

MEETING NOTICE

August 8, 2002

Licensee: Duke Cogema Stone & Webster
P.O. Box 31847
Charlotte, NC 28231

Docket No.: 70-3098

Date and Time: August 27, 2002, 7:00 p.m.

Location: North Augusta Community Center
495 Brookside Avenue
North Augusta, SC 29861

Purpose: To provide information to the public on the "Draft Safety Evaluation Report on the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility," dated April 30, and NRC's process and schedule for future reviews concerning the Construction Authorization Request.

NRC Attendees: Andrew Persinko, Melvyn Leach, Joseph Glitter, Timothy Johnson and other NRC technical staff.

Contact: Andrew Persinko, at (301) 415-6522 (AXP1@NRC.GOV)

Category: Category 3 Meeting: The public is invited to participate in this meeting by providing comments and asking questions during the meeting.

NOTE: NRC Meetings are open for interested members of the public to attend pursuant to the "Enhanced Public Participation in NRC Meetings; Policy Statement," 67 *Federal Register* 36920, May 28, 2002.

ADAMS Accession number: ML021290167, Draft Safety Evaluation Report on the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility

Link to Web Page:
<http://www.nrc.gov/public-involve/public-meetings/meeting-schedule.html#NMSS>

Attachment: Meeting Agenda

MEETING AGENDA

DATE OF MEETING: August 27, 2002

LOCATION OF MEETING: North Augusta Community Center
495 Brookside Avenue
North Augusta, SC 29861

PURPOSE: To provide information to the public on the "Draft Safety Evaluation Report on the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility," dated April 30, and NRC's process and schedule for future reviews concerning the Construction Authorization Request.

7:00PM

Welcome/Introduction

Overview of NRC Review and Conclusions in Draft Safety Evaluation Report

NRC Review Plans and Schedule

Status of Public Hearings

Status of Environmental Impact Statement

8:15

Discussion of NRC Review and Conclusions by Technical Area
Technical areas are:

Safety Assessment/Radiological Consequence Analysis

Chemical and Process Safety

Electrical/Instrumentation and Control Systems

Confinement and Ventilation Systems

Quality Assurance

Fire Protection

Mechanical Systems

Nuclear Criticality Safety

(Discussions will be performed in parallel in a question and answer format at eight locations inside the Community Center)

10:15

Closing Remarks

MIXED OXIDE FUEL FABRICATION FACILITY: SUMMARY OF NRC DRAFT SAFETY EVALUATION REPORT

AUGUST 27 , 2002
NORTH AUGUSTA, SC



Attachment 3

INTRODUCTIONS

Francis “Chip” Cameron
Moderator

AGENDA

- Overview of NRC Review and Conclusions in Draft Safety Evaluation Report
- NRC Review Plans and Schedule
- Status of Public Hearings
- Status of Environmental Impact Statement

AGENDA

- Discussion of NRC Review and Conclusions by Technical Area
 - ▶ Safety Assessment/Radiological Consequence Analysis
 - ▶ Chemical and Process Safety
 - ▶ Electrical/Instrumentation and Control Systems
 - ▶ Confinement and Ventilation Systems
 - ▶ Quality Assurance
 - ▶ Fire Protection
 - ▶ Mechanical Systems
 - ▶ Nuclear Criticality Safety
- Closing Remarks

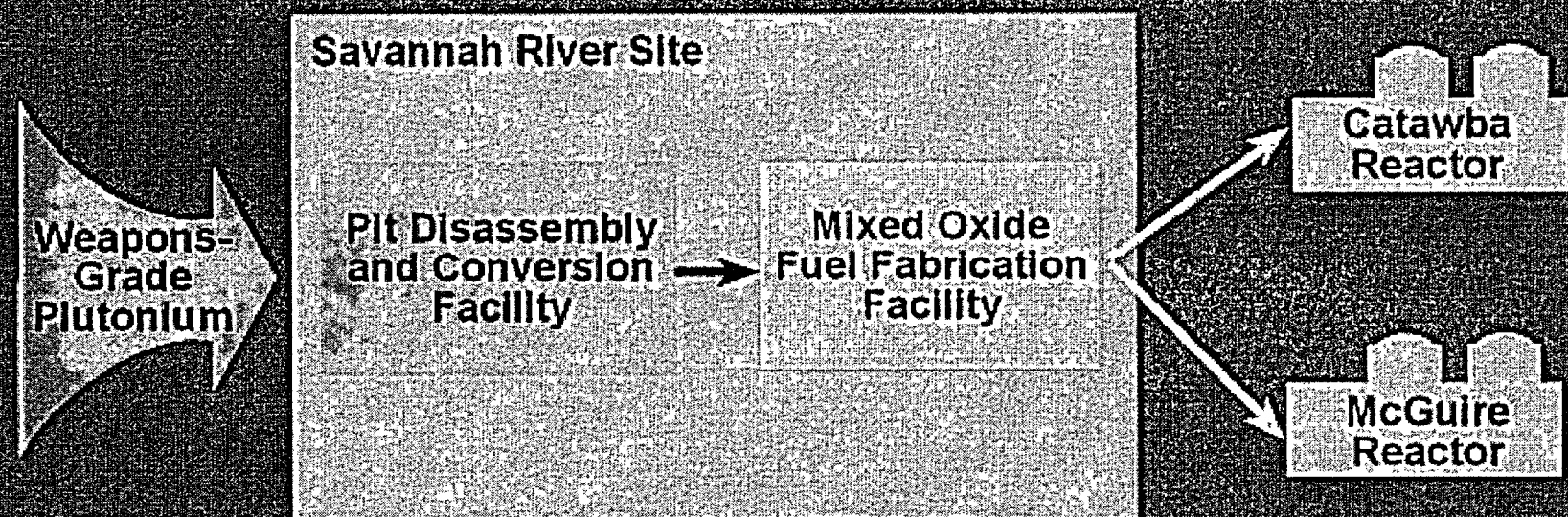
SUMMARY OF DRAFT SAFETY EVALUATION REPORT

Andrew Persinko
NRC Project Manager

A BRIEF HISTORY

- Reduce the threat of nuclear weapon proliferation
- Agreement with Russia
 - ▶ 34 metric tons plutonium
- Department of Energy Program
 - ▶ Convert the plutonium to MOX fuel
 - ▶ Contract with Duke Cogema Stone&Webster (DCS) (the applicant) to build and operate MOX fuel plant
 - ▶ Build the plant at the Savannah River Site

NRC Role in Regulating Mixed Oxide Fuel



Yellow = NRC regulated

Blue = DOE regulated

NRC LICENSING PROCESS

Overview

- Must meet NRC regulations
- Protect public, workers and environment against radiological hazards
- Safety analysis (10 CFR Part 70)
- Environmental analysis (10CFR Part 51)
- Hearings (10 CFR Part 2)

NRC LICENSING PROCESS

- Before DCS can start construction, the NRC must grant a:
 - Construction approval
- Before DCS can operate the facility, the NRC must grant a:
 - License to possess and use special nuclear material.

NRC LICENSING PROCESS

Construction Approval

- Design bases of the principal structures, systems, and components
- Quality assurance program
- “...reasonable assurance of protection against natural phenomena and the consequences of potential accidents...”

NRC LICENSING PROCESS

Design Basis

- “...information which identifies the specific functions to be performed by a structure, system or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for design...” (10 CFR 50.2)
- Examples
 - ▶ Pressure vessel
 - Applied loads design basis / shape not design basis
 - ▶ Building structure
 - Applied loads design basis / location of beams and columns not design basis

NRC REVIEW PROCESS

General

- Formed multi-disciplinary team of scientists and engineers
- Reviewed DCS documents and information
- Asked questions and evaluated DCS answers
- Held technical meetings open to the public
- Compared DCS information with regulatory documents and industry standards
- Used information from other NRC safety reports

NRC REVIEW PROCESS

General

- Verified DCS information by performing independent calculations
- Increased knowledge of plutonium safety and handling
- Conducted system walkdowns of similar MOX facilities
- Discussed technical issues with foreign regulators of MOX facilities

NRC DRAFT SAFETY EVALUATION REPORT

- Evaluates Construction Authorization Request and supporting information
 - Based on initial DOE program
- Presents NRC staff's preliminary conclusions / snapshot in time
- Conclusions may change

MOX WEBSITE

- Access through NRC website:
 - ▶ <http://www.nrc.gov>
 - ▶ Click on “Nuclear Materials”
 - ▶ Click on quick link to “Mixed Oxide (MOX) Fuel Fabrication Facility”

SUMMARY OF OPEN ITEMS

- Nuclear criticality safety
- Fire protection
- Chemical safety
- Radiological consequences
- Confinement and ventilation systems
- Mechanical systems

