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August 23, 1993

Dr. Stephan Brocoum, Director
Analysis and Verification Division
Office of Geologic Disposal
Office of Civilian Radioactive
Waste Management
U. S. Department of Energy
Washington, DC 20585

Subject: Bi-Monthly Design Issues Status Report
Contract DE-AC01-92-RW00227, Work Package 10016-001-004-0003-01

Dear Dr. Brocoum:

WESTON has prepared a status report summarizing repository design issues significant to OGD, Analysis and Verification Division, and the OCRWM program. The reporting period covered by this status report extends from May 16, 1993 to July 15, 1993.

Three design topics are discussed in the enclosures to this letter. Each enclosure discusses a separate design topic. These enclosures are generally formatted in three sections describing:

- background on the topic;
- current status; and,
- issues related to the topic.

The topics selected for this reporting period are briefly described below:

- Enclosure 1 discusses design activities in support of the defense and commercial HLW vitrification programs;
- Enclosure 2 discusses issues related to design activities in support of waste package program; and
-  Enclosure 3 discusses issues related to design activities in support of the Exploratory Studies Facility.



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If you have any questions concerning the repository design issues status report please contact me on 646-6690.

Sincerely,

WESTON TECHNICAL SUPPORT TEAM



Daniel P. Zerga
Design/Program Management Task
Leader
Geologic Disposal Department

Approved by



A. Lowell Snow
Program Manager

Enclosure 1 (16 pages)
2 (13 pages)
3 (16 pages)

cc: A. Berusch
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**DESIGN ACTIVITIES IN SUPPORT OF
HLW BOROSILICATE-GLASS WASTE ACCEPTANCE AND
MPC-DISPOSAL ISSUES**

BACKGROUND

- The Savannah River Site's Defense Waste Processing Facility (DWPF) is currently in full-scale plant testing in preparation to begin vitrifying their liquid HLW by mid-1994. Qualification Runs are scheduled to begin in August 1993. To assure that the Waste Producers vitrify the HLW in a consistent manner, and that adequate information is available about the final glass waste-form to support repository performance-assessment, design and licensing activities, the DOE has developed the Waste Acceptance Process. As part of Waste Acceptance activities, a Technical Review Group (TRG) has been set up by EM-343 to perform Technical Reviews of DWPF documentation, i.e., the DWPF Waste Compliance Plan (WCP) and Waste Qualification Reports (WQRs). Refer to WESTON Dockets HQW.#921215.0005 and HQW.#930122.0004 for previous progress reports on Waste Acceptance Process documentation reviews.
- The West Valley Demonstration Project (WVDP) is a similar facility for the vitrification of Commercial HLW. The WVDP is approximately 2 years behind the DWPF in schedule. It is currently undergoing some system-turnover testing, and should commence full-scale radioactive ("Hot") operations by January 1996. The TRG is also reviewing WVDP's Waste Acceptance Process documentation (WCP and WQRs).

CURRENT STATUS

- In this reporting period (May 16 - July 15, 1993), there were two TRG Meetings in support of DWPF and WVDP Waste Acceptance documentation reviews. Notes from these meetings are found in Attachments 1 and 2. The purposes of these meetings were: (1) to evaluate the West Valley Demonstration Project (WVDP), Waste Qualification Report (WQR) Package-1 (Canister Materials, Canister Identification and Labeling); WVDP, WQR Package-2 (Explosives etc, Organics, Heat Generation, and Maximum Dose Rate); and WVDP, WQR Package-3 (Free Gases, Chemical Compatibility, and Subcriticality); (2) to complete the review of the revised Defense Waste Processing Facility (DWPF) Waste-Compliance Plan (WCP) and the revised DWPF Waste Qualification Reports (WQRs) Volumes 2, 5, 6, 8, and 9, due to the new EM Waste Acceptance Product Specifications (EM-WAPS); and (3) to develop consensus comments for the DWPF WQR Volume 12 (Reporting Dose and Heat-Generation Rates of the DWPF Product).

- Two meetings were held during this reporting period in which disposal issues in the design of Multi-Purpose Canisters (MPCs) were discussed. The Storage and Transportation Issues Resolution Steering Group (S&T IRSG) met on June 17, 1993 in Washington, DC. The Group's main objectives are to identify technical and licensing issues relevant to the storage of spent nuclear fuel and transportation to the repository in general, but in particular to the design and certification of the Multi-Purpose Casks (MPCs), and to provide programmatic and regulatory guidance to various working groups for resolution of these identified issues. The other meeting was a DOE Burnup Credit Workshop, which was held in San Diego, CA on June 24-25, 1993. This meeting concentrated on the technical issues concerned with the use of Burnup Credit in the design of MPCs for the disposal function. Notes from these meetings are in Attachments 3 and 4, respectively.
- Another EM-37 Workshop on the DOE Spent Nuclear Fuel National Strategy was held in Rockville, MD, on July 7-8, 1993. This meeting was a follow-up to the April 28-30 Workshop, which initiated efforts toward the disposition of DOE-Owned Spent Nuclear Fuels (SNF).

ISSUES

- **West Valley Documentation:** The TRG expressed general dissatisfaction that the West Valley WCP and WQRs do not seem to be written to the same standards as DWPF documentation. Even allowing for their less urgent schedule and much smaller budget, the TRG cited West Valley with several instances of careless writing and tardy responses. Among other suggestions, one was that West Valley ask DOE for more funding to hire full-time or outside technical writers. Another strong recommendation was that West Valley ensure that their documentation be peer-reviewed, and obtain DOE-WV management concurrence prior to technical review by the TRG. As of this writing, West Valley's revised WCP, reflecting changes because of the new EM-WAPS, was still not deemed satisfactory by the TRG. Further communication between EM-HQ and DOE-WV is being pursued in this matter.
- **EM-WAPS:** There is continuing uncertainty regarding the status of the EM-WAPS vis-a-vis the WA-SRD. The RW position remains that the WCPs need to be consistent with the WA-SRD. However, they are now consistent with the EM-WAPS, and not the WA-SRD. This issue will remain a recurrent one, until RW concurs with the EM-WAPS, either by a Technical Review or by an MOA.
- **DWPF Qualification-Runs Data:** The DWPF informed the TRG that it was ready to start providing RW with Qualification-Runs Data, but was concerned that RW (YMPO) may not have the physical capability to handle the flow of information requested as a result of TRG review positions (which are above and beyond ~~what is~~ required in the

that

Production Records). However, the RW position is that this issue is an administrative one, and should not concern the TRG, which is a technical body.

- **MPCs and Burnup Credit:** Burnup Credit for waste-package disposal emerged as a major consideration in the design of MPCs, in both the Storage & Transportation Issues Resolution Working Group meeting, as well as in the Burnup Credit Workshop. Burnup credit design for transportation purposes has been continuing for several years, but designing for criticality control for the long durations of concern in the disposal phase promises to be a challenge that should be addressed in a timely manner, and will require extensive interaction with repository-design and waste-package design staff.

**HIGHLIGHTS AND ISSUES
DWPF AND WVDP TRG MEETING
May 25-26, 1993
Buffalo, NY**

The Technical Review Group met in Buffalo, NY on May 25-26, 1993. The purposes of the meeting were to:

- 1) Evaluate the remaining revised responses to comments on the West Valley Demonstration Project (WVDP), Waste Qualification Report (WQR), Package-1 (Canister Materials, Canister Identification and Labeling);
 - 2) Evaluate the responses to WVDP, WQR, Package-3 (Free Gases, Chemical Compatibility, and Subcriticality);
 - 3) Develop consensus comments for WVDP, WQR, Package-2 (Explosives etc, Organics, Heat Generation, and Maximum-Dose Rate); and
 - 4) Resolve the remaining issues on the Defense Waste Processing Facility (DWPF) Waste Compliance Plan (WCP), due to the new EM Waste Acceptance Product Specifications (EM-WAPS).
- **WVDP WQR Package 2:** The main purpose of this meeting was for the TRG to develop a set of consensus comments for the West Valley Waste Qualification Report (WQR) Package 2. This WQR Package comprises 4 items (Spec 3.3 for Explosiveness, Pyrophoricity, and Combustibility, Spec 3.4 for Organic Materials, Spec 3.7 for Heat Generation, and Spec 3.8 for Maximum Dose Rate). The first two of these items are all new text, while the last two consist of marked-up texts of the 1990-91 draft. Because West Valley's revisions in the current draft were to be compared to the old draft, the TRG was directed to evaluate its comments from the previous review for relevance and for inclusion in the current set of consensus comments.
 - **WVDP WQR Package 1:** All remaining comment-response pairs were dispositioned satisfactorily, with the exception of one. The remaining item (Comment C019) is a request to include welding-parameter information for the canister labels in the WVNS HLW Canister Fabrication Specification (WVNS-FA-114). WVDP has agreed to amend WVNS-FA-114 and will append it to WQR Specification 2.2 (Fabrication and Closure). The TRG needs to track this item in that WQR Package; however, the TRG will issue its Final Report for WQR Package 1, with this comment remaining as an Open Item.

