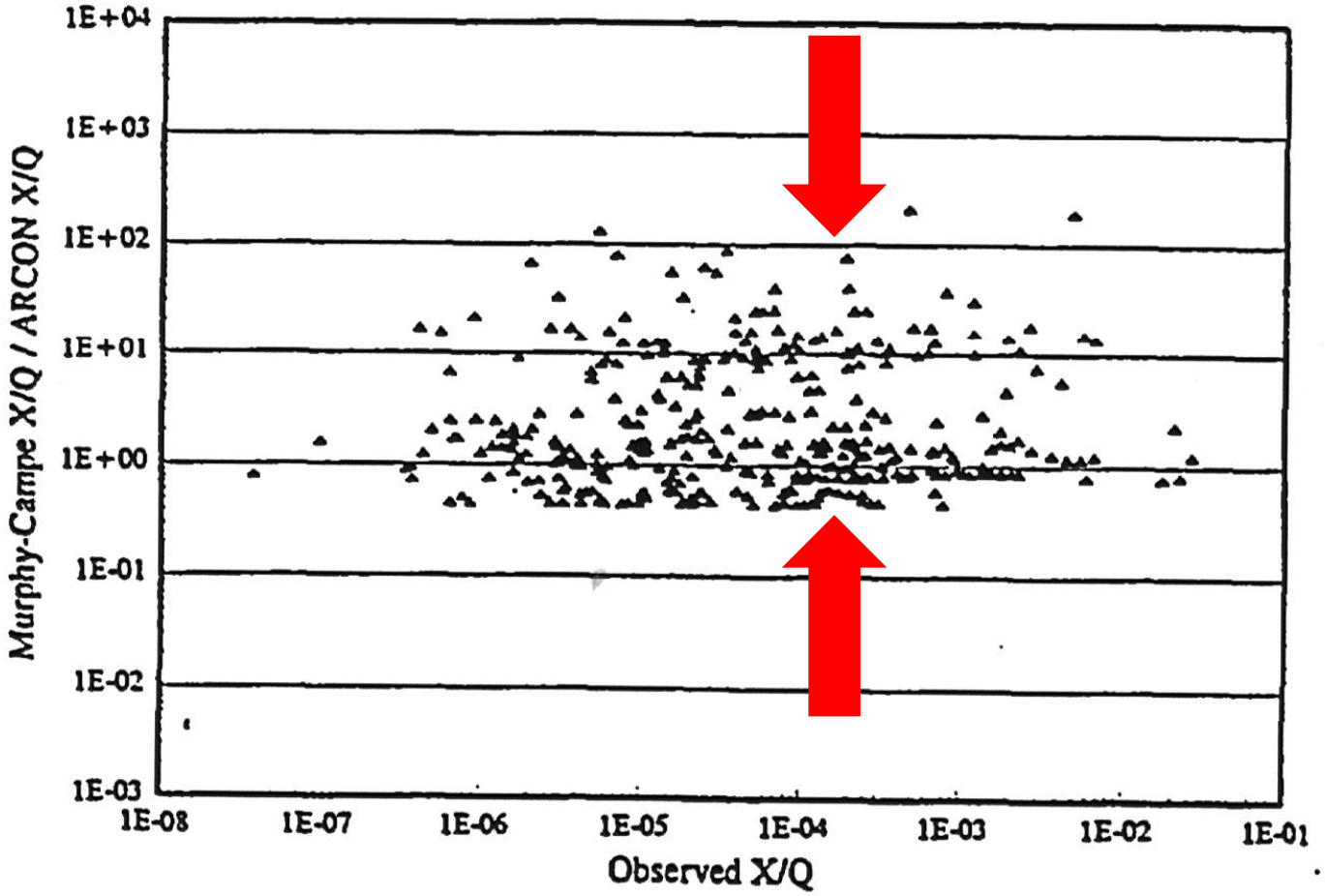


Figure 28 Murphy-Campe / ARCON concentration ratios by observed concentration

(based upon data from 7 reactor sites in NUREG/CR-6331 on ARCON96)

Applicant Using Circa 3E-4

Which value to use?