SUMMARY OF CLOSED ITEMS

- Overall safety strategies
- Natural phenomena design bases
 - Earthquake, wind, tornado, snow
- Electrical/instrumentation and control design basis
- Quality assurance program

SCHEDULE

- Issued draft SER for construction 4/30/02
- Received supplemental Environmental Report 7/11/02
- Receive revised Construction Authorization Request 10/02

SCHEDULE

Continued

- Issue draft EIS for public comment 2/03
- Issue revised draft SER 4/03
- Issue final EIS 8/03
- Issue final SER and construction licensing decision 9/03

STATUS OF PUBLIC HEARINGS

John Hull
NRC Office of the General Counsel

STATUS OF NRC ENVIRONMENTAL REVIEW

David Brown
Health Physicist

NRC Environmental Review

Introduction

- Schedule of NRC's Environmental Review
- Examples of DOE Program Changes that Affect the Environmental Review
- Upcoming Public Information Meetings

NRC Environmental Review

Schedule for Environmental Review

- February 13, 2002 - DCS informed NRC of DOE Surplus Plutonium Disposition Program changes.
- February 27, 2002 - scheduled date for NRC to issue the Draft Environmental Impact Statement (DEIS)
- April 24, 2002 - NRC announced a delay in issuing the DEIS and asked for Public Comments on the DOE program changes.

NRC Environmental Review

Schedule for Environmental Review

- July 11, 2002 - DCS submitted a revised Environmental Report.
- August 12, 2002 - NRC accepted the DCS Environmental Report for review.
- September 17-19, 2002 - Public Informational Meetings are scheduled for N. Augusta, Savannah and Charlotte.
- February 2003 - NRC to issue Draft Environmental Impact Statement

NRC Environmental Review

Schedule for Environmental Review

- April 2003 - Public Comment period ends
- August 2003 - NRC to issue Final Environmental Impact Statement

NRC Environmental Review

Examples of Changes in DCS Environmental Report

- A new Waste Solidification Building
- Transportation-related impacts now include “generic Midwestern” reactors.
- New impacts from processing alternate plutonium oxide feedstock

NRC Environmental Review

Public Information Meetings

7:00 pm - 10:00 pm

► September 17, 2002

N. Augusta Community Center

► September 18, 2002

Coastal Georgia Center

305 Fahm Street

Savannah, Georgia

► September 19, 2002

Charlotte-Mecklenburg Government Center

600 E. Fourth Street

Charlotte, North Carolina

TECHNICAL DISCUSSIONS

Lead Technical Specialists

- Chemical Safety - Alex Murray
- Criticality Safety - Muffet Chatterton/Harry Felsher
- Confinement and Ventilation Systems -Tim Johnson
- Electrical/Instrumentation and Control -Fred Burrows
- Fire Protection - Sharon Steele
- Mechanical Systems - Bill Gleaves
- Quality Assurance - Wil Smith
- Safety Analysis - Rex Wescott/Dave Brown

Mechanical Systems –

A Summary of NRC's Evaluation
of DCS's Proposed MOX Facility

Mechanical Systems –

A Summary of NRC's Evaluation of DCS's Proposed MOX Facility

IMPORTANT CONCEPTS FOR MECHANICAL DESIGN

- 1. Design Bases for Principle Structures, Systems, and Components**
 - 2. Capacity**
 - 3. Redundancy and Diversity**
 - 4. Safe Shutdown**
 - 5. Welded Construction**
 - 6. Passive Features/Remote Operation**
 - 7. Corrosion Resistance and Corrosion Allowances and Monitoring Programs**
 - 8. Personnel Protection**
 - 9. Seismic Design**
 - 10. Impact of Non-Principle Structures, Systems, and Components on Safety-Related Systems**
 - 11. National Codes and Standards: Such as American Society of Mechanical Engineers' Boiler and Pressure Vessel Code, Sections VIII on Construction of Pressure Vessels, American Institute of Steel Construction N-690 Specification for Design, Fabrication, and Erection of Steel Safety-Related Structured for Nuclear Facilities, AWS D1.3 Structural Metal Welding Code for Sheet, ASME B31.3, Process Piping**
-

Mechanical Systems —

A Summary of NRC's Evaluation of DCS's Proposed MOX Facility

PURPOSE OF NRC STAFF REVIEW

- Determine whether the material transport systems' principle structures, systems, and components (PSSCs) and their design bases have been adequately addressed.
- Ensure that the Construction Authorization Request addresses
 - PSSC design bases.
 - Baseline design criteria and defense-in-depth.

FOCUS OF REVIEW

- PSSCs and supporting equipment.
- Safety of workers, public, and environment.
Equipment interaction, reliability, safety, unanalyzed hazards, and unidentified events.
- Historical performance of similar systems.

OUTCOME

- DCS committed to design & build facility in accordance with widely accepted industry codes and standards.
 - for MATERIAL TRANSPORT SYSTEMS: DCS meets requirements for defense-in-depth and basic design criteria; design basis provides reasonable assurance for protection against natural phenomena and potential accidents.
 - for FLUID TRANSPORT SYSTEMS: based on an open item regarding system design for corrosion the staff cannot conclude the design bases provides reasonable assurance for protection against natural phenomena and potential accidents.
 - for FLUID SYSTEMS: based on 4 open items regarding system design the staff cannot conclude the design bases provides reasonable assurance for protection against natural phenomena and potential accidents (no PSSCs identified for nitrogen system and seismic isolation valves)
 - for HEAVY LIFT CRANES: DCS meets requirements for defense-in-depth and basic design criteria; design basis provides reasonable assurance for protection against natural phenomena and potential accidents.
-

Mechanical Systems –

A Summary of NRC's Evaluation of DCS's Proposed MOX Facility

OPEN ITEMS

- The design of the seismic isolation valves (includes all systems penetrating MFFF walls except for fire protection system, Section 5.0)
- The design basis for the corrosion allowances that will be used on systems that will not be readily accessible for inspection (for example, double-walled piping and piping in process cells)
- Accident scenario of flammable/explosive gases (hydrogen) to insufficient purging in the sintering furnace airlock. (safety significance of nitrogen system)
- No PSSCs have been identified for the nitrogen blanket on the hydroxylamine and hydrazine tanks. (explosive accumulations of gases)
- No PSSCs have been identified for the calciner carbon bearing. (confinement of material)
- The design basis for the non-PSSC instrument air system. (impact on connected systems)

CLOSED ITEMS

- System-level descriptions and examples of components that are PSSCs. Such as: redundant brakes with fail-safe design, structural oversizing of drive equipment, overspeed detection, mechanical stops, overtorque detection, electrical interlocks, magnetic grippers, glovebox hoods, and shielding.
 - Design bases for the Material Transport System.
 - Non-PSSC status for Heavy Lift Equipment.
 - Design bases for 3013 Canister, waste drums, fresh fuel casks, transfer containers
 - The National Codes and Standards that will be used to design and construct the fluid transport system.
 - Fluid systems will be in double-walled piping or in process cells
 - Design bases for materials of construction
 - Emergency Diesel Generator Fuel Oil & Exhaust System
-

Nuclear Criticality Safety

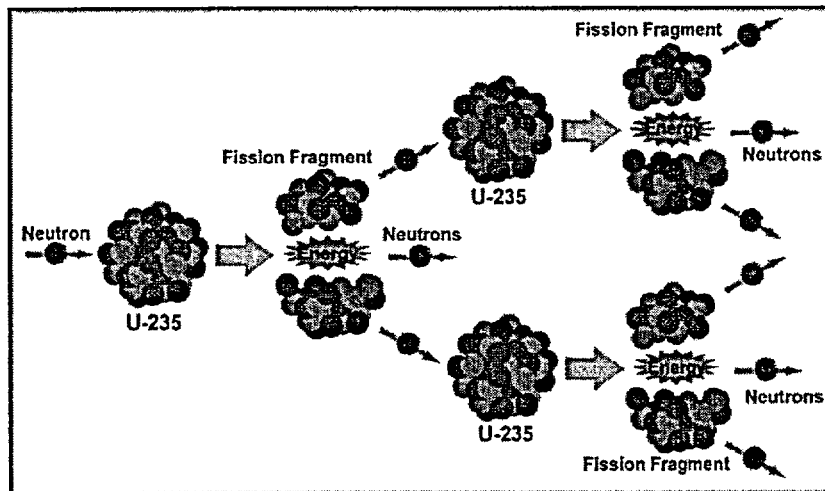
What is meant by Nuclear Criticality Safety?