- **WVDP WQR Package 3:** The TRG evaluated West Valley's resolutions to both the old and new comments. At the April TRG meeting, comments from the previous review which were still considered relevant by the TRG were given Conditionally Accepted (CA) status. At this meeting, West Valley provided revised text to the WQR Sections 3.2 (Gas Specification) and 3.10 (Subcriticality Specification), allowing response evaluations and removal of Conditional status. However, West Valley did not provide revised text for Section 3.9 (Chemical Compatibility Specification). The comments related to this section were left as CAs.
- **DWPF WCP:** Prior to the meeting, the TRG reviewed the remaining Conditionally Accepted comments against revised pages provided by DWPF. Most of these had been dispositioned at the April 1993 TRG meeting in Washington, DC. Because of the relatively trivial nature of these remaining issues, final disposition was accomplished via conference call. With this action, the TRG review of the DWPF WCP against the EM-WAPS is complete, and the TRG Final Report has been issued.
- **West Valley Documentation vis-a-vis EM-WAPS:** Citing several instances of careless writing and tardy responses, the TRG Program Manager (Chet Miller) expressed the opinion that, in terms of generating its Waste Acceptance documentation, West Valley appeared not to be operating under the same urgency as DWPF was. Additionally, several TRG members felt that it was a waste of time to continue the current review cycle against the old WAPS, especially given the compressed schedule under which the TRG was performing its reviews for DWPF documentation. Chet Miller recognized that it seemed appropriate to initiate reviews of West Valley documentation (the WCP and WQRs) against the new EM-WAPS. In response, Ron Palmer of West Valley agreed to have a rewritten WCP and the WQR Package 2 out by July 8, in time for the TRG meeting at the end of July. Chet Miller informed the TRG that he was going to ask EM-HQ and DOE-WV for new Work Plans and Charters to allow these document reviews, and to allow the postponement of the upcoming review of the West Valley WQR Package 4 until it had been rewritten against the new EM-WAPS. Also, the TRG review of the West Valley WQRs should not begin until the WCP review is complete.
- **Other Issues:**
 - **RW Audit:** A QA White Paper entitled "High-Level Waste Forms Design Controls," in which the authors claimed that the TRG apparently did not notice that the canisters which West Valley bought in 1987 for their drop tests are significantly different in alloy composition from the canisters to be used for Qualification Runs was brought to the attention of the TRG. The TRG was not aware of the veracity of this claim or of any possible impacts. A copy of the White Paper was to be obtained from RW QA for TRG examination at the next meeting.

- **DWPF Qualification Runs Strategy:** At the previous meeting, Ken Picha (EM-343) presented a White Paper listing several concerns about DWPF's proposed reduction in the number of Qualification Runs. The TRG was tasked to be prepared to arrive at a consensus position for the Buffalo meeting. However, most of the TRG members were not prepared with positions, except one member who was of the opinion that the DWPF should not shorten its test period below 6 months.

- **Next TRG meetings have been scheduled for:**
June 30 - July 1, 1993 Seattle, WA
July 27-29, 1993 Portland, OR

**HIGHLIGHTS AND ISSUES
DWPF AND WVDP TRG MEETING
June 30 - July 1, 1993
Seattle, WA**

The Technical Review Group met in Seattle, WA on June 30 - July 1, 1993. The purposes of the meeting were to:

- 1) Evaluate the remaining revised responses to comments on the Defense Waste Processing Facility (DWPF), Waste Qualification Reports (WQRs), Volumes 2, 5, 6, 8, and 9, due to the new EM Waste Acceptance Product Specifications (EM-WAPS); and
 - 2) Develop consensus comments for the DWPF, WQR, Volume 12 (Reporting Dose and Heat-Generation Rates of the DWPF Product).
- **DWPF WQR Volumes 2, 5, 6, 8, and 9:** At the February 1993 TRG meeting in San Diego, the DWPF requested that the TRG re-review these DWPF WQR Volumes for changes reflecting the new EM-343 WAPS. These were the critical WQR Volumes which the DWPF considered essential to have been reviewed by the TRG prior to commencement of Qualification Runs. A TRG review of these Volumes was completed in time to meet an internal EM deadline in January 1993. The DWPF envisaged this re-review to have been completed by early July 1993, in order to support its HQ Operational-Readiness Review for Waste-Qualification Runs. This meeting closed-out the re-review cycle for these WQR Volumes, and Mike Cloninger distributed the Final Report for TRG member concurrence.
 - **DWPF WQR Volume 12:** Consensus TRG comments were generated at this meeting on the DWPF WQR Volume 12 (Reporting Dose and Heat Generation Rates of the DWPF Product). There were several individual comments asking for clarification of the way that concentrations of Y-90 and Ba-137m were reported in the WQR text. Other comments questioned how this WQR Volume could outline a compliance plan in such detail, when the storage facility will not be built for several decades and when the technology for measuring dose rates will have changed by then.
 - **Other Issues:**
 - **Handouts:** TRG Chairman handed-out the revised TRG review schedule. Technical Review Manager handed-out Work Plans for the West Valley WQR Package 4, and also a corrected Pg. 1 of the DWPF WCP.

- **EM-WAPS:** Technical Review Manager informed the TRG that RW OA staff, along with Lake Barrett, were concerned that RW is on DWPF's critical path. This raised a discussion on the status of the EM-WAPS vis-a-vis the WA-SRD. The RW position (re: John Roberts memo of February 1, 1993) remains that the WCPs need to be consistent with the WA-SRD. However, they are now consistent with the EM-WAPS, and not the WA-SRD. This issue will remain a recurrent one until RW concurs with the EM-WAPS, either by a Technical Review, or by an MOA.
- **TRG Personnel Replacements:** TRG member Diane Harrison (YMPO) was resigning her post, and it was unsure at the time of the meeting whether Dean Stucker (RW-22, HQ) was going to replace here on the TRG. Michael Wherley (Support to Chet Miller, TRG Chairman) was being replaced by Steve Bren. Scott Higginbottom (TRG Observer, DOE/SR) will also be replaced by Larry Hinson.
- **DWPF Qualification-Runs Data:** DWPF informed the TRG that the DWPF was ready to start providing RW with Qualification-Runs Data, but was concerned that RW (YMPO) may not have the physical capability to handle the flow of information (which is above and beyond ^{what} what is required in the Production Records). DWPF suggested that discussion might be required to make sure that the repository project will have the systems capable of accepting the incoming information. A TRG member stated that, since the TRG was a technical body, it should not concern itself with administrative problems and he suggested that DWPF make their concerns known to RW through DOE-SR and EM. The Technical Review Manager, however, stated that if TRG actions have resulted in requiring DWPF to report data in the Production Records (PRs) above ^{what is} what is required in the WAPS or the WA-SRD, then maybe there was a problem ^{which} which the TRG should ^{look at,} and ^{possibly} maybe be able to fix. At the next meeting, DWPF will provide a list of the categories of information of concern. The TRG was also asked to bring copies of the EM-WAPS to the next meeting to allow comparison of what is required in the PRs.
- **The next TRG meeting was scheduled for July 27-29, 1993 in Seattle, WA. The purposes of this meeting will be to:**
 - 1) Evaluate revised responses to comments on the WVDP WCP;
 - 2) Evaluate responses to comments on the WVDP WQR Package 2; and
 - 3) Evaluate responses to comments on the DWPF WQR Volume 12.

**STORAGE AND TRANSPORTATION ISSUES-RESOLUTION
STEERING-GROUP MEETING**

June 17, 1993
Washington, DC

- The Storage and Transportation Issues-Resolution Steering Group (S&T IRSG) convened its second meeting on June 17, 1993, at the M&O offices in Washington, DC. The Group's initial meeting was on May 18, 1993, during which a tentative Charter for the Steering Group was established. The Group's main objectives are to identify technical and licensing issues relevant to the storage of spent nuclear fuel and transportation to the repository, in general, but in particular to the design and certification of the Multi-Purpose Casks (MPCs); and to provide programmatic and regulatory guidance to various working groups for resolution of these identified issues.
 - The purposes of this meeting were to:
 - Finalize the draft charter,
 - Discuss and prioritize identified issues,
 - Discuss recent NRC interactions ,
 - Generate action items, and
 - Generate an agenda for the next meeting.
 - The meeting attendees were:
 - Priscilla Bunton (Chair) (RW-331)
 - Linda Desell (RW-331)
 - Robert Morgan (M&O Duke)
 - Ali Haghi (M&O Duke)
 - Jeff Williams (RW-421)
 - Bill Lake (RW-431)
 - Jay Jones (RW-422)
 - John Richardson (WESTON)
 - Chris Charles (WESTON).
- Chris Charles represented Alan Berusch (RW-22), who was not present.
- **Finalizing the Draft Charter:** Bill Lake (RW-431) said he believed that there were important interfaces between transportation and disposal functions, especially in the areas of long-term criticality control and burnup credit. He is therefore in favor of including RW-20, Office of Geologic Disposal, in the list of concurrence signatures on the Charter.

Jeff Williams (RW-421) undertook to ask Ron Milner (RW-40) to agree to put RW-20 on the Charter.

- **NRC Interactions:** Linda Desell (RW-331) discussed with the Group a recent interaction between the Nuclear Waste Technical Review Board (NWTRB) and Robert Bernero (Director, NRC Office of Nuclear Material Safety and Safeguards). Bernero suggested to Dr. Price (NWTRB) that the NRC could be amenable to receiving from DOE a Petition for Rulemaking under 10 CFR Part 60, to get NRC to agree to consider an SNF-filled MPC (with storage overpack) as a "certified waste form" (which would allow it to be inserted into a repository medium-specific disposal overpack). Among the issues Ms. Desell felt to be of concern to the IRSG were: What approach should DOE take in formulating a Petition for Rulemaking? Should DOE take a similar approach with canistered Borosilicate-Glass Waste? What criteria will NRC use to evaluate certification?

It was suggested that, since this is an area of direct interface with the YMPO Waste Package design people, this Committee needs to enter into a discussion with them. Ms. Desell agreed, and recognized a need to formalize this issue before asking Carl Gertz to shift funding to Waste-Package design. Ms. Desell hoped that eventually the IRWG might be in a position to advise the Waste-Package section on how much funding would be necessary.

- **Issues Discussion & Prioritization:** A significant portion of the meeting ^{involved} was given over to discussion of the following technical and programmatic issues, ~~A brief discussion of the issues follows,~~ in order of the priority they were given by the IRWG.

which are briefly described

Issues 1 to 4: Burnup Credit

The Group agreed that the issue of Burnup Credit and in general, design for criticality control, was the most immediate issue. It was suggested that the issue be divided into four separate issues:

- NRC acceptance of burnup credit for criticality control for the transport of PWR spent-nuclear fuel;
- NRC acceptance of overall criticality control for the disposal of PWR spent nuclear fuel;
- NRC acceptance of burnup credit for criticality control for the transport of BWR spent-nuclear fuel; and
- NRC acceptance of overall criticality control for the disposal of BWR spent nuclear fuel.