DPV Panel Findings

Essentially agreed with DPV:

- Panel noted generic use of ARCON96 OK
  - **but** site specific application for MOX not verified/validated against site test data
- NRC guidance on software not followed
- Staff guidance on code selection and user needs

Office/Division Responses

<u>On DPV/DPO Appeal, not in alignment with DPV Panel Report:</u>

- Docketed information available
- MDs and NUREG/BR-0167 (Software QA Guidance) not useful
- Sufficient staff guidance available
- RES user-need memo for development/application of scientific codes

DPO Appeal

Three Main Points:

- Information cited is not V&V
- No adequate QA on applicant's code
- Safety issues remain

Received DPO Report Monday (12/13), from a quick review:

- DPO appeal denied
- Implies V&V for site-specific application not needed

DPV on Waste Management Concerns

- Safety issues refer to premature closure of Open Items AP-05 and AP-06. Applicant should:
  - Confirm MFFF wastes are treated to meet SRS WACs and will be accepted
  - Identify PSSCs and DBs for the waste unit, such as an inventory limit DB and shutdown requirement
- Clearly within NRC regulatory authority

Waste DPV

NRC:

- Delayed the DPV for about a year
- Denied the DPV – waste is under DOE jurisdiction

Subsequently:

- NTEU filed a grievance on the process
- I requested the ACRS/ACNW review the DPV and the safety issues

DPVs on Chemical Limits and Flammability

<u>NRC:</u>

- Delayed the DPV for about 10 months
- Asked for resubmission

<u>Subsequently:</u>

- NTEU filed a grievance on the process

Summary

- Process and specific safety concerns
- Potential for more DPOs
- We – NRC, applicant, and DOE - need to do a good job and address these issues

MEMORANDUM
MAY 5, 2003

TO: Martin J. Virgilio, Director
Office of Nuclear Material Safety and Safeguards

FROM: Alexander P. Murray, Senior Chemical Process Engineer
Special Projects Section
Special Projects and Inspection Branch
Division of Fuel Cycle Safety and Safeguards

SUBJECT: AUTHORIZATION FOR PUBLIC RELEASE -
DIFFERING PROFESSIONAL VIEW ON WASTE MANAGEMENT AT THE PROPOSED MIXED OXIDE (MOX) FUEL FABRICATION FACILITY
DOCKET NUMBER: 070-03098

I hereby request that the U.S. Nuclear Regulatory Commission make available to the public my Differing Professional View, dated May 5th, 2003, on the above subject, and that the agency make public my identity as the author.

MEMORANDUM
MAY 5, 2003

TO: Martin J. Virgilio, Director
Office of Nuclear Material Safety and Safeguards

FROM: Alexander P. Murray, Senior Chemical Process Engineer
Special Projects Section
Special Projects and Inspection Branch
Division of Fuel Cycle Safety and Safeguards

SUBJECT: DIFFERING PROFESSIONAL VIEW ON WASTE MANAGEMENT AT THE PROPOSED MIXED OXIDE (MOX) FUEL FABRICATION FACILITY
DOCKET NUMBER: 070-03098

Attached is the subject Differing Professional View (DPV). In summary, the DPV discusses concerns regarding the adequacy of information used to close waste management issues in the NRC staff's review of the Construction Authorization Request (CAR) for the MOX facility. In summary, the applicant has asserted waste will go to the U.S. Department of Energy (DOE) and it is not an issue for the review. The prevailing management/staff position accepts this assertion. I conclude this is too simple an interpretation that contradicts the regulations, prior NRC precedence, NRC Standard Review Plans (SRPs), DOE's experience with waste management, and the simple fact that the waste management facility and its waste acceptance criteria do not currently exist. Consequently, waste related safety issues may not be adequately addressed at the proposed MOX facility. In addition, the burden of proof has not been placed on the applicant.

I request that (1) the management/staff decision accepting the applicant's position on these waste management events be reversed; (2) the applicant is requested to submit a strategy, with safety controls identified as needed, for directly addressing waste processing, waste acceptance by DOE, and potential waste-related events; and (3) NMSS establish consistent guidance for addressing waste issues during licensing of facilities, particularly when a third party or an agency (such as the U.S. DOE) is significantly involved and alternatives are limited or non-existent. This is particularly applicable when there are many uncertainties in plant design and the programmatic approach, such as with the proposed MOX facility or future enrichment facilities. Such guidance could be in the form of a Branch Technical Position (from the Fuel Cycle Facilities Branch) or a separate guidance document (say, a NUREG document).

I request that the DPV panel allows me the opportunity to clarify my views and provide additional information on this complex and important subject, as discussed in NRC Handbook 10.159. Also, per Handbook 10.159, I propose Walt Schwink as a qualified individual who can serve on a review panel for this DPV. Finally, I will continue to monitor the emphasis on the schedule and the issue closure process.