Examples of general knowledge of NCS:

What is Nuclear Criticality Safety (NCS)?:

- Protection against an accidental criticality (i.e., uncontrolled nuclear fission chain reaction)

Illustration of a nuclear fission chain reaction with U-235:



Why is NCS important?:

- Potential for energy and radiation hazard to workers

How will NRC evaluate NCS for the MOX facility?:

- Same as for any other fuel cycle facility (i.e., licensing, oversight, enforcement)
- Addressing specific issues related to using plutonium

Nuclear Criticality Safety

What are important concepts in NCS?

Examples of important concepts in NCS for fuel cycle facilities:

What does the goal of zero accidental criticalities mean?:

- No nuclear fission chain reactions
- Facility operations must be subcritical during both normal and credible abnormal operations, thus effective neutron multiplication factor ($k\text{-eff}$) < 1.0
- $k\text{-eff} = (\text{neutron production rate}) / (\text{neutron loss rate})$
- $k\text{-eff} = 1.0$ means critical

What factors are used to keep operations subcritical?:

- Material - Mass, Element, Enrichment, Heterogeneity
- Shape - Geometry, Volume, Concentration, Density
- Poison - Solid, Liquid
- Others - Reflection, Moderation, Unit Interaction

How are those factors used?:

- To make it difficult to create a problem
- To make it easy to do the right thing
- To make maloperation inconvenient
- To make proper operations convenient

Nuclear Criticality Safety

What are open CAR NCS items?

Examples

- **NCS personnel experience levels with plutonium and/or MOX fuel**
- **NCS margin of subcriticality for safety, when calculating *k-eff***
- **NCS use of the term ‘highly unlikely’**

What are closed NCS CAR items?

Examples

- **NCS personnel education levels**
- **NCS commitment to the double contingency principle**
("Process designs should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible.")
- **NCS use of a criticality accident alarm system**
- **NCS use of a preferred design approach**

CHEMICAL AND PROCESS SAFETY

1. NRC Staff Conduct of Review

- * NRC regulates the following aspects of chemical and process safety:**
 - chemical hazards of radioactive materials (e.g., depleted uranium dioxide)
 - chemical hazards of chemicals produced from radioactive materials (e.g., NO_x release from plutonium nitrate/nitric acid solutions)
 - chemical hazards that affect the safe handling of licensed radioactive material (e.g., N₂O₄ reagent release upon plutonium handling operations)

- * Performance requirements in 10 CFR 70.61**
 - High consequence: render acute chemical exposures highly unlikely if endanger life of worker or irreversible/other serious health effects outside controlled area boundary
 - Intermediate consequence: render acute chemical exposure unlikely if irreversible/other serious effects to worker or mild transient health effects outside controlled area boundary
 - applicant submits proposed quantitative standards for chemical health effects for NRC approval

- * Staff review used the guidance provided in the MOX Standard Review Plan (NUREG-1718)**

- * Staff obtained open literature documents and performed independent analyses as necessary to supplement the review**

2. Chemical Safety in the Application

- * Applicant has proposed the use of TEELs - Temporary Emergency Exposure Limits - for chemical health effects (Table 1)**

Table 1: Selected Chemicals, Inventories, and TEELs

| Chemical | Approximate Chemical Quantity Onsite | TEEL-1 mg/m3 | TEEL-2 mg/m3 | TEEL-3 mg/m3 |
|---|--------------------------------------|--------------|--------------|--------------|
| N ₂ O ₄ | 206 gal, 35% | 15 | 15 | 75 |
| HNO ₃ | 429 gal, 13.6 M | 2.5 | 12.5 | 50 |
| HAN | 435 gal, 1.9 M | 10 | 25 | 125 |
| N ₂ H ₄ .H ₂ O | 206 gal, 35% | 0.006 | 0.04 | 0.04 |
| UO ₂ | 37.5 tonnes | 0.6 | 1 | 10 |

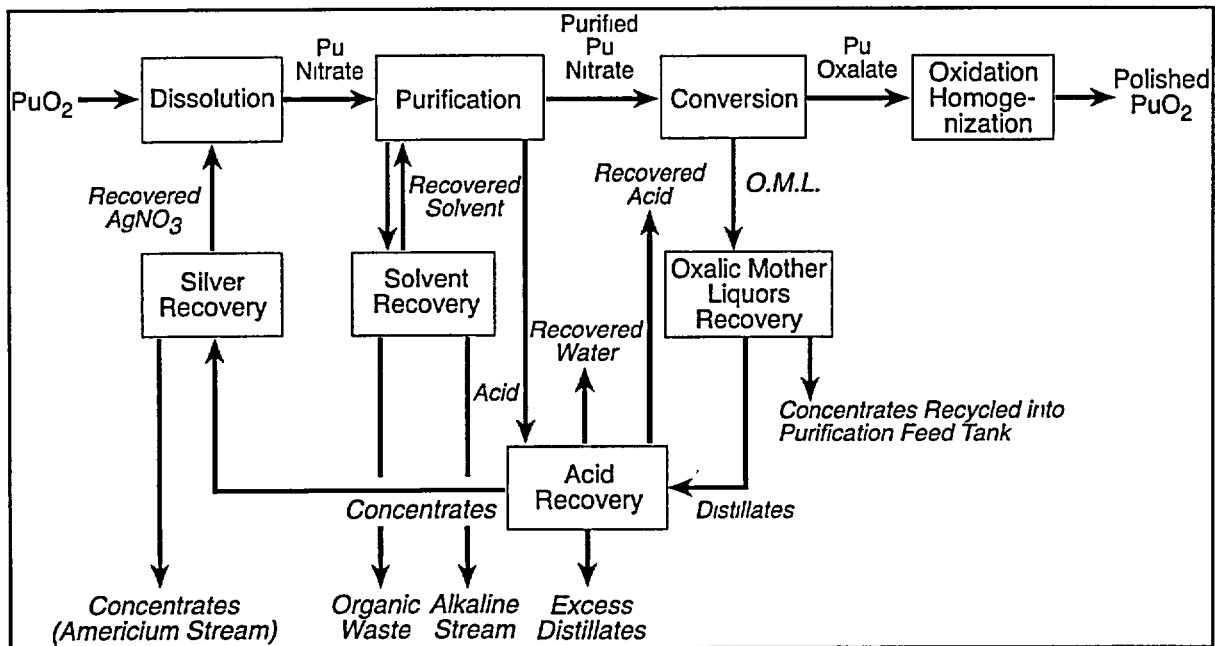
- * Staff review has identified potential concerns with chemical releases at the proposed facility**
- * Special case of uranium compounds**
 - radiation hazards relatively small
 - chemical hazards and toxicity effects dominate potential risk for low enriched materials
- * Only specific design feature to mitigate consequences of chemical releases: special filters for chemicals on the emergency control room HVAC**