All these issues were assigned the highest schedule priorities, with results expected within 4 years.

RW-431 was of the opinion that the technical issues for burnup credit have already been solved for transport (these consist of burnup-credit calculations, poison control, fuel-cask loading geometry, and structural integrity). However, for long-term disposal, criticality control has never been addressed, and this will require extensive interaction with repository and waste-package design staff (RW-20).

Issue 5: NRC acceptance of and participation in DOE's EA on MPCs

The optimum method to make MPCs available to utilities as Storage Casks is for DOE to obtain a Certificate of Compliance under 10 CFR Part 72, via rulemaking. The rulemaking process, however, requires that an Environmental Assessment (EA) be written by the NRC. To facilitate an accelerated schedule, the meeting participants discussed options that may be appropriate for the DOE to interact with the NRC as a cooperating agency.

The Group was informed that the NRC were^{es} advised by their attorneys against cooperating with the DOE on its EAs, because it would impair the NRC's reviewer independence. It was suggested that a Safety Analysis Report (SAR) was more appropriate to support a Petition for Rulemaking, rather than an EA. The NRC would then prepare an EA on the basis of the DOE's SAR. The DOE could develop an SAR for the MPCs by 1995.

Issue 6: MPC Materials/Fracture mechanics and internal corrosion

Certain materials have not been accepted by the NRC for use in transportation casks. Examples are the use of cast iron for cask bodies, and the use of borated stainless-steel as a structural material in cask baskets. The welding of borated stainless-steel is also currently not accepted for structural purposes. The final selection of MPC fabrication materials must be evaluated to ensure timely NRC certification.

Issue 7: Licensing - 10 CFR 50, 60, 71, 72

Since the MPCs will be used for storage (possibly both at-reactor and away-from-reactor storage) as well as for transportation and disposal, the applicable regulations with which any MPC license must comply will be from 10 CFR Parts 50, 60, 71, and 72. It is important to identify any potential inconsistencies between these regulations, and ideally, to develop an integrated licensing strategy that will not allow conflicting interpretations by the various licensing groups within NRC to complicate and delay the license application.

Issue 8: Design/Licensing of Cask-to-Cask Transfer Device

Utilities that cannot handle in-pool loading of large MPCs will require some form of on-site cask-to-cask transfer device. EPRI has done some conceptual-design work for both

wet and dry transfer devices. Additionally, the DOE has a cooperative agreement with Sacramento Municipal Utility District (SMUD), in which spent-fuel transfer technology is also being studied. Additionally, the Newport News Shipping Company has a device for transferring U.S. Navy fuel, which may have civilian applications. This issue was not considered by the IRWG to be of immediate concern.

Issue 9: Transportation of MPC following storage

This issue is virtually identical to one that has been identified for the DOE/SMUD cooperative program, i.e., how to certify a spent-fuel cask for transport following long periods of storage. A spent-fuel cask is subject to periodic inspections during storage; however, the concern is that the storage cask should not have to be opened to inspect the integrity of the fuel and related cask structures prior to transport. An advantage of the MPC is that a new transport overpack will be fitted over the filled storage cask prior to transport. This should obviate the necessity to check the storage-cask seals, the integrity of the fuel and support baskets, etc. It is possible that the NRC will require some statistical monitoring and sampling of the MPCs while in storage, especially if there have been periods of transport, ~~during the storage duration~~. The IRWG does not believe that this issue requires consideration by the Group at present; the Waste Confidence Rule and cask SAR design should resolve the technical aspects of this issue. However, one member expressed the belief that this is an issue requiring design and programmatic interfaces between storage and disposal.

Issue 10: Containment Source-Term

A methodology for calculating the source-term in a typical MPC is required for containment-design purposes, and the methodology needs to be approved by the NRC. Bill Lake stated that this was an issue for both the Transportation and Disposal Departments.

Issue 11: ALARA \$/man-rem

The costs per person/rem of \$1,000 as given in 10 CFR 50 Appendix I are considered too low by the M&O, who recommend a value of \$10,000 as being more realistic for use in cost-benefit analyses. However, Ms. Desell (RW-331) believed that the \$1,000 value is too high, and recommended coordination with DOE-EH.

Issue 12: Use of MPCs with Failed Fuel

Since fuel-rod cladding is considered to be one of the spent-fuel-containment barriers, failed fuel is required to be canistered. The issue for MPCs is whether failed fuel in an MPC will require "double" containment, i.e., in an additional canister, or whether the NRC will consider the MPC itself to be an adequate containment barrier for failed spent fuel.

Issue 13: Depleted Uranium

One possible material for shield plugs in the MPCs is depleted uranium. A potential issue is whether or not the depleted-uranium shield plugs will count towards total MTU limits for the repository specified in the NWPA. The M&O will prepare a White Paper on this issue, and will argue that, since depleted uranium is "source material" and not spent fuel or high-level waste, the repository MTU limits will not apply to any depleted uranium used in the MPCs.

- **Tentative Agenda for July 7 meeting:**
 - NRC Interactions (am)
 - Finalize Charter (pm)

DOE BURNUP CREDIT WORKSHOP
June 24-25, 1993
Town and Country Hotel, San Diego, CA

- The DOE held a Burnup-Credit Workshop in San Diego on June 24-25, 1993. The purpose of the workshop was to provide a forum for the presentation of technical issues related to criticality control in cask design, using Burnup Credit, and in particular, to discuss Burnup Credit in the design of Multiple Purpose Canisters (MPCs).
- Representatives from DOE-HQ and the DOE Field Offices, Sandia, Oak Ridge, General Atomics, the M&O, and WESTON were present.
- RW-431 presented an overview of the DOE's licensing strategy with the NRC for transportation casks. The strategy used by DOE-Transportation has been to work with the NRC through the cask manufacturers, and has been reasonably successful. He stated that obtaining burnup credit certification for the MPCs is a new challenge for DOE, particularly burnup credit for disposal, as this issue has not been considered before. RW-431 listed the NRC's explicit concerns, i.e., end-effects, burnup-credit measurements, and DOE oversight of cask loading, and the NRC's anticipated concerns, i.e., benchmarking, fuel history for criticality calculations, and safety margins. He suggested that a new strategy for DOE to pursue with the NRC for the MPCs may be to continue to work with the NRC at staff level, but to also interact more with NRC management. He said that starting in Fiscal 1994, DOE intends to submit 3 Topical Reports to NRC on burnup credit: one would be on Storage & Transport issues for PWR fuels, another for BWR fuels, and the third on Disposal Issues for both PWRs and BWRs.
- The status of the General Atomics casks (GA-4 and GA-9) was presented by Jack Boshoven of GA. The capacity of the GA-4 cask is dependent on the maximum enrichment of the spent fuel, if burnup credit is not used. (Using the Fresh-Fuel Assumption, the capacity of a GA-4 cask is reduced from 4 PWR assemblies at 2.9% initial enrichment to only 2 assemblies at 4.5% initial enrichment.) To maintain maximum cask performance, GA is interested in pursuing the burnup-credit option. GA believes that using burnup credit would enhance the public safety by reducing the number of cask shipments. Among the additional data required to finalize the analyses are a revised reference problem set and agreement on bias assumptions.
- In presenting the status of the BR-100 cask, Larry Hassler (Babcock & Wilcox Fuel Company) stated that not much work has been done in burnup credit, since BWFC was redesigning its casks to address some structural and heat-flow issues. However, BWFC was in the process of updating its KENO and ORIGEN codes.

- Dick Cacciapouti (Yankee Atomic Electric Company) made a presentation on a PWR Axial-Burnup Profile database, which YAEC is developing. The database will be PC-Lotus based, and will use both fixed, in-core measurements, as well as 3-D calculations. Uncertainties increase at the ends of the fuel assemblies, though not unmanageably.
- Ron Ewing (Sandia National Laboratory) displayed a "Fork" detector assembly, and described its utility for burnup-credit verification, by measuring neutrons and gammas directly from assemblies in a Spent-Fuel pool. The system is self-calibrating and compatible with pool operations, and has been used successfully at Oconee to within 2.5% of the theoretical burnup-fit curve, after correcting for initial enrichment. A campaign to measure all 493 assemblies at Rancho Seco is being planned. Arkansas Nuclear is also considering use of the Fork system.
- Steve Bowman (ORNL) presented a verification-analysis project using reactor-restart, fresh-fuel, and mixed-oxide criticals. The strategy is to validate isotopic-prediction models by comparing with spent-fuel chemical-assay data, and to validate criticality analysis methods by comparing with fresh-fuel critical experiments. Mixed-oxide criticals are also used, and provide more controlled experiments than reactor-restart criticals. Reactor criticals have been completed for Surry Unit 1 and Sequoyah Unit 2 ~~(have been completed)~~ ②
- Michelle Brady (Sandia) presented a "single-sided, uniform-width, closed-interval, lower tolerance-band" methodology for bounding the biases and uncertainties in calculating k_{eff} for burnup credit. The methodology is statistically valid, appears to satisfy all criteria for criticality-code validation, and enables a margin of safety to be inferred. In another presentation, she proposed a "Spent-Fuel Safety Experiment" for measuring the worth of spent fuel, including end-effect measurements, using Materials Characterization Center (MCC) spent fuel.
- Jim Thornton (M&O) described the current status of the MPC Conceptual Design program, the purpose of which is to provide input for a detailed system-level evaluation to support a final decision by DOE, whether to incorporate MPCs into the CRWMS. Five MPC configurations are currently being developed in 2 weight classes (125 ton and 75 ton). One of the 5 concepts incorporates burnup credit, and is in the 125-ton range, carrying 21 PWR assemblies (as opposed to the non-burnup-credit version, which has a capacity of 17 PWR assemblies, or 40 BWR). The M&O will eventually evaluate all 4 other versions with burnup credit. For disposal purposes, the M&O intends to maximize the use of burnup credit. *single is not a range!*
- Tom Doering (M&O Las Vegas) presented the repository's criticality requirements for a disposal package. There were several issues to be considered for the design of waste disposal packages for criticality control over long periods of time. Among these are geologic occurrences, such as flooding, and other phenomena, such as the degradation of basket and cladding materials, with the resultant loss of container geometry and/or

neutron absorbers. The accurate modeling of these phenomena and their effects on the waste package and the spent fuel is an essential part of waste-package criticality design. Burnup credit for disposal packages is considered to be one part of the total criticality design problem.