DIFFERING PROFESSIONAL VIEW ON
WASTE MANAGEMENT AT THE

PROPOSED MIXED OXIDE (MOX) FUEL FABRICATION FACILITY
DOCKET NUMBER: 070-03098

1. Summary:

Prevailing NMSS Staff/Management Position: On the MOX Construction Authorization Request (CAR), management and some staff members have accepted the applicant's position on waste management, namely that the waste will go to a planned facility at the DOE Savannah River Site (SRS), for which a design and waste acceptance criteria have not been finalized. While DOE is the agency funding the program and there is a top-level contractual requirement for DOE acceptance of the waste, there are no assurances that waste management attributes will be satisfactorily addressed in an expedient and safe manner. This approach is unusual and is different from the NRC's usual approach of requiring waste management and disposition issues to be adequately addressed early in the licensing process. In addition, the burden of proof for adequate waste management has not been placed on the applicant. Finally, DOE has an uneven experience with waste management, and the simple fact is the waste management facility and its waste acceptance criteria do not currently exist.

DPV Position: (1) the management/staff decision accepting the applicant's position on these waste management events be reversed; (2) the applicant is requested to submit a strategy, with waste acceptance criteria (WACs - or reference a clear design and planned facility capability) and safety controls identified as needed, for addressing waste processing and potential waste-related events; and (3) NMSS establish consistent guidance for addressing waste issues during licensing of facilities, particularly when a third party or an agency (such as the U.S. Department of Energy - DOE) is significantly involved and alternatives are limited or non-existent. This is particularly applicable when there are many uncertainties in plant design and the programmatic approach, such as with the proposed MOX facility or future enrichment facilities (e.g., depleted uranium - DU). Such guidance could be in the form of a Branch Technical Position (from the Fuel Cycle Facilities Branch) or a separate guidance document (say, a NUREG document).

Significance: If the prevailing management position is not reversed, a facility could be licensed for which the waste management requirements are not identified or, ultimately, there is a mismatch requiring backfits. Either impact safety. Furthermore, if there is a mismatch between the constructed MOX facility and the waste processing facilities, additional treatment capability may be necessary at the MOX facility, which may increase potential hazards and the need for safety-related components. This could also require delays in the commissioning of the facility or interruptions in operations, which would negatively impact international agreements on the disposition of weapons grade plutonium. Ultimately, costs would increase. This would negatively impact the NRC strategic goals of maintaining safety, improving regulatory effectiveness, and increasing public confidence. The potential news impact of waste mismanagement would be extremely critical of the NRC and could result in increased Congressional oversight. It is worthwhile noting that the cost (schedule, backfits, funding, delayed agreements etc.) of doing the waste management approach properly now are likely to be significantly lower than ameliorating the situation later.

2. The NRC, Facility Waste Management, and the Regulations:

The NRC is the lead regulatory agency at its licensee facilities. For the proposed MOX facility, the principal governing regulation is 10 CFR Part 70:

- Part 70.22 lists the requirements for the contents of applications. 70.22(a)(7) mentions a description of equipment and facilities which will be used by the applicant to protect health and minimize danger to life or property, including devices for the disposal of radioactive effluents and wastes.

- Part 70.23(a)(3) mentions that a license application will be approved if the NRC determines that the applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property. Inclusion of waste management and devices is implied.

- 70.23(b) contains a general safety statement: *"The Commission will approve construction of the principal structures, systems, and components of a plutonium processing and fuel fabrication plant ... 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."* Waste-related activities are not mentioned.

- 70.61 presents the performance requirements required of all new Part 70 facilities. Radiological and chemical consequence criteria, and likelihoods, are identified. No waste specific requirements are mentioned.

- Part 70.62(c) (iii) further elaborates that the ISA (Integrated Safety Analysis) should identify facility hazards that could affect the safety of licensed materials and thus present an increased radiological risk. Waste is not mentioned.

- Part 70.65 lists other material to be included in an application and mentions that a description of each process must be contained within the ISA. Waste-related operations are not specified.

In addition, the Atomic Energy Act (AEA) also contains general clauses "... to protect the health and safety of the public" (Section 2, paragraphs (d) and (e)). Section 161(b) states in part, "... to protect health or to minimize danger to life or property." Section 182(a) contains a similar statement. Again, waste-related issues are not explicitly mentioned but are inferred.