3. The Chemical Aspects of MOX Fabrication

* **The Proposed MOX Facility (MFFF) consists of two basic processes**

- AP - Aqueous Polishing
- MP - MOX (powder) Process

Figure 1: AP Process Overview

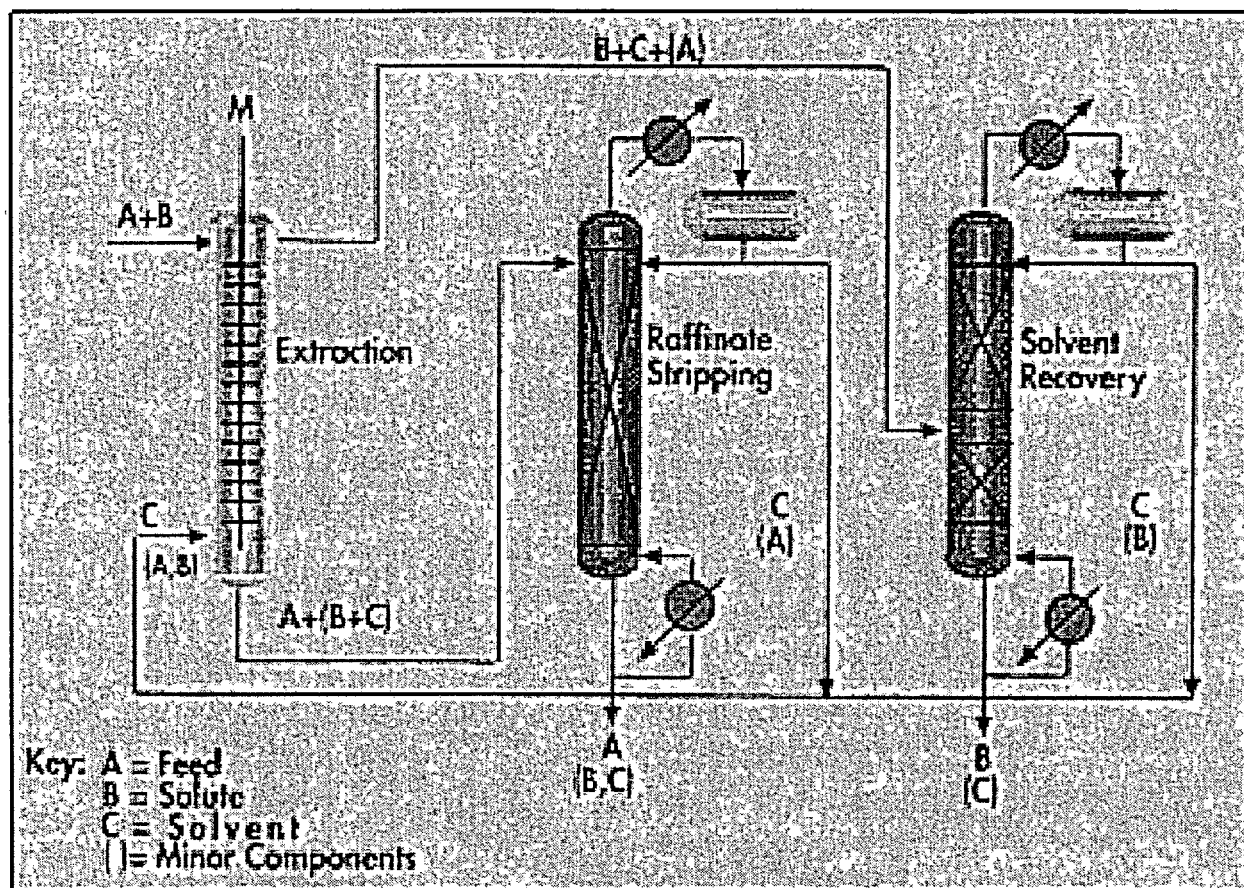


* **AP purifies the plutonium by removing chemical and radioactive impurities**

- Similar to processes conducted at DOE facilities (Hanford and Savannah River)
- NRC-licensed facilities have also used variations of the same process for scrap recovery and recycle
- Currently applied on a significant scale in France, United Kingdom, Russia, and Japan
- process operations are conducted in cells and gloveboxes

- * The impure plutonium dioxide from DOE is dissolved in nitric acid, assisted by electrolysis
- * AP uses solvent extraction into an organic, kerosene-like solvent as the principal means of purification
 - Based upon an updated PUREX process
 - Chemicals are tri-butyl phosphate (TBP) in dodecane (similar to kerosene)
 - Both columns and mixer-settlers used (Figures 2-4)

Figure 2: Typical Solvent Extraction Arrangement



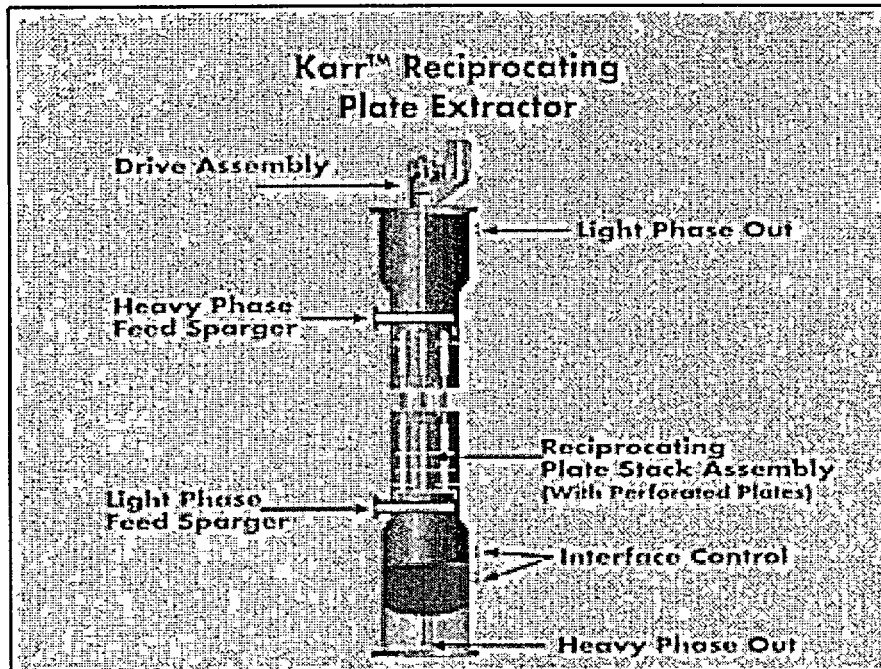
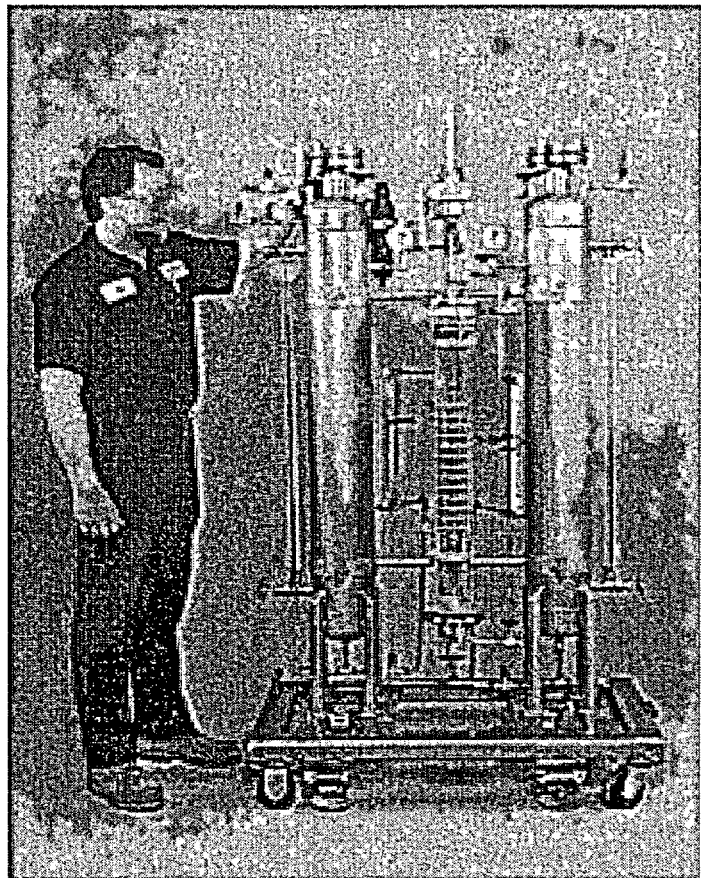


Figure 3: Schematic of Reciprocating Karr Column

Figure 4: Example of Experimental Unit - Karr Column in Center



- * Additional purification by precipitation
- * Purified plutonium nitrate converted to oxide by oxalate precipitation and calcination
- * About 50% of AP associated with reagent recovery and waste processing

MP - MOX Powder Process (Figure 5)