DESIGN ACTIVITIES IN SUPPORT OF WASTE PACKAGE

BACKGROUND

- The M&O is continuing its development of the Multi-Purpose Canister (MPC) in accordance with the schedule outlined in the "MPC Implementation Plan" issued on February 24, 1993. The goal continues to be issuance of a summary report to DOE on September 30, 1993 to enable a decision on the integration of MPCs into the CRWMS. For additional background, refer to WESTON Docket HQW.#930729.0002.
- Planning for the second Waste-Package Workshop, to be held in Las Vegas on September 21-23, 1993, continued in this period. DOE is seeking participants to present Waste Package concepts and supporting information on materials selection, fabrication, closure, Non-Destructive Evaluation (NDE), performance assessment and testing.
- Thermal loading continues to be a major, critical issue for the Program in both the waste package and repository areas. The NWTRB devoted a Full Board Meeting to the subject during this reporting period. The scope of this meeting encompassed waste package, repository, hydrological, geological, total-systems performance, and other areas, but discussion in this enclosure will be limited to waste-package matters.

CURRENT STATUS

- At an MPC Review meeting on May 19, 1993 (Attachment 1), it was stated that materials selection for the MPC will be aimed at satisfying MGDS requirements, with Alloy 825 selected for the MPC shell, 316 stainless-steel for the basket structure, borated aluminum alloy for criticality, and helium fill-gas. Burnup strategy involves taking burnup credit, utilizing neutron absorbers and criticality-control materials, and maintaining geometry in partial flux-trap designs. Regarding costs, Lake Barrett said a "very good" and a "very, very good" canister should be offered. The M&O estimated costs at approximately \$600K if Alloy 825 is used, \$400K for stainless-steel, and \$200K for carbon steel. A two-inch wall thickness may be required, depending on the method for lifting the canister. Calculations for waste-package heat-output showed that cladding temperatures would not exceed the permissible limit of 350 degrees C.
- A meeting of the M&O MPC/MRS Design Group was held on June 28, 1993 (see Attachment 2). Major work activities were focussed on conceptual designs for the MPC, Transportation Cask, Utility Transfer System, MRS, and Cask-Maintenance Facility. Revision of functional-flow diagrams and CRWMS architecture was underway to accommodate the new systems under development. Three, 125-ton MPC configurations

are being considered: 21 PWR assemblies with burnup credit, 17 PWR assemblies with no burnup credit, and a 40 BWR assemblies design, which does not require burnup credit. A 75 ton MPC without burnup credit would contain 12 PWR assemblies, and another 75 ton MPC would contain 24 BWR assemblies with no burnup credit required. Criticality analysis of these configurations showed that a number of existing PWR assemblies cannot be included in the 21 element MPC, if burnup credit is not allowed, whereas, the 17-element MPC will be acceptable for all but a few of the existing assemblies. Thermal analyses continue to show that temperature limits in 10CFR Part 71 (transportation requirements) will be met. Testing requirements for structural analysis were outlined as well as contemplated trade-off studies involving MPC-shell materials, dimensions, shield plugs, neutron absorbers, and transfer casks. Preliminary cost estimates for the MPC ranged up to \$626K for the 21 PWR canister and \$750K for the 40 BWR canister, both using Alloy 825.

- A site-visit to the Oconee Nuclear Station, where the Nuhoms Storage System is in use, revealed that the utility (Duke Power) would be very happy to adopt the MPC technology as a solution to its future storage problems (Attachment 3). It was also learned that no water remains in the Nuhoms canister, after the vacuum-drying step that is employed. This is important in relation to the selection of materials for the MPC.
- An MPC Workshop conducted by RW-40 with M&O assistance was held on July 1-2, 1993 (see Attachment 4). The workshop was attended by representatives of the utilities, cask manufacturers, NRC, and a variety of other organizations, and had as its purpose the gathering of input from stakeholders and the public on their concerns about the MPC. DOE's object was to develop issues, not to resolve them at this meeting. A list of issues was developed, with enthusiastic participation by all present. In general, participants felt that DOE should place less emphasis on repository-design considerations and focus on near-term utility storage and transportation needs. There was a lot of criticism of the use of Alloy 825 in the MPC design, because of its expense. Bill Lee (Sierra Nuclear), for example, suggested the use of inexpensive, coated, carbon steel, as is currently used in available licensed technology, instead of expensive alloys; later, when repository needs are known, the more expensive alloys can be employed in design of the waste-package overpack, if necessary. DOE announced its intention to follow-up on the issues raised in this meeting with a second workshop in the fall.
- A number of decisions pertaining to the planned Waste-Package Workshop were made at a planning meeting held in Las Vegas on June 8, 1993 (Attachment 5). The location will be the Las Vegas Plaza Suites Hotel. A tour of Yucca Mountain will be available on September 20, the day before the Workshop starts. A draft Federal Register Notice was prepared, and the Workshop agenda and information package (to be sent to participants in advance) were discussed. A list of possible experts to serve as panelists was also prepared. The actual publication of the Federal Register Notice occurred on July 13, 1993.

- At the July NWTRB Full Board Meeting, entitled "Thermal Loading: The Integration of Science and Engineering," several salient points were evident (Attachment 6):

-There is a fundamental disagreement between LLNL and other (primarily LBL) scientists on the consequences of various thermal-loading options and the validity of the models designed to describe them. Specifically, LLNL favors an "extended-dry" strategy which involves prolonged heating of the repository to above boiling-point temperatures (to keep waste packages dry), whereas the other scientists either worry about the effects of such heating or doubt that it can be achieved for all waste packages for a sufficiently long time (LLNL is now conceding that not all packages will remain dry all of the time).

-LLNL hopes to prove it's case by use of in-situ heater and "large-block" tests, which may or may not provide convincing data by the time of the LAD scheduled for the third quarter in 1996.

-The selection of a thermal-loading strategy is said to be critical in order to make proper design decisions for the waste package in terms of materials selection, size, spent-fuel characteristics, heat dissipation, etc. The selection of a "cold" strategy would probably impact MPC designs since it is generally believed that such MPCs would have to be small. Another viable option is to decouple the MPC from the repository (i.e., use the MPC for storage and transportation but not for disposal).

ISSUES

- The issue of 21 versus 24 assemblies per MPC continued during this period, but the trend is favoring 21, primarily because of support from MGDS personnel. Criticality remains a major concern, particularly for the repository. Basket materials must maintain criticality control (i.e., assembly configuration and criticality-control elements) for long periods because of, for example, decay of Pu isotopes for 20,000 years. Flux-traps are not considered favorably because of design difficulties (heat limitations) and penalties (safety and cost). The MPC and Transportation Cask are closely coupled, and should be designed together according to statements in the June 28 meeting (Attachment 2), but there are indications that this will not be done in the RFP process. Issues emphasized in the MPC Workshop include the relative amounts of effort to be placed on repository needs versus near-term utility and transportation needs (should the MPC be a three-purpose or two-purpose system?). Cost considerations in design, manufacturing, and materials selection also constituted a major concern.

- Resolution of the thermal-loading question remains a very important issue in the context of the current program because:
 - 1) The current YMPO waste-package design depends upon a long-term hot, dry environment (to minimize steel corrosion); and
 - 2) Even if a waste-package design that is insensitive to thermal conditions is employed, non-waste-package consequences (e.g., geologically-related) may prohibit a "hot" scenario and, therefore, MPCs (and waste packages) may have to be limited in size;
- A solution to the thermal dilemma is to design a waste package that will withstand either a "hot" or "cold" thermal scenario, or both, by using a relatively thin, corrosion-resistant alloy on the outside of a thicker steel wall. This is just the opposite of the design currently being advocated by YMPO.
- A strategy worth consideration is to decouple the MPC from the repository-disposal function in the program. This would allow postponement of an early decision on thermal loading and allow pursuit of a waste-package wall-design that is insensitive to thermal loading conditions.
- Stakeholders at the MPC Workshop believe that the MPC design should be directed to storage and transportation needs rather than to repository needs.

**MEETING SUMMARY
MPC REVIEW FOR RW-1
Washington, DC
May 19, 1993**

This meeting consisted of presentations by the M&O on the status of the MPC to Lake Barrett. The agenda, which was not rigorously followed, was as follows:

- Material Selection,
- Performance Credit,
- 21 Versus 24 Assemblies,
- Long-Term Criticality/Burnup Credit, and
- Ability to Use Existing Technology.

Discussions included the following:

- Materials selection - design selection will be aimed at satisfying MGDS requirements, with Alloy 825 selected for the MPC shell, 316 SS for the basket structure, borated aluminum alloy for criticality, and helium fill-gas.
- Questioning cost-versus-performance, Lake Barrett said we should offer a very good canister and a very, very good canister. The M&O claimed canister costs would be approximately \$600K for Alloy 825, \$400K for SS, and \$200K for carbon steel. A two-inch wall thickness may be required, depending on the method for lifting the canister.
- Basket materials must maintain criticality control (i.e., maintain assembly configuration and criticality-control elements) for long periods in the MGDS₂ because of, for example, decay of Pu isotopes out to 20,000 years.
- Current strategy involves:
 - Burnup credit, fissile-material depletion and decay,
 - Neutron absorbers, criticality-control materials, and
 - Geometry and configuration in partial flux-trap design.
- Alternate strategies:
 - Moderator-displacement materials (weight limitations),
 - Full flux-trap design (heat limitations), and
 - Limit number of assemblies (safety and cost limitations).
- Limitations with criticality control in the Repository were discussed, including the question about what would happen if the waste package goes critical a long-time after closure.