3. Overview of Waste Management Related Documents and Events:

3.1 MOX Construction Authorization Request (CAR - DCS-NRC-000038; February 2001):

The applicant submitted the CAR on February 21, 2001. MOX refers to Mixed uranium-plutonium OXide fuel that can be used in existing commercial nuclear reactors. MOX can either refer to the fuel itself or the MOX Fuel Fabrication Facility (MFFF). This is a facility that would be built and operated by a private contractor at the DOE Savannah River Site to manufacture MOX fuel, under NRC regulatory authority. The applicant is following a two-step licensing approach - the construction authorization request (CAR) has been received by the NRC and is undergoing review. A separate, possession and use license will be submitted by the applicant at a later time. As regards waste management, the CAR identified a liquid waste treatment unit but provided little information about it.

3.2 Request for Additional Information (RAIs) and RAI Responses (September 2001):

In response to NRC RAI Number 143, the applicant provided information in September 2001 on the liquid waste unit that included a flow diagram and quantities of waste streams. No information on WAC and DOE/SRS acceptance, and PSSCs and design bases were provided for the waste unit.

3.3 NRC Staff Analyses in the Draft Safety Evaluation Report (DSER) - April 2002:

The staff analyses and conclusions are summarized in Section 11.2.1.12 of the staff's Draft Safety Evaluation Report (DSER, NRC, April 2002). This noted the applicant's approach that included waste sampling, compliance with the SRS WACs, and applicant-SRS communications links. The DSER identified two open items related to waste:

- Confirm that the wastes generated (based upon program redirection) will conform to the SRS WACs and that SRS will accept these wastes. Identify any PSSCs and design bases for the waste unit, such as maximum inventories. (AP-05)

- The applicant identified the high alpha waste system as an IROFS. The staff found the applicant should identify design basis safety functions and values for this unit. (AP-06)

Note that this approach started to address regulatory requirements for and staff concerns about waste management.

3.4 Waste Management in the Revised Construction Application Request (RCAR) - October 2002:

The applicant redacted all previous information on waste management. The information in the RCAR provides the following, brief summary.

The Liquid Waste Reception Unit receives liquid waste from the AP process for temporary storage before sending it to SRS for treatment and processing (revised CAR Sections 11.3.2.14 and 10.1.4). The functions of this unit are to treat the following liquid waste streams:

- The low level liquid waste stream, which is comprised of the following: (1) room HVAC condensate, rinse water from laboratories, and washing water from sanitaries which are potentially non-contaminated and are collected as low-low-level liquid waste; (2) the distillate stream from the acid recovery unit which is contaminated and slightly acidic; (3) miscellaneous floor washes from C2/C3 rooms and overflows or drip tray material from some of the reagent tanks in the AP building; and (4) the chloride stream from the scrubbers used during the dechlorination step for AFS feeds (i.e., from the Dechlorination and Dissolution Unit). A double-walled pipe with leak detection is used for transfer to the SRS.

- The high alpha waste stream is a combination of three waste streams: americium, alkaline waste, and excess acid. The americium stream collects americium and gallium nitrates, and all of the silver used in the dissolution unit, along with traces of plutonium. The alkaline waste stream from the solvent recovery area contains dilute caustic soda (NaOH), sodium carbonate, sodium azide, and traces of uranium and plutonium. The excess acid stream from the acid recovery unit contains high alpha activity excess acid. The high alpha storage tank along with the high alpha buffer storage tank are a holding point for high alpha wastes and provide 90 days of storage. It is transferred to the SRS in batches via a dedicated, double-walled stainless steel pipes provided with leak detection.

- The stripped uranium (< 1% U-235) waste stream receives the contents of the uranium dilution tanks in the purification cycle. It is also transferred to the SRS in batches via a dedicated, double-walled stainless steel pipes provided with leak detection.

- The excess solvent/organic liquid waste stream receives the organic waste from the solvent recovery unit. The slightly contaminated solvent is anticipated to be a low-level waste (LLW). This waste is stored in a 300 gallon carboy or other suitable vessel and transferred by truck to the SRS for disposition.

Table 1 provides a summary of the waste streams and quantities.