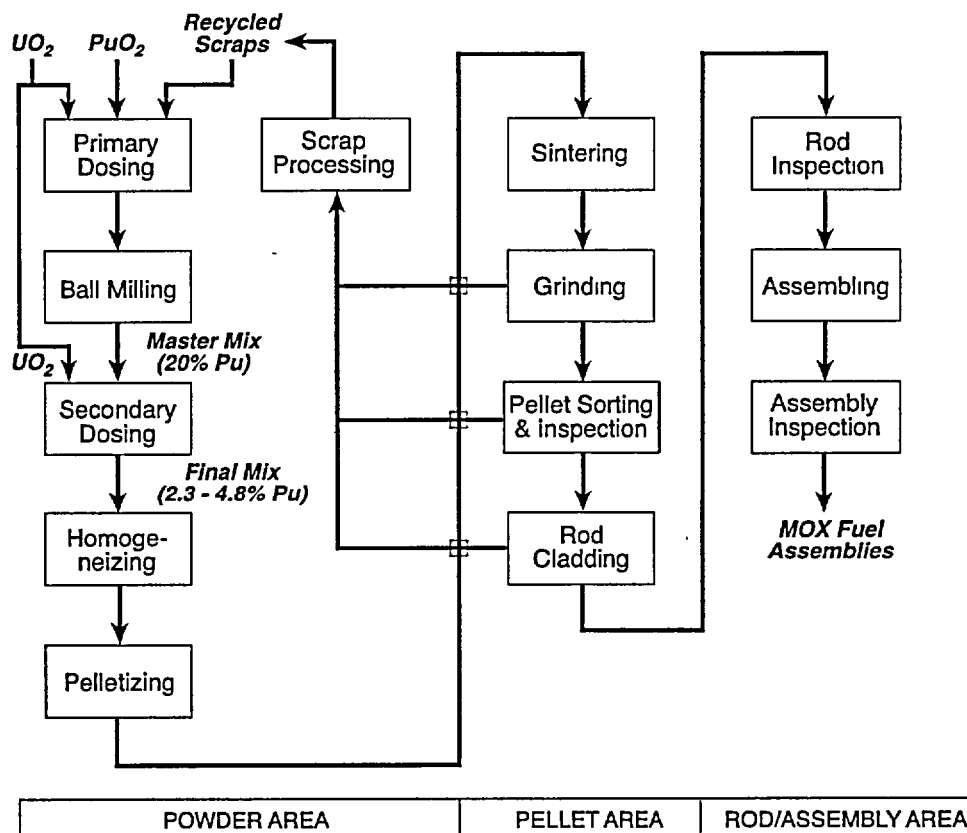


Figure 5: MP Flow Diagram

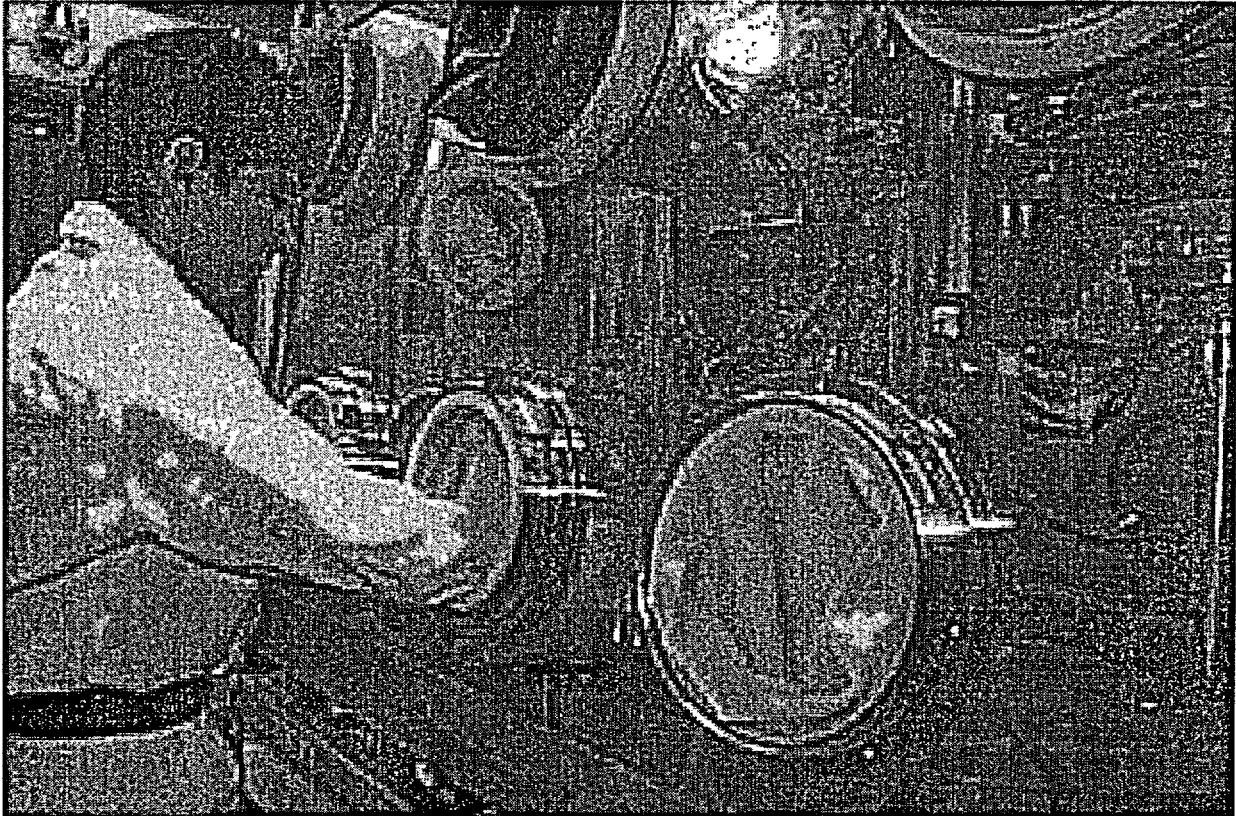
- * **MP is a dry powder milling and blending process**
 - similar to uranium fuel fabrication at existing NRC licensees
 - applied on a significant scale in France, Belgium, and United Kingdom
 - comprised of some 38 process units in the proposed facility

- * **Purified plutonium dioxide powder is blended with depleted uranium dioxide powder (Figure 6) and milled (size reduced) to form a master mix (about 20% Pu)**
 - all powder operations are conducted under a nitrogen gas atmosphere
 - all operations prior to rod inspection are conducted in glove boxes (Figure 7)



**Figure 6: Uranium Dioxide Powder
(PuO₂ appearance is similar)**

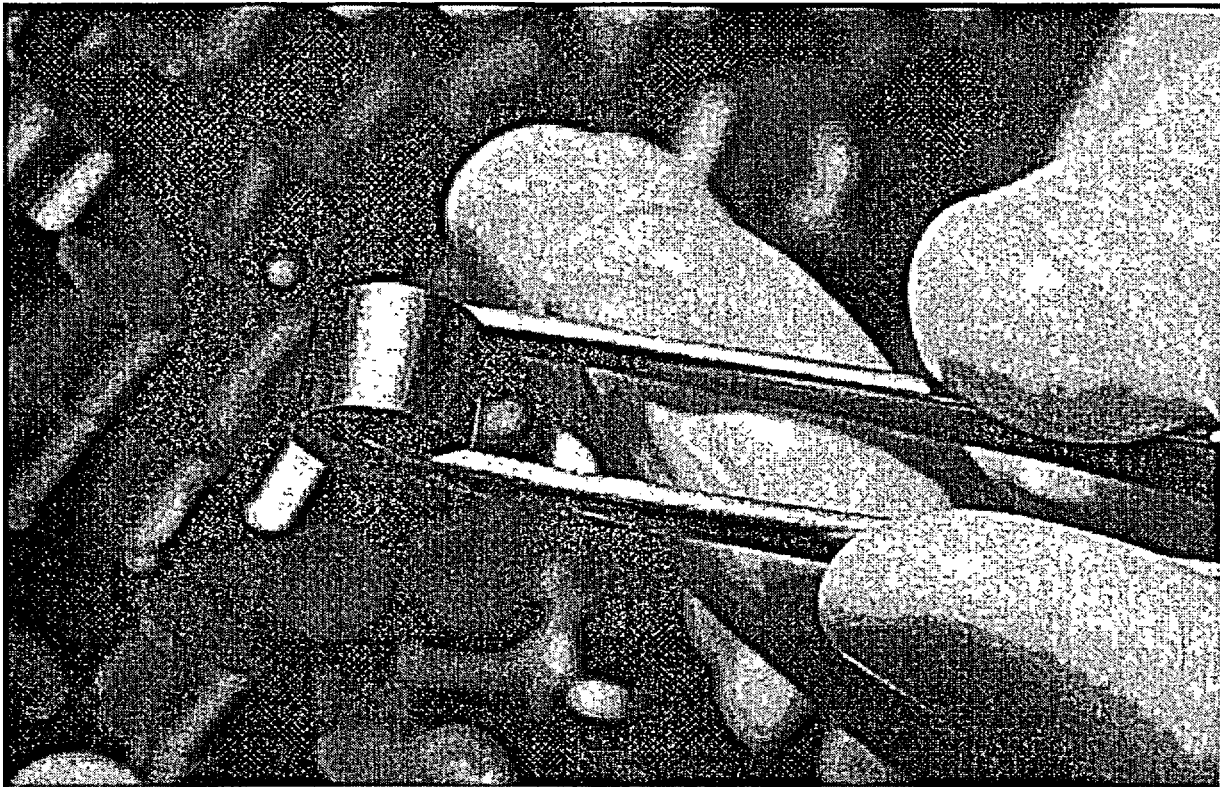
Figure 7 : A typical glovebox (Melox Plant, France)



- * Additional depleted uranium dioxide and dry chemicals (such as soaps and binders) are added to the master mix, blended, and homogenized to form a final powder mix (2.3-4.8% Pu)**
- * The final powder is pressed into pellets and sintered into a high density material using a furnace**

 - high temperatures in the furnace remove the organic materials
 - a hydrogen/argon gas mixture provides a reducing atmosphere in the furnace that produces higher pellet densities (Figure 8)