- Cost savings of changing the $K(\text{eff})$ from 0.95 to 0.98 was found to be minor (\$32.8M for 4521 ²¹PWR waste packages).
- Criticality issues are burnup credit, basket geometry, and long-term poisons. Flux traps are not considered favorably because of design difficulties and penalties.
- Arguments were presented by Hugh Benton (B&W) in favor of the 21 PWR maximum size for the MPC, but Barrett continued to wonder why 24 could not be used.
- Calculated waste-package heat-output and temperatures for 21-PWR packages were presented to show that cladding temperatures do not exceed the 350°C limit.
- Existing technologies, licensed for storage, were listed (Castor V/21, Nuhoms, NAC S/T, and SN DVCC). It was noted that there is no technology licensed for both storage and transportation, although PAC NUC and NAC STC are currently working on this. Redesign of existing technology would probably be required for transportation and disposal, but costs would be high.

MEETING SUMMARY
MRS/MPC Design Group Quarterly Progress Review
Charlotte, NC
June 28, 1993

This meeting was held in the offices of Duke Engineering and Services, Inc., with DOE HQ (RW-40 and RW-20), M&O, and WESTON personnel in attendance. The agenda for the meeting consisted of the following:

- MPC System Functions and Architecture,
- MPC and Transportation Cask,
- Utility-Transfer System,
- MRS Facility, and
- Design Specifications.

Major work activities in progress are focused on conceptual designs for the MPC, Transportation Cask, Utility-Transfer System, MRS and Cask-Maintenance Facility. A breakdown of detailed tasks and their schedules in these areas was presented.

Proposals for revising functional flow diagrams and CRWMS architecture to accommodate the MPC, Utility-Transfer System, and Transport Cask were discussed, but a final disposition of this problem had not been reached.

Configurations for the MPC and transportation cask were discussed by Alan Wells, a new member of the M&O team, who appears to be very knowledgeable in the area of cask design and NRC licensing. The MPC and Transportation Cask are closely coupled and must be designed together. Three 125 ton MPC configurations are being considered; for PWRs the primary design calls for burnup credit (21 assemblies), with no burnup credit for the fallback design (17 assemblies). The BWR MPC does not require burnup credit (40 assemblies). A 75-ton MPC without burnup credit would contain 12 PWR assemblies, and another 75-ton design would contain 24 BWR assemblies with no burnup credit required. Drawings were presented showing dimensional, materials, flux-trap, welding, and other design details for these MPC configurations as well as for the 125-ton transport cask. *= 35-T more than rail load limit!*

Criticality analysis of the above configurations shows that a number of existing PWR assemblies can not be included in the 21 element MPC, if burnup credit is not allowed, whereas the 17 element MPC will be acceptable for all but a few of the existing assemblies. Shielding codes, methodology, and regulatory limits were also discussed, with indications that dose rates will not be a problem, except possibly at the ends of the container.

Thermal analyses in progress indicate that temperature limits prescribed in Part 71 of the regulations (transportation requirements) will be met, and that cladding temperatures in the

MGDS will probably be sufficiently low. Testing requirements for structural analysis were outlined, as well as contemplated trade-off studies involving MPC-shell materials, dimensions, shield plugs, neutron absorbers, and transfer casks (versus transportation casks).

Preliminary MPC cost estimates indicate a range of \$418,000 to \$626,000 for the 21 PWR canister and \$559,000 to \$750,000 for the 40 BWR canister, with the low value for a shell material of carbon steel and the high value for Alloy 825 in both cases.

Four general design approaches are being considered for the Utility-Transfer System: direct transfer, cask-to-cask, ISFSI System, and the no-MPC System case. The design process in each case consists of:

- Define project scope and deliverables,
- Define major system functions,
- Define configuration items,
- Derive subsystems and equipment,
- Solicit vendors for existing equipment and cost,
- Prepare technical report with system cost, and
- Prepare preliminary design specification.

A description of the MRS facility that handles MPCs consisted of layout plans for the transfer and cask-maintenance facilities, together with delivery schedules.

Design specifications for the MPC System, Transportation Cask, Utility-Transfer System, and ISFSI Transfer and Storage Systems are in the very early stages of development. Architecture diagrams were presented for each of these together with the QAP-3-8 Procurement Specification format.

**TRIP REPORT
VISIT TO OCONEE NUCLEAR STATION
Clemson, NC ?
June 29, 1993**

This tour was arranged for DOE and contractor personnel by Duke Power Company, and included visits to the turbine room serving all three reactors at the site, one of the control rooms, one of the pools, the ISFSI dry-storage facility, and the "World of Energy" exhibits. A considerable amount of time was taken up by paperwork, badging, and radiation checks throughout the day. A noteworthy observation was that the spent-fuel pool had a very "scummy" surface, which was explained by the guide as due to a large number of bugs that had recently entered the building when the door was opened and the need for filter-system maintenance. (This was surprising to see, since the writer had recently seen a pristine pool at the Idaho Engineering Laboratory.) The visiting group viewed the storage modules of the ISFSI from outside the double-fenced area for a short period.

A talk on dry spent-fuel storage was given by Gary Walden of Duke Power Company before our visit to the ISFSI. The need for this facility came about because the two pools at the site had been reracked twice, and further storage space was needed. The decision was made to go to dry storage as a solution in 1986, and the NUHOMS system was selected in 1987. A 10 CFR Part 72 license was approved in January, 1990 for 88 modules; 40 of these have been built, of which 22 have been loaded with spent-fuel canisters (24 assemblies in each), thereby allowing pool inventories to be reduced to prudent levels in May, 1992.

Design details of the NUHOMS-system components were provided, together with staging and loading-operating procedures. Walden maintained that no water remains in the canister after the vacuum-drying operation. (This is important in relation to the selection of materials for the MPC.) The total time required from fuel loading into the canister to storage in the ISFSI was given as 82 hours.

Occupational exposures during loading operations were reported to be decreasing over time, because of improved methods and despite the fact that the fuel to be handled is getting hotter as time goes on.

Finally, in response to a question, Walden said, "We could switch to MPCs easily. We would love to do that. Many plants have to do something in the late 90s."

**MEETING SUMMARY
MPC WORKSHOP
Crystal City, VA
July 1-2, 1993**

This workshop, conducted by RW-40 with M&O assistance, was attended by an estimated 160 persons, including representatives of utilities, cask manufacturers, NRC, and a variety of other organizations, as well as a large contingent of DOE and contractor personnel.

Lake Barrett opened the meeting by stating that the MPC is very important, and that Secretary O'Leary wants all the issues pertaining to the MPC on the table and clearly identified. He regards the MPC as a "win" for everyone, i.e., for the utilities, DOE, ratepayers, etc. DOE intends to hold another meeting in October to firm up any resolutions ~~coming out of this~~ ^{resulting from} meeting. In response to a question ~~at this point~~, he said the MPC is not the exclusive alternative yet, although it looks more favorable as time goes on; it is not a solution to the 1998 problem, but it will mitigate the problem.

Ron Milner presented the historical background of the MPC and said the goal is to have a conceptual design by the end of FY93 and availability of the MPC in 1998.

Holmes Brown, lead facilitator of the workshop, reemphasized that the purpose of the workshop was to obtain stakeholder and public comments and concerns about the MPC, and that DOE would not make any commitments at this time, i.e., the purpose was to develop issues, not resolve them.

In the open comment period that followed, Bill Lee (Sierra Nuclear) exhorted DOE to not ignore a number of licensed, cheap technologies that are already available and easily applied, citing the ventilated storage cask which employs carbon steel at 1/10 the MPC design cost. Cheap coatings, such as nickel plate, can be applied to the steel, if some corrosion protection is needed. Repository needs will not be known for a many years, he argued, and Alloy 825 can be used later on the overpack, if needed.

Bob Halstead (State of Nevada) had a long list of concerns, four of which dealt with DOE's general approach to MPC development:

- Unrealistic schedule,
- Underestimates disposal phase requirements and uncertainties,
- Ignores potential benefits of dual-purpose (storage/transport) approach, and
- Ignores stakeholder concerns about cask monitoring during storage and transport.

A Houston Power representative complained that the current MPC is too small for their 14-foot long fuel, and he expects accommodation of this fuel. On the other hand, Yankee Atomic said they can not handle 75 or 100 tons and their fuel is 4-feet shorter than standard fuel.

The meeting then divided into four teams for breakout sessions, each led by professional moderators and each covering four topics: storage, transportation, disposal/repository, and technical aspects of MPC design. M&O resource persons gave presentations in each area, and then the team developed and discussed a list of issues.

STORAGE

- DOE must consider near-term utility needs (DOE should accommodate existing fuel & handling/storage systems and unique facilities).
- Utilities need to know ASAP, system-interface requirements for timely storage-system selection.
- Repository requirements should not drive near-term, at-reactor storage.
- System requirements need to be clarified and communicated for comment, as part of the CDR Process.

TRANSPORT

- Review existing canisters to identify changes needed to facilitate transport.
- Explicitly address transport after long-term site-storage (in terms of transport facilities, population, etc.).
- Emphasize study of cost-effectiveness of materials selected for MPC.
- Improve stakeholder confidence by more direct consideration of state, local, utility issues.
- Focus design effort on maximum capacity, with compatibility in plant-facility limits, NRC requirements, 1998 schedule.

REPOSITORY

- Recognize potential MGDS-induced risks and timing:
 - Deferred implementation,
 - Thermal/weight-design constraints,
 - Consider first-phase, dual-purpose canister, and
 - Site uncertain.
- Integrate waste package for MPC with site requirements:
 - Container thickness,
 - Long-term R&D integration,
 - Corrosion extrapolation methods, and
 - Effect of design limits on safety.