Table 1: Waste Stream Descriptions and Quantities in the Waste Reception Unit

Waste Stream Designation	Annual Volume, gallons	Main Chemical or Isotope	Disposition, gallon
Liquid Americium Stream (concentrated stream from acid recovery)	10,000 (16,520 max)	Am-241: <24.5 kg/yr (84,000 Ci) Pu: <205 g/yr Hydrogen ions: 180,000 moles/yr Nitrate salts: 1,500 kg/yr from silver nitrate Silver: < 300 kg/yr Trace quantities of thallium, lead, and mercury	**High Alpha Waste to DOE WSB** 14,301 gallons 21,841 gallons (max.)
Excess Acid Stream	1,321 2,378 (max.)	Am: < 14 mg/yr (rectification step after two evaporation steps) Hydrogen ions: 13.6 N	
Alkaline Stream	2,980 4,000 (max.)	Pu: < 16 g/yr U: < 13 g/yr Na: < 147 kg/yr	
Stripped Uranium Stream	42,530 46,000 (max.)	Pu: < 0.1 mg/yr U: < 5,000 kg/yr (1% assay) Hydrogen ions: 26,000 moles/yr	**Stripped Uranium to DOE WSB** 42,530 gallons 46,000 (max.)
Excess Low-Level radioactive solvent wastes	2,700 3,075 (max.)	Solvent: 30% TBP in dodecane Pu: < 17.2 mg/yr	**LLW Solvent to DOE/SRS Solvent Recovery** 2,700 gallons 3,075 gallons max.
Distillate Waste	109,000 111,000 (max.)	Am-241: < 0.85 mg/yr Activity: 1.12E8 Bq/yr Hydrogen ions: <6,240 moles/yr	**Liquid LLW to DOE/SRS ETF** 338,230 385,800 (max.)
Chloride Removal Waste	46,230 76,000 (max.)	Only when processing AFS materials: < 0.75 g/l (will be diluted to < 0.15 g/l to meet ETF WAC).	
Rinsing Water	158,000 173,800 (max.)	Alpha activity: < 4 Bq/l	
Internal HVAC Condensate	25,000 (max.)	Trace contamination	

In revised CAR Section 10.1.4, the applicant discusses waste minimization and waste management. Liquid and solid wastes produced at the proposed facility will be transferred to the SRS for processing and disposal. DCS indicates it has worked closely with SRS during the MFFF design phase and has provided SRS with waste characterization information. DCS

states the SRS has reviewed and evaluated the information in the context of the existing Waste Acceptance Criteria (WACs). DCS is committed to meeting the SRS WAC or providing a stream that qualifies for a WAC Deviation and Exemption. The MFFF waste streams meet the SRS WAC except for the chloride stream. DCS states that, based upon an evaluation by SRS, the chloride concentration is sufficiently close to the WAC that a WAC Deviation and Exemption for the SRS Effluent Treatment Facility (ETF) will be issued. The WAC for the SRS Waste Solidification Building (WSB) has not been issued, but the applicant states the interface between them and SRS will ensure that the WSB is designed to manage the MFFF high alpha waste stream and the depleted uranium stream.

The applicant states sodium nitrite is added to the alkaline waste stream to destroy any azides. Also, the alkaline waste stream will be acidified in a separate neutralization tank prior to being mixed with the diluted uranium nitrate in the high alpha waste tanks. Nitrite addition, neutralization and acidification are performed to eliminate the potential for an explosion from azide formation that may form under alkaline conditions. In acidic media, the azides have a solubility limit greater than their concentration. Since the solubility limits of azides in alkaline media are lower, the alkaline media is neutralized to increase the solubility limits. This ensures that the azides do not precipitate and create an explosion potential.

The applicant has identified the High Alpha Activity and Stripped Uranium waste transfer lines as PSSCs (RCAR Sections 5.5.2.3.6.5 and 10.5.2). These are double walled stainless steel pipes seismically qualified and designed with leak detection. The lines will be designed to accommodate mechanical and seismic loads. For load handling events, the safety strategy relies upon prevention. The PSSCs are the waste transfer lines. The safety function is to protect the lines from activities taking place outside the MFFF building. For external events (e.g., external fires, explosions, extreme winds, tornadoes, missiles, rain, and snow/ice loadings), the safety function is to prevent damage to the line. The design basis for both functions is ASME B31.3 for process piping. ASME B31.3 is a section of the code that requires consideration of loads in the design of piping.

An explicit inventory limit is not specified. Currently, the facility is designed to accommodate up to 90 days equivalent of most waste solutions (e.g., of the values in Table 1; the storage of the LLW destined for the ETF will likely be less than 90 days equivalent), although the applicant anticipates there will be transfers of liquid wastes every two weeks. The applicant has indicated the facility will shut down before exceeding the liquid waste storage capacity. This is interpreted to mean active waste generating operations would be curtailed at some setpoint before the tankage is completely full, until the potential backlog of waste at the MFFF is cleared. Actual setpoints would be defined at the ISA stage.