**Figure 8: Uranium Dioxide Fuel Pellets
(MOX pellets are similar)**



- * Pellets are ground to specific dimensions and inspected**
- * Pellets are loaded into rods and the rods are sealed and inspected (Figures 9 and 10)**

Figure 9: Visual Inspection of Fuel Rods

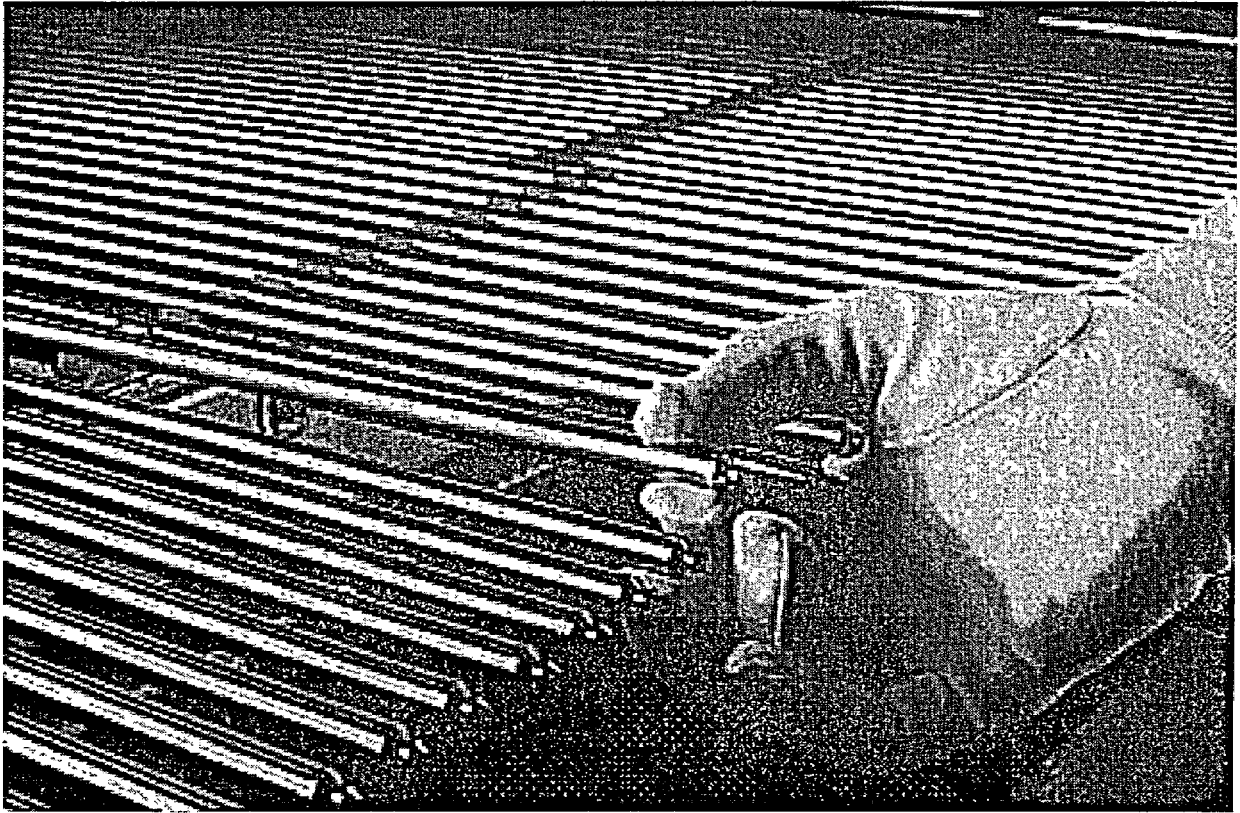
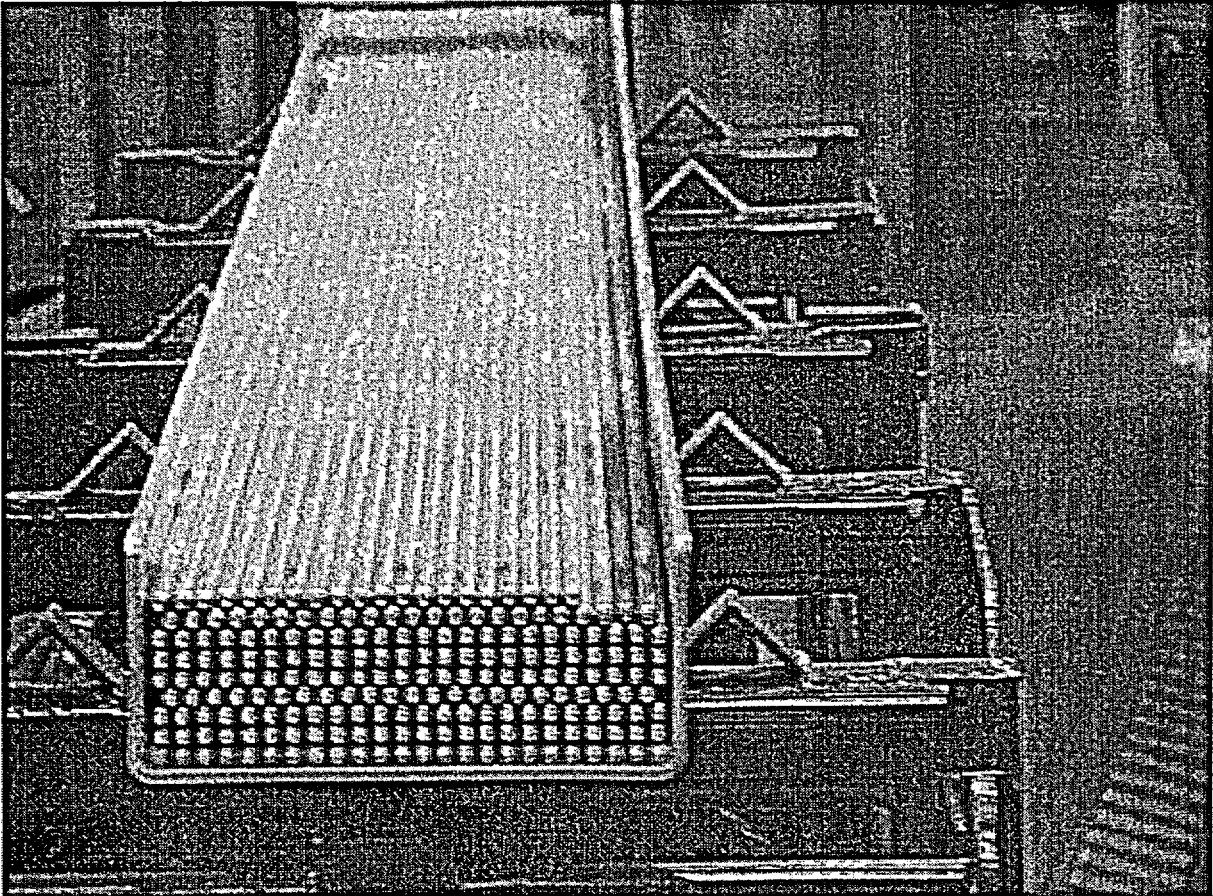


Figure 10 : Typical Fuel Rods (uranium fuel - MOX rods are identical)



- * Rods are inserted into grid straps and spacers to form assemblies (Figures 11 and 12)