- Consider thermal loading and other key MPC drivers:
 - Thermal-loading strategy affects storage, transport, and acceptance;
 - Integration of DOE defense waste and commercial fuels;
 - MPC impact on MGDS-worker exposure; and
 - MPC compatibility with other host rock.
- DOE must decide if MPC is two-purpose or three-purpose (S,T, and D).
- NRC licensing requirements should be identified, including utility-package closure requirements.
- MPC implementation should not be the basis of the decision on mode of waste emplacement (related to thermal decision).
- Thermal design of the MPC is a function of the thermal loading of the repository. Identify associated constraints and schedule impact on MPC design and testing.

TECHNICAL-DESIGN ASPECTS

- Publish design criteria; need more visibility and discussion/optimization. Establish performance specifications.
- Be cost conscious in design, manufacturing techniques, material selection (e.g., use of recycled material, etc.); identify/discuss cost drivers.
- Learn from current experience. Do not reinvent the wheel. System must handle range of fuel types.

GENERAL "PARKING LOT" ISSUES

- Stakeholder representation/input needed to define functional requirements for each phase:
 - Facility host-states/tribes/locals,
 - Public-utility commissions, and
 - Environmental groups.
- Public acceptance - MPC resolution of perceived risk - will MPC make ISFSI,MRS, repository more acceptable to hosts/general public?
- MPC system-design issues (TBD):
 - Timing/sequencing with repository,
 - Goal of universality (%SNF?),
 - Possible exclusion of Navy and HEU fuel,
 - Accommodate robotics and automation,
 - Equity/contract issues re;delivery to utilities,
 - Role of PRA/WCA in MPC-system design, and
 - Consider WIPP TR system experience.
- What is the meaning of the 1998 contract-acceptance date?
- How will NEPA requirements be satisfied?

MEETING SUMMARY
WASTE PACKAGE WORKSHOP PLANNING MEETING
Las Vegas, NV
June 8, 1993

A meeting of the Planning Committee for the Waste-Package Workshop to be held in September, 1993 was chaired by Hugh Benton (M&O/B&W); others in attendance were Alan Berusch (DOE), M.Smith (DOE), W.Clarke (LLNL), D. Stahl (M&O), T.Doering (DOE), R.Fish (M&O), K.McCoy (M&O), and H.Cleary (Weston). The meeting accomplished the following:

- Las Vegas Plaza Suites Hotel selected as location, with accommodation for up to 200 persons anticipated.
- Draft of Federal Register Announcement was reviewed and revised for publication, ASAP. Also reviewed a checklist of items required in preparation for the Workshop.
- Workshop dates are September 21-23, 1993, with September 20 set aside for a tour of Yucca Mountain for participants.
- M&O draft of a technical-information package that will be provided to participants in advance was reviewed in a cursory fashion, but the Planning Committee will complete a detailed review of this within a week's time and report back to Hugh Benton.
- There was considerable discussion and revision of the M&O draft agenda for the Workshop, which must retain some flexibility to allow for the number and nature of the specific concepts that will be proposed in response to the Federal Register notice.
- A list of mailing prospects will be prepared to include presenters at the previous workshop, NWTRB, NRC groups, various trade organizations, etc. to ensure receipt of the announcement information.
- Finally, a list of experts to be employed in the Workshop was finalized, with alternates for some of the technical areas, in the event an invitee cannot participate. Holmes Brown will again act as the Workshop facilitator.

DESIGN ACTIVITIES IN SUPPORT OF EXPLORATORY STUDIES FACILITY

BACKGROUND

- On May 27, 1993, the DOE through Reynolds Electric & Engineering Company (REECo), awarded a \$13 million contract to Construction & Tunneling Services, Inc. (CTS) of Kent, Washington for the purchase of a 25 ft diameter Tunnel Boring Machine (TBM). The TBM will be initially used to excavate a 5 mile ramp-loop as a part of the Exploratory Studies Facility. Delivery of the 720 ton TBM is expected in late spring of 1994. Ongoing tunnel excavation may continue with conventional drill and blast until the TBM arrives.
- Meeting notes from the Rapid Excavation Tunneling Conference in Boston, MA, on June 13-16, 1993 is included in Attachment 1.
- The Yucca Mountain Site Characterization Project Office (YMPO) performed management and independent technical Title II Design Reviews of Design Package 1B (North-Portal Surface Facilities) and Design Package 2 (North Ramp from portal to Topopah Spring level). These reviews were conducted at the 50 percent-complete stage. The purpose of the reviews was to provide assurance to DOE/YMP and Project participants that the design presented is technically correct, in compliance with the upper-tier documents, and satisfies the requirements of the Principal Investigators. As a result of a comment submitted on Design-Package 2, a major reconfiguration of the Exploratory Shaft Facility (ESF) has been proposed. ESF reconfiguration issues are discussed in Attachment 2. (Additional information relating to the design-review issues is available from the previous Bi-monthly Design-Issues Status Report, March 16 to May 15, 1993.)
- The MGDS Technical-Baseline Development and Transition is almost complete. By the end of July, all new baseline documents had been approved by the Change Control Board (CCB). A discussion of the Technical-Document Hierarchy Transition is covered in Attachment 3.

CURRENT STATUS

- Excavation of the ESF North-Ramp starter tunnel continues. The top heading has reached its preplanned length of about 200 ft and workers are now following up with the excavation of the bench. To date, the progress has been slow primarily because the existing ground conditions are worse than what was expected. The "pilot drive"

drill and blast plans proved to be difficult to exercise and excessive overbreak across the back was the result. Ground-support system of rock bolts, lattice girders and shotcrete had its own problems. Lattice girders did not work as intended and their use was stopped. The inside perimeter of first 40 ft of the North Ramp starter tunnel will be completely finished with a thick layer of concrete. This is primarily for aesthetic reasons. Once the bench excavation is completed to the 200 ft-mark, mining will stop, until approval for the proposed ESF Reconfiguration is given. (Note: The ESF North Ramp starter tunnel is being constructed based on design changes submitted as a Change Request to facilitate the ESF Reconfiguration. The changes to the ESF Technical-Baseline document allow for continued ramp excavation with or without the reconfiguration.)

- In order to move ahead with the ESF Reconfiguration, the following action plan has been established:
 - Proceed with construction of the North-Ramp starter tunnel at the adjusted gradient,
 - Proceed with design-review process,
 - Prepare impact analysis,
 - Present to the CCB,
 - Change Technical Baseline, and
 - Report changes in the SCP Semi-Annual Report.

When Bob Sandifer was asked by Lake Barrett at the Program Management Meeting on June 30, 1993, how much time would be needed to make the "go/no-go" decision on "reconfiguration," he stipulated about six months or approximately the first of the year (1994). A number of regulatory and other considerations regarding the proposed ESF reconfiguration have been listed and are to be included in the overall analysis.

- For the 90% Title-II Design Reviews, both Packages 1B and 2 have been split into subsets. The surface-design group has subdivided Package 1B into three packages; Packages 1B, 1C and 1D. And the subsurface-design group has subdivided Package 2, also into three packages; Packages 2A, 2B and 2C. The main reason for multiple packages is to support the rescheduling of construction activities. The 90% Title-II Design Reviews of these packages will not be fully completed until late July, 1994.
- The 90% Title-II Design Review of Packages 2A and 1B (in that order) have begun.

ESF Design-Package 2A includes the following:

- Surface and subsurface conveyor-procurement specifications and general layout drawings,
- Long-lead, electrical-equipment procurement specification,
- One-line drawings for support of TBM operations,

?

- Drawings and specifications for continued drill and blast to the Bow Ridge Fault area, including TBM launch chamber and test alcoves, and
- Transportation-system study.

ESF Design Package 1B includes the following:

- Change-House Building,
 - Shop Building,
 - Water-Distribution System,
 - Subsurface-Wastewater Pond,
 - Sanitary-Sewer System,
 - 69kV Power & Feeders
 - Site-Power Distribution, and
 - H-road, Site-Grading and Paving.
- The DOE-NRC Technical Exchange on Exploratory Studies Facility, Title-II Design Process, which was originally scheduled for late July, has been postponed.
 - Status of the Technical Document Hierarchy Transition is as follows:
 - In a July 14, 1993 letter from Gertz (RW-20) to Shelor (RW-30), it was recommended that Document Change Proposal Number 56 (DPC 56), Interim Approach for the Technical Baseline, be modified to reflect a two-phased approach in the implementation of the technical baseline; and, that the associated hold point (Hold OSC-92-003) be cancelled, since it's intent had been satisfied by the design-requirement document review and approval process.
 - Soon after receipt of this letter, Shelor responded to the Program Baseline Change Control Board (PBCCB) with the request for submittal of Baseline Change Proposal (BCP) 00-93-02, which allows for the implementation of the technical baseline in stages.

ISSUES

- Tunnel Excavation - With regard to excavation activities relating to the North-Portal starter tunnel, the following items are issues of concern:
 - 1) the lack of a geotechnical-design summary report,
 - 2) a misunderstanding of the NATM approach, such as the sequencing of excavation activities and communication between designers and constructors,
 - 3) lack of drill and blast-execution procedures and documentation of work effort,

- 4) poor control drilling and blasting techniques, resulting in excessive overbreak and irregular size and shape of openings, and
 - 5) ground-support systems used to date and those planned for the future.
- **Reconfiguration** - In addition to the nine "Considerations Regarding Proposed ESF Changes" which were presented by Carl Gertz at the Program Management Meeting on July 31, 1993, the following should be considered:
 - Interpretations of the geologic data resulting in a new and higher contact selection for the TSw1/TSw2 interface,
 - Access options for reaching the planned Multi-Test Level (MTL) located in the eastern (lower) block,
 - The fact that the stepped-layout options (15, 16, 32 and 33) of the ESF Alternative Studies (predecessors to the proposed reconfiguration) did comparatively poorly in the rankings, and
 - The transition to a new design may be difficult and time consuming, because of the degree of detail involved in development of the SCP-CD and comparing that detail with preconceptual schematics of the new reconfiguration design (i.e., emplacement modes, ventilation systems, retrieval conditions and operations, performance-conformation requirements etc.).
- **ESF Title-II Design Reviews** - The ESF design packages for the Surface Facilities at the North Portal and the North Ramp to Topopah Spring have been subdivided from the two packages for the 50% design review to at least six packages for the 90% design review. Originally, these 90% design reviews were to be completed by August of 1993, but now, they won't be finished until July, 1994. This is not as a major scheduling problem, in that the spitting of packages was done primarily to facilitate construction, while evaluating "reconfiguration" issues and major design considerations; however, the effect will be of consequence, in that more packages have to be dealt with, meaning more reviews and more interfacing between packages.
- **MGDS Technical-Baseline Transition** - ~~The~~ implementation of BCP 00-93-02 does not result in technical changes to ongoing or completed work in the areas of radiological safety, waste isolation, occupational health and safety, or environmental. The Basis for Design (BFD) for Surfaced-Based Testing Facilities (SBTF) will need to be revised for future work to incorporate the new, specialty-engineering requirements. No changes are required for current or past activities.