In revised CAR Table 5.5-3a, the applicant shows Unit KWD (liquid waste) tank inventories for americium (Am-241) of 15.9 kg, 2.35 kg, 4.06 kg and 4.06 kg, for TK4020, TK4030, TK4040, and TK4050, respectively. This is a total of 26.37 kg of Am-241, or about 85,000 curies. The amount of Am-241 removed by processing the maximum annual throughput of 3.5 MT of WGPu is 24.5 kg. Consequently, the waste inventories shown in revised CAR Table 5.5-3a represent about one year's throughput. As noted above, the high alpha storage tank (TK4040) and high alpha buffer storage tank (TK4050) will provide approximately 90 days equivalent of storage (revised CAR pp. 11.3-35, 10-5). Therefore, these tanks would only be expected to have up to a maximum of 1.0 kg Am-241, based upon 90 days of storage. The largest single tank inventory is TK4020, the americium reception tank, which is assumed to hold 15.9 kg (51,000

Ci). This is the source term for the controlling event in the safety assessment. However, during normal operations, the waste would be transferred to the WSB for treatment at a rate of 25 transfers per year; if the 90 day storage equivalent is used, this would be 4 transfers annually. Both are bounded by the safety assessment.

3.5 March 2003 Monthly Status Report:

This status report identified the status of open items. Waste management items AP-05 and AP-06 are shown as being closed per SRP 8.4.3.4 and 8.4.3.5. These acceptance criteria do not specifically mention waste or waste-related attributes. Staff were discouraged from pursuing the waste management issues further, particularly as they apply to WACs and arrangements with DOE.

4. Discussion:

MOX management and some staff accepted the position that the applicant's information is adequate, that waste management issues are adequately addressed, and that all issues are closed for the construction authorization stage. However, I note that the waste processing facility that would accept the MFFF waste does not currently exist and does not have WACs for two waste streams (high alpha and stripped uranium); these streams potentially amount to 68,000 gallons annually and up to 15,000 gallons (90 days equivalent) could be stored at the MFFF at any one time. In addition, the applicant has committed to meeting the SRS WAC or providing a stream that qualifies for a WAC deviation and exception - it is not clear that a commitment to a non-existent facility and WAC is acceptable at the construction authorization stage. It is also difficult to conclude that no additional safety controls would be required beyond those already identified by the applicant. These phrases from the applicant's documentation do not necessarily provide assurance that the waste management approach for MOX is adequately determined for the construction authorization stage. This places the staff in the precarious position of accepting an approach for construction that may not provide adequate assurances of safety or require changes after the facility is built, and then having to defend the staff's acceptance in potential hearings on the application.

This situation is further complicated by the involvement of DOE. DOE has an uneven record with waste management. Although not strictly analogous, it took DOE 20 years to obtain the necessary permits and open the Waste Isolation Pilot Plant (WIPP) for TRU waste disposal (some of the MFFF wastes will be TRU). Similarly, DOE has contracts with utilities for the acceptance of spent nuclear fuel (SNF) - after 20 years, DOE has not accepted any significant quantities of SNF and many nuclear power plants have had to construct onsite storage facilities. To further complicate the situation, DOE may contract the final design, construction, and operation of any new MOX-related waste facilities to a company not currently associated with the SRS M&O contractor. SRS waste management facilities for the MFFF are under DOE regulatory authority and are not licensed by the NRC. It is not clear what is adequate for the staff to make a reasonable evaluation and safety determination.

The MOX Environmental Report and Draft Environmental Impact Statement (DEIS) briefly mention waste management. However, these do not contain information or assessments on

waste management timing, DCS/SRS/DOE interfaces and arrangements, WACs, adequacy of design/approach etc. Again, the staff is left hanging.

The MOX SRP does not have a separate chapter on waste management. Section 8 (Chemical Safety) can be used because of its emphasis on chemistry and processing, but it contains no explicit acceptance criteria for waste management. Section 10 (Environmental Protection) briefly mentions waste management in the context of effluents (e.g., 10.4.1(D) and 10.4.3(B)(b)(n)). The guidance is not clear; there is no mention of interfaces, contracts, WACs etc but the implication is for more information beyond what has been supplied for the MFFF. Additional, clearer guidance is needed for the staff.

This has potential implications beyond MOX. The NRC may receive applications for new enrichment facilities. These would generate low level wastes and significant quantities of depleted uranium (DU), probably as the hexafluoride. DU will likely involve interfaces between the applicant and DOE. Again, the staff does not have clear guidance on regulatory acceptance criteria for this situation (licensing applications) with DU and wastes from future enrichment facilities.