Figure 11 : Typical Grid Straps and Spacers

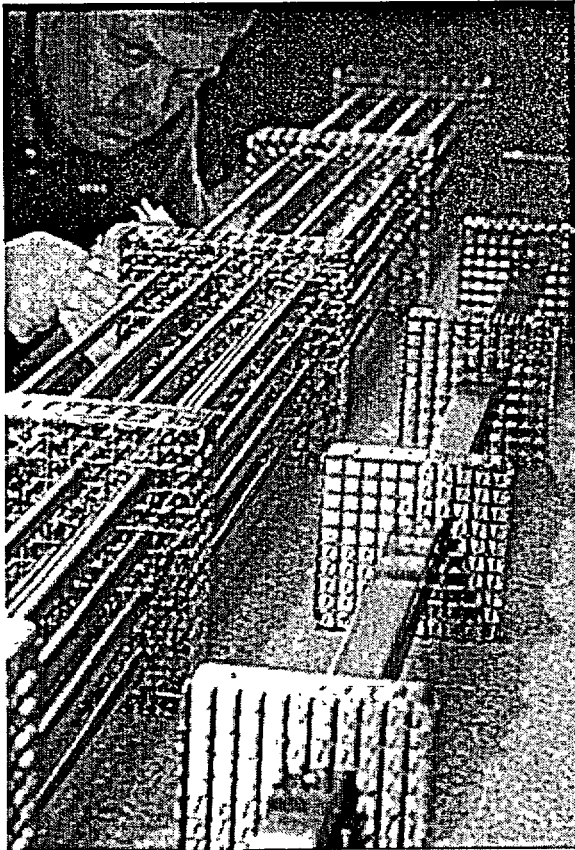
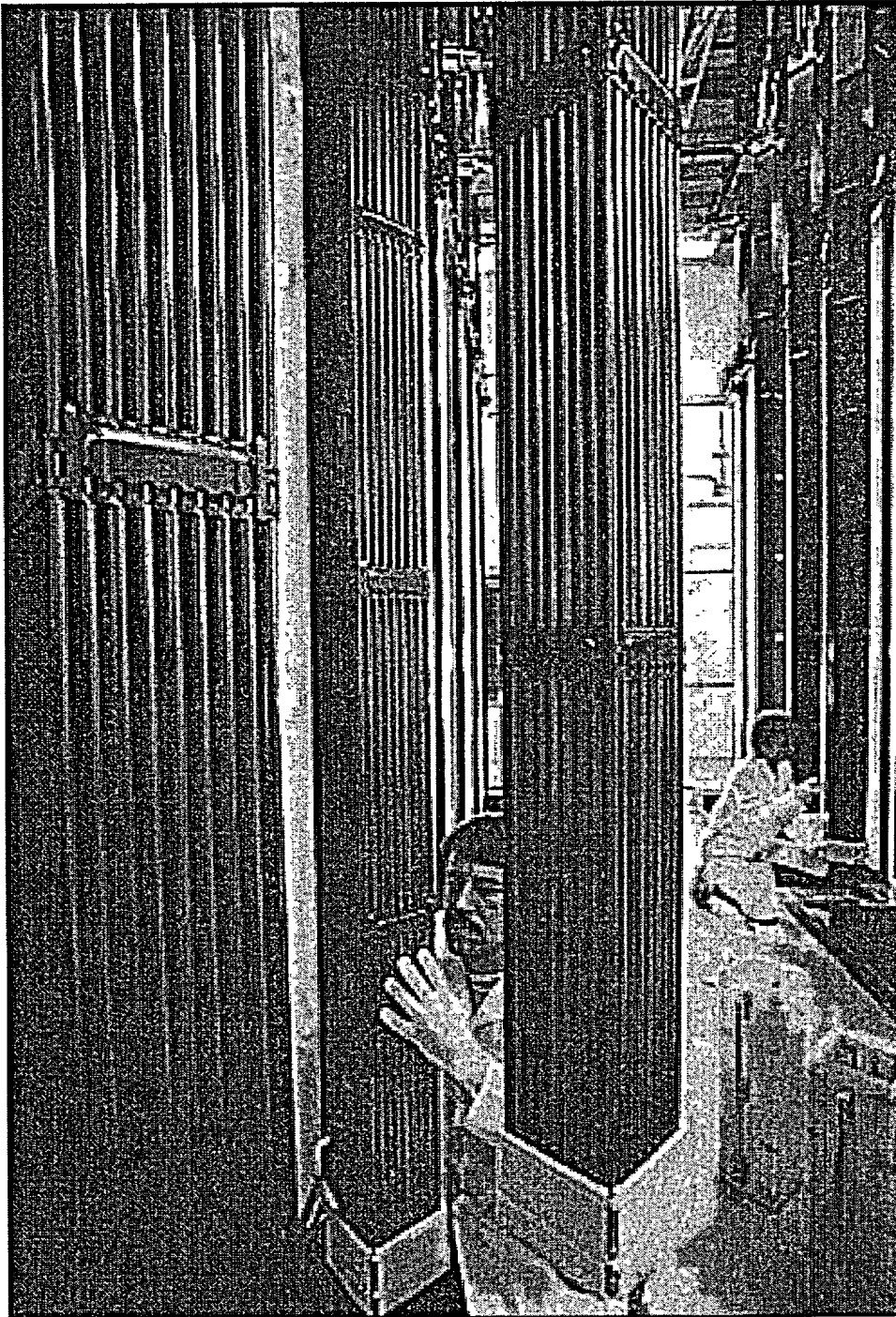


Figure 12 : Typical UO₂ PWR Assembly (MOX Assemblies Similar)



- * Assemblies are inspected, stored, and shipped to the reactor site (Figure 13)

Figure 13: Typical Fuel Assembly Storage (UO₂ - MOX storage is similar)



4. STAFF EVALUATION AND FINDINGS

*** Applicant has not met regulations due to open items**

*** Section 8 of Draft SER: Chemical and Process Safety
10 Open Items:**

- "red oil" analysis is not complete
- HAN/hydrazine analysis is incomplete
- HAN/hydrazine/azide
- pH control for avoiding precipitation in waste unit
- modeling of hazardous chemical releases
- potential controls to protect the worker from a laboratory explosion
- safety functions for the delivery of chemicals
- chemical toxicity impacts from DUO2
- adequate margin for the solvent temperature design basis
- design basis for habitability in the Emergency Control Room

*** Section 11.2 of Draft SER: Aqueous Polishing Process
and Chemistry**

13 Open Items:

- protection of the electrolyzer against overtemperature
- potential fires/explosions from flammable gases around and in the electrolyzer
- electrolyzer events involving titanium
- corrosion monitoring of alloys susceptible to silver(II) corrosion
- confirm that wastes will meet the SRS WACs and that SRS will accept these wastes
- identify design bases and safety functions for the high alpha waste system
- identify design bases for the feed material to the proposed facility
- provide a design basis and PSSCs for flammable gases and vapors in the Offgas unit
- provide a design basis and PSSCs for the maximum solvent temperature
- provide a design basis and PSSCs for the removal of toxic and potentially reactive gases in the Offgas unit
- corrosion monitoring of components exposed to aggressive species in the Offgas unit
- provide design basis and PSSC information on the sampling system
- identify a safety strategy for hazardous chemical releases from the loss of confinement of radioactive materials

*** Section 11.3 of Draft SER: Mixed Oxide Process
System Description and Review**

4 Open Items:

- provide design basis and PSSC information associated with the pyrophoric/burnback nature of some UO₂ powders
- provide design basis and PSSC information associated with the pyrophoric nature of some PuO₂/PuO_x powders
- provide design basis and PSSC information associated with potential steam explosion events in the sintering furnace
- provide design basis and PSSC information associated with potential explosions in the sintering furnace room

*** Staff reviewing additional information as it is
submitted by applicant**

*** Staff found the following areas acceptable at the
preliminary design/construction stage**

Closed Items:

- mass, energy, and radioactivity balances
- overall process description
- completeness of chemical listing and quantities
- general approach of using EPA ALOHA code and NUREG/CR-6410 for guidance in modeling chemical releases
- feed concentration controls for peroxide and hydrazine hydrate
- design basis temperatures for gloveboxes and cells

5. DISCUSSION OF SEVERAL OPEN ITEMS

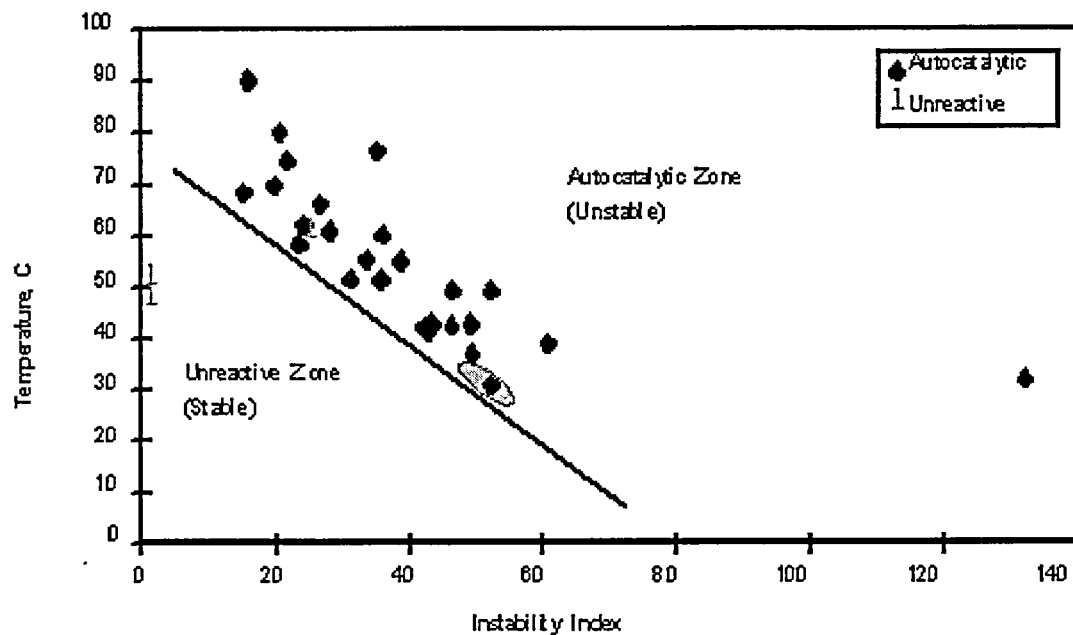
*** Red Oil Phenomena**

- formation of nitrated intermediates in TBP/solvent/nitric acid systems
- under certain conditions, the intermediates are potentially explosive
- several explosive events have occurred in nuclear facilities
- most recently at Tomsk in FSU, in 1994
- applicant has identified the potential for the phenomena and a temperature limit design basis
- staff review indicates proposed approach may not be consistent with the experience and literature
- staff concludes a lower temperature, and additional design bases and PSSCs may be needed