**MEETING NOTES
RAPID EXCAVATION AND TUNNELING CONFERENCE
JUNE 13-16, 1993
BOSTON, MASS**

About 650 individuals from all over the world attended the Rapid Excavation and Tunneling Conference (RETC) held in Boston, MA. Many of the participants were associated with Superconducting Super Collider and Yucca Mountain Projects. Ed Cording and Russ McFarland from the Nuclear Waste Technical Review Board (NWTRB) were in attendance. Carl Gertz (YMPO) gave the luncheon speech on the Yucca Mountain Project. Construction Tunneling Services (CTS), who just won the contract to construct the TBM for Yucca Mountain Project, hosted a display booth. A copy of the proceedings is available for reference.

The RETC had a wide variety of papers from tunnel design to case histories, from small to large openings, and from soft ground to hard rock. A number of papers discussed equipment and efforts to improve performance. Of special interest for Yucca Mountain Project were sessions on New Austrian Tunneling Method (NATM), Tunnel Boring Machine (TBM) Case Histories and TBM Advancements. There were no papers specifically on the Yucca Mountain Project.

In discussions with individuals from the M&O's Las Vegas office and other individuals associated with the program, the following information on the project was obtained at the conference:

- An M&O design team has been working on an "enhanced" ESF ramp-loop layout. This proposed reconfiguration originated from a comment submitted at the Title II - 50% Design Review of Package 2, which essentially stated that the grade of the north ramp should be reduced to about 3% to facilitate rail haulage for men and materials transport. The commenter also emphasized that such a change could provide for more flexibility in the design of the potential repository. The design team has selected a new Topopah Spring entry point at a location along the original ramp alignment, but out past the projected intersection of the Ghost Dance fault and at a significantly higher elevation within the TSw2 than previously used. This change will allow the ramp to be driven down at a grade of less than 3%.
- As part of the proposed new layout change, the main exploratory drift would run parallel to the Ghost Dance fault, along its west side at an offset of about 400 feet from the fault's current main surface trace. This relocation provides for several improvements, perhaps the most significant is that it provides more flexibility for the potential repository design layout. The proposed design also:

- 1) allows for a reduction in ~~the~~ grade of the main exploratory drift,

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- 2) allows for relatively short perpendicular drifts to intersect the Ghost Dance Fault, as opposed to cutting across the fault at a difficult, obtuse angle; additional characterization drifts to intersect the fault can be constructed as needed,
- 3) locates the main drifts for a potential repository in an area that most likely would not be ^{used} utilized for long-term emplacement of waste (for the SCP Conceptual Design, the area dedicated to ~~the~~ main drifts, including a considerable standoff zone, used ~~up~~ a significant swath of potential emplacement area),
- 4) better ^{utilizes} utilizes the potential repository horizon by creating two, relatively flat, emplacement blocks, separated by the Ghost Dance Fault zone; the upper, larger block would be west of the fault, while the lower, smaller block would be on the east side of the fault, and
- 5) would facilitate overall ^{use} utilization of rail for potential emplacement of waste; this is a significant improvement, if a large MPC-type waste package is used.

- These proposed changes, under consideration, may affect the ESF development schedule, but the overall impact should be small, since the additional length of tunneling will most likely ~~in itself be small~~ ^{be offset}. Additional tunnel length required for the North ramp will be made up by a shorter tunnel length at the South ramp. Also, if rail is to be used for men and materials haulage, additional schedule time should be gained, realizing that rubber-tire haulage would, ^{have} required bypass cutouts on about 2000 ft intervals. The construction of such bypasses would adversely impact TBM availability. Also, rubber-tire haulage systems usually create a washboard type road surface, due to bouncing of vehicles; this action continues to deteriorate the road surface over time and requires constant maintenance or the possible need for special road surfacing, preferably concrete.
- The proposed reconfiguration should provide more flexibility in addressing the thermal loading issue, with respect to area requirements, and possibly potential repository layout design. For an "extended-dry" scenario, the area needed for the potential repository could possibly be accommodated within the western (upper) block, thereby avoiding the Ghost Dance fault-zone completely. For an opposing low thermal-load case, a much larger area will be required. The proposed reconfiguration appears to offer more flexibility in the ^{use} utilization of the area within the current, proposed, repository-boundary limits for waste emplacement configurations than the SCP Conceptual Design. Development of other potential areas (i.e., North block) would still be feasible.
- Access ramps, main drifts and emplacements drifts for the proposed repository layout would potentially be at grades suitable for rail haulage of a larger MPC (100+tons) waste package, thus providing improved transport flexibility. This would also be an important safety issue.

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- The design-team members are enthusiastic about the "enhancements" and strongly believe that, in the long run, will yield an improved ESF layout and potentially a more flexible repository design. On the other hand, there are concerns about, 1) the timing of the change with regard to ongoing field activities; in particular, ~~the~~ excavation of the starter tunnel; and 2) the process for seeing the changes through completion. ?
- New data from ongoing coring and re-evaluation of old core-data indicates that the quality of the rock at Yucca Mountain may not be as good as originally estimated. Rock Quality Designations (RQD) values for TSw2, for instance, now appear to be somewhat lower than originally predicted. This does not mean the planned underground openings will be more difficult to excavate, on the contrary, TBM productivity may be higher in a more highly fractured rock. Lower RQD values indicate that more ground support and long-term maintenance of the openings may be required. For example, an opening that ~~required~~ ^{only} rock bolts in the SCP Conceptual Design may now need both bolts and several layers of shotcrete. Mapping of the exposed rock surface under these conditions will be more difficult. *
- The ESF Design Package 2, North Ramp from Portal to Topopah Spring level, is being subdivided into three separate design packages to facilitate consideration of the potential design changes and related ongoing studies while keeping Title-II, 90% Design Review to a workable ^{yet} reasonable ^{schedule.}

ESF CHANGES UNDER CONSIDERATION
Program Management Review Meeting
June 30, 1993 - Vienna, VA and Las Vegas, NV

At the Program Management Review Meeting (Videoconference between Las Vegas and Vienna) on June 30, 1993, Carl Gertz and Bob Sandifer presented "ESF Changes Under Consideration." There were two specific changes discussed:

- ESF Reconfiguration , and
- North Portal Entrance Redesign.

In addition, there was considerable discussion on how design changes are managed and how other impacted components of the program (e.g., Repository Design, surface-and underground-test programs) are handled in light of these changes.

HISTORY

A discussion of critical historical items, ^{that} which have implications with regard to the present reconfiguration considerations are presented here to give some understanding as to the evolution of design.

SCP-CDR Layout

The Conceptual Design Report (1987) repository layout (the "porkchop"), was conceptualized with two access ramps in the North: 1) the Tuff Ramp, which was to be used for muck haulage, sloped down at 17.9% and 2) the Waste Ramp, which was to be used for the transport of 7-ton waste containers, sloped down at 8.9%. Test-level (repository-horizon) elevation at ramp entry locations was 3100 ft.

Grievess' / PBQD TBM Layout

Starting in about 1988, a Parsons Brinckerhoff mining engineer, M. Grievess, developed a stepped-block TBM repository layout. This design was in response to D. Deere's (NWTRB) recommendation that mechanical excavation (TBM) be reconsidered as the primary mining method. (Note: TBM layouts were recommended before, but were rejected as non-conventional for a welded-tuff rock.) The Grievess' layout was an all-TBM layout. He reconfigured the repository into relatively flat blocks, on separate levels. Access between blocks was by ramps. Main drifts, which served as access to development blocks, were situated along strike of the Ghost Dance fault. The fault essentially separated the east, or lower, block from the west, or upper block. At the time of this work, new data and corresponding planar models developed by Sandia indicated that it would be possible to adjust the repository horizon up about 140 ft to an entry elevation of around 3240 ft. This higher horizon helped facilitate the Grievess' layout into the specified boundary.

ESF Alternatives Study

In 1991, the "Exploratory Studies Facility Alternatives Study" was completed. This study compared 34 options and ranked them in terms of ~~their~~ relative desirability. The winning option or top-ranking was option #30. Like the CDR case, access included two ramps: 1) a Waste Ramp in the North, again at 8.9%, and 2) a Tuff Ramp now at the South with a grade of 14%. The option #30 repository layout used essentially the same "porkchop" boundary but with the dedicated MTL at the south end. Entry elevation for ^{the} waste ramp for this option, like the SCP-CDR, was still at about 3,100 feet.

Four other options, based on the Grieves' stepped-block TBM layout, were also included in the Alternatives Study. All four of these options (#s 15, 16, 32, & 33), were different from Option #30 in that, 1) primary access to the ESF was by shaft and, 2) access to the Calico Hills was by shaft. None of these four cases were ranked very high (15 and up). A stepped-block layout, with ramp accesses to both the ESF and to the Calico Hills, was not included in the ESF Alternatives Study.