*** HAN/Hydrazine**

- Used as reducing agents and scavengers in the (oxidizing environment of) nitric acid/nitrate solutions
- under certain conditions, the mixture and intermediates are potentially explosive (Figure 14)
- several explosive events have occurred in nuclear and chemical facilities
- most recently at DOE Hanford, Washington State, in 1997
- applicant has identified the potential for the phenomena and design basis
- staff review indicates the proposed approach has not adopted all DOE recommendations for design bases and identified design bases and PSSCs to prevent explosive intermediate formation (e.g., azides)
- staff concludes additional design bases and PSSCs may be needed

Figure 14: HAN Stability Index



* **Hazardous Chemical Releases**

- applicant has concluded that chemical releases do not exceed the performance requirements of 10 CFR 70.61
- staff review indicates several chemicals have the potential for significant effects at 100 m and/or adequate margin needed
- staff review found some operator actions for safety may be needed outside of the emergency control room
- applicant has indicated PSSCs that protect the worker from radioactive releases also provide protection from chemical releases
- staff review found that these PSSCs may not be adequate for chemical releases to the worker and the SRS worker nearby
- potential toxicity of DUO2 powders not addressed
- staff concludes additional design bases and PSSCs may be needed

* **Electrolyzer**

- applicant has identified a prevention strategy for over-temperature, based upon a temperature limit
- staff review found credible events (electrolytic reactions and titanium interactions) that might not be prevented by the strategy
- staff review noted that mitigative strategies may not be effective for chemical release events
- staff concludes additional design bases and PSSCs may be necessary

* **Waste Area**

- applicant indicated there will be design bases and PSSCs for this area
- staff review found limited information on wastes (Table 2)
- staff will review additional information when it is submitted by the applicant

Table 2: Waste Stream Descriptions and Quantities in the Waste Reception Unit

| Waste Stream Designation | Maximum Flow Rate, Gal/year (note 1) | Normal Flow Rate, Gal/yr | Concentration or Annual Quantity (note 2) |
|---|--------------------------------------|--------------------------|--|
| Excess Acid | 1,321 | 1,321 | Americium < 14 mg/yr |
| Stripped Uranium | 42,530 | 35,400 | Uranium = 16 g/L or 2,150 kg/yr U-235 concentration < 1% Plutonium < 0.1 mg/L |
| Liquid Americium | 10,000 | 8,350 | Americium = 24.5 kg/yr Gallium = 42 kg/yr Plutonium < 150 g/yr |
| Alkaline Wash | 2,980 | 2,483 | Uranium < 13 g/yr Plutonium < 13 g/yr |
| Total Flow Rates | 56,831 | 47,554 | |
| Note 1: Maximum flow includes unplanned recycling. Note 2: Concentrations are based on normal flow rate. Total radioactive material quantities are the same for maximum or normal flow rate. Concentrations based on maximum flow rates would be less. | | | |

These values are based upon the original applicant's submittal and are expected to be revised because of the program changes.

*** Sintering Furnace**

- applicant's proposed approach uses a furnace with an argon/hydrogen mixture as the cover gas; a good fraction of the proposed operating range is flammable in air (Figure 15)
- sintering furnace is not located in a glovebox
- applicant has proposed a prevention strategy for hydrogen/leaks based upon hydrogen detectors, oxygen sensors, and pressure controls
- staff review found that hydrogen flow is not terminated by sensors in the room or over-pressure conditions
- staff review found analyses by the applicant did not include a potential steam explosion

Figure 15: MOX Pellets entering sintering furnace at Melox



SAFETY ASSESSMENT

The Safety Assessment may be thought of as the front end of the development of the Integrated Safety Analysis (ISA) which will be prepared at the license stage to comply with the requirements of 10 CFR 70. The objectives of the safety assessment are to identify hazards and events which could challenge the safety of the facility and the principal structures, systems, and components (PSSCs) needed to mitigate or prevent these events. These three posters display the mechanics of the applicant's safety assessment process, the purpose of the NRC's safety assessment review, the scope of the NRC's safety assessment review, the review criteria, and open items which were identified in the review.

POSTER 1

Poster 1 shows the basic process steps of the safety assessment of the design basis and how it relates to and supports the ISA which will be completed for the next stage of licensing.

As shown on the diagram, the major inputs at the construction authorization stage are the site description from which natural phenomena hazards and external man-made hazards are identified and the preliminary facility design from which internal process hazards are identified.

All credible events are then grouped into event types in accordance with the hazard and the workshop or process that they are associated with. For each event, accidents are identified, bounding consequences are evaluated, and the unmitigated consequences compared with the performance requirements of the regulation.

Where performance is not met, PSSCs are identified such that the consequences are prevented or mitigated in accordance with the requirements of the regulation. These identified PSSCs, which are generally at the systems level, then become inputs to the final design.

POSTER 2

In the final design or ISA stage, the system level PSSCs are broken down into items relied on for safety at the system and component level. At this stage, reliability and dependability values are determined so that consequence frequencies may be calculated.

These frequencies are compared with the regulation's performance objectives, improved if necessary, and safety limits are identified where required to assure acceptable initial conditions.

POSTER 3

Purpose

The major purpose of the safety assessment review was to review the hazards analyses which the applicant used to develop the PSSCs for the facility. The safety assessment review was a team effort and was complemented by detailed technical reviews of the more discipline or process specific sections of the application.

A number of issues were fed back to the safety assessment from the technical reviews and were defined in the context of performance issues. These issues are identified in the staff Draft Safety Evaluation Report as unidentified events, incomplete strategies, or incomplete design bases (which are covered in the technical reviews)

Throughout the review process, the safety assessment team meetings served to help reviewers become aware of each other's issues and provide other technical input as necessary.

Scope

The scope of the safety assessment review consisted of reviewing the applicant's analyses of natural phenomena such as seismic events, floods, and high winds as well as external man-made events such as potential industrial explosions, chemical releases, or aircraft hazards; and process hazards. The evaluation of process hazards required an evaluation of facility worker consequences, public and site worker consequences, environmental consequences, and the means for preventing or mitigating these consequences

Criteria

The criteria used in the safety assessment review consisted of likelihood (or probability) which was directly applied, in most instances, to evaluation of natural phenomena and external man-made events. For the evaluation of process hazards, all events were initially considered as events which may occur within the life of the facility.

The applicant used a deterministic argument for many of the facility worker consequence evaluations. Sometimes the staff required additional information such as dose calculations to evaluate the reasonableness of the argument. The applicant also applied deterministic reasoning for excluding some natural phenomena and external man-made events from consideration.

The use of safe and accepted practices was considered in reviewing the applicant's selection of PSSCs and mitigation and/or prevention strategies. In some cases, the history of certain types of events at similar or related facilities was researched to establish what practices may have caused the event. In other cases adherence to standards, regulatory guides, and practices safely used in the nuclear industry was accepted as an indication of safe and accepted practice.

The availability of mitigation and prevention strategies as a criteria, was primarily applied to prevention or mitigation of consequences to the site worker or public from process hazards. Generic hardware failure rates along with the recognition that choice of surveillance interval can significantly increase dependability was often considered if it was determined that a strategy, if properly implemented, would be acceptable for meeting the 10 CFR 70.61 performance requirements.

Open Items

The open items consisted of the need for more information to verify the applicant's assumptions regarding a postulated explosion in F-Area to ensure that such an event would not cause a radioactive release at the facility; the need for projected flight information to update the applicant's aircraft hazard analysis; and the need to justify the applicant's strategy of preventing a seismic induced release in regard to isolation of utility and or other gas or fluid lines.