NWTRB ESF Ramp & Main-Drift Sizing Analysis

The NWTRB report (to O'Leary on March 25, 1993) ² which addressed ESF-opening sizes, ² concluded, ² assuming rubber-tired equipment for men and material supply, ~~that~~ a 25 ft-diameter tunnel would support only single-lane traffic. In order to facilitate double-lane traffic, the NWTRB recommended a 27.5 ft diameter tunnel. (Rail scenario was not investigated in this report.)

M&O White Paper on Ramp Diameters

On April 1, 1993, L.D. Foust (M&O Manager) submitted a White Paper on Ramp Diameter. In section 5.4.1.3 of that report, advantages of a rubber-tired system over a rail-mounted system was presented. Also, the report stated that for a rail-mounted system "3% grade is a good practical limit". One argument for rubber-tired system is that ramps can be steeper and, therefore, shorter, which has a significant impact on construction schedule and cost. Speed limits for rubber-tired with good roadbed is 25 MPH ² while rail is limited to 15 MPH. Rail requires constant extension ² whereas rubber-tired requires a smooth surface.

ESF Title-II Design

At a later date, ¹ repository-horizon entry-elevation used for the SCP-CDR was adjusted up, ^{was} from 3,100 feet to about 3,240 feet. This adjustment was based on better data coupled with an improved planar layout geometry model ² which Sandia Labs had developed. (As noted earlier, this elevation adjustment was already included in the Grieves' TBM design.) This change in elevation allowed the designers to lessen the grade of ^{the} North ramp to 6.9%. This ramp-grade was used in the ESF Title-II Design. The South ramp was changed completely in that a new portal location was selected that would result in a very slight grade of only 1.6%. (Background information supporting this major grade-change from 14% to 1.6% was not located.)

At the ESF 50% design review of ~~the~~ Package 2, Title II (North Ramp from Portal to Topopah Spring level), a comment was submitted by Dana Rogers (M&O Mining Engineer) that the ramp

grade should be reduced from -6.85% to something flatter than -3%, which would then allow for the utilization of rail haulage for the transport of men and materials in support of the TBM operation. (The option of rail haulage had been suggested by the NWTRB on previous occasions, and the comment was elevated to the DOE/YMPO level of management before a resolution [Enhanced ESF Layout] was proposed.)

Waste Package Design

The SCP-CDR used thin-wall canisters (about 7 tons each) with in-hole emplacement. Haulage of these containers were to be by rubber-tired trucks which could travel down ramps at the steeper grades used in the SCP-CDR design. Sometime in 1991, at the suggestion of the NWTRB, a more robust waste container was studied. This eventually led to the further studies of a Multipurpose Canister (MPC), which is now being seriously evaluated. This container will weight in excess of 100 tons. Transport of these very large containers into the repository has yet to be fully addressed. Initial studies suggest that rail haulage may be the best, if not the only, option.

Thermal Loading

Coupled with the MPC design is the Thermal-Loading Issue. An "extended-dry" case or "above boiling" strategy would require less area for emplacement of 70,000 MTU³ of waste. If such a strategy was applied, all the waste might be emplaced in the available repository area west of the Ghost Dance Fault. The Ghost Dance Fault might then become a non-issue.

CURRENT STATUS

The following design changes have been proposed:

- Reduce the grade of the North Ramp to -2.1%, while keeping the alignment the same. New ramp is about 2000 ft longer at 8500 ft and intersects the TSw2 at a higher elevation of ~3490 ft (Originally the SCP-CDR elevation was 3100 ft.)
- Realign the main exploratory drift to a near N-S direction, from the new entry location, to intersect the original alignment of the South ramp. (The exploratory drift had a NE-SW alignment and was inclined up at about +4.5%. It essentially divided the "porkchop" repository-block in half.) The proposed exploratory drift is designed so, the initial grade from the North is almost flat at +0.5%, for most of its length; then, near the South, the grade increases to +2.0% and finally to +2.6%. This drift will run parallel to the Ghost Dance fault with a westerly offset from the original surface trace of about 400 ft. Access to the Ghost Dance fault for characterization can be done at selected locations along this drift. Three such side-drifts are proposed.
- The South ramp to the surface will now be steeper than before, going from -1.6% to -2.6%.

- The Dedicated Main-Test Area will still be located in the Eastern or lower block. The exact elevation of this area is unknown. Access will most likely be via ramp, which loops around and down in the Northwest corner of the repository. Grade and excavation method of this ramp is currently unknown. Schematic indicates a tight radius, which would preclude TBM. There is also the possibility that access would be off of the exploratory main, but that drift would have to decline down at a fairly steep angle to avoid the TSw1/TSw2 contact.
- Extensions of both ramps toward the west were also shown on the schematic. The North ramp would extend all the way to Solitario Canyon fault at grades ranging from -2.3% to +0.5%. The South ramp would extend to the Southwest corner of the "porkchop" at -0.6% to -0.9%. When these extension are to be made and how has not yet been determined.

ISSUES

- **DESIGN REVIEW PROCESS** - *Is the design-review process working as it should?* Two items indicate that it is: the ARMCO structure and the ESF reconfiguration. Both of these changes came about as a result of the design review process. The ARMCO structure was first introduced as a result of a design review (Title II, Package 1A-90%) and was later reconsidered for improvements (Title II, Package 2-50%), and then finally eliminated as a result of a total reevaluation of the structure function. The ESF reconfiguration evolved from a comment submitted in the Title II 50% Design Review of Package 2. The process required that the design team evaluate their options for response, to include major conceptual modifications, including a thorough reevaluation of the proposed repository geologic setting and baseline concepts for layout and emplacement. Because these changes are so far reaching, proper implementation of design-change controls will be instrumental in achieving a clean and traceable transition.
- **ESF/ACD INTERFACE** - *Is the ESF/ACD interface working?* Evidently it is, the ESF reconfiguration reflects a change, which incorporates ACD design flexibility. Interface activities are enhanced by the fact that ACD design staff are working closely with the ESF design team on their current design efforts. The only major draw back appears to be the lack of project history among team members. Design issues, which have been dismissed in the past are resurfacing. This is typical of long , complex projects with constantly changing staffs.
- **MPC CONSIDERATIONS** - *What are MPC implications with regard to ESF reconfiguration and the ACD?* Changes being made to the ESF ramp-loop include important considerations for a bigger package, such as decreasing ramp

and potential repository-drift grades. This not only makes for safer operating conditions, but also allows for the option of rail transport of waste packages. A larger waste package will require larger openings than were used in the SCP Conceptual Design. Associated impacts of larger openings on repository design need be addressed; some concerns include: opening stability over time and differing thermal conditions, support systems for a selected range of rock conditions, extraction ratios and the resulting minimum drift-spacing, retrievability scenarios, ventilation and blast-cooling requirements, and performance-confirmation inspections. Also, the fact that a large waste package will be placed on the drift floor rather than in an emplacement hole creates other concerns, which have not yet been fully addressed and evaluated.

- **AREA REQUIREMENTS & THERMAL LOADING** - *There are many repository design concerns with regard to thermal-loading scenarios. Are these concerns being addressed to the detail needed?* The current strategy for thermal loading is to keep all options open, while critical decision-making data is collected. It is important that the ACD and related ESF work carry the extreme thermal-loading scenarios (i.e., 20 to 120 kW/acre) and feed design-and operations-related considerations into the thermal-loading decision-making process. For example, an "extended-dry" case will create an extreme, "hot" working environment, requiring a complex operations system. Details of such a system need to be evaluated in order to address a multitude of safety-related issues.

- **GHOST DANCE FAULT** - *Will a redesign of the ESF ramp-loop affect the quantity and quality of data required to characterize the Ghost Dance fault? A relocation of the main exploratory drift to run parallel to the Ghost Dance fault would most likely result in more and better data because; 1) the exploratory drift itself becomes a source of data; and 2) short crosscuts, perpendicular to the exploratory main, can be driven at any number of locations.*

Is there enough flexibility in the ACD process to incorporate a major shift in the location of the mains from what was originally in the SCP-CD? The SCP-CD was essentially a pre-conceptual design. The intent of the design was to outline the design process, so that, in subsequent designs, all the necessary steps would be addressed. The Ghost Dance fault is a scissors fault ^{that} divides the repository into two main blocks: the east block and the west block. Repository layout is better suited by utilizing these blocks as separate areas for repository development. Also, by positioning the mains along the fault zone, fewer usable emplacement acres will be lost.

Prediction of FZ width existing + rock quality = serious uncertainty that may compromise safety, increase cost of ground-support, lead to obliteration of hydrologic/geologic phenomena by much shatter + increase the potential for infiltration.

- **ACCESS TO THE MULTI-TEST LEVEL (MTL) IN THE ESF** - *How will the MTL be accessed?* There are at present only two options, 1) by way of a ramp from the main exploratory drift on the west, or upper block, down to the lower, east block, or 2) via a ramp ^{that} which tightly curves in a clockwise manner off the

extension of the North ramp to the lower block. Neither of these options appear satisfactory at this time. The ramp would have to be quite steep to accomodated the elevation change over a fairly short distance and the ramp, which appears too tight a radius for the proposed TBM, would create significant delays in the schedule.

- **TSw1/ TSw2 CONTACT SELECTION - *How critical is the geologic selection for the ESF North Ramp entry loaction?*** ~~The~~ reduction of the ramp-grade is highly dependent on the ability to move the horizon-entry location of the proposed repository up a significant distance. This new entry location is based on new data obtained from a corehole ~~NRG#6~~ which is located on the opposite side of the Ghost Dance fault from ~~where~~ the entry location ~~is~~. Extrapolation of this data across the fault zone is highly speculative, especially considering that ~~the~~ displacement along the Ghost Dance fault ~~is not~~ is uncertain. Flexibility needs to be built into the design, if the high-lithophysal contact is discovered, upon completion of the North-ramp tunnel, to be much lower than current predictions.
- **CONSIDERATIONS REGARDING PROPOSED ESF CHANGES -** The following list is a summary of specific considerations compiled in reponse to the ESF reconfiguration.
 - Orientation of the exploratory main drift in relation to the major joint-set,
 - Minimum overburden requirements,
 - Height above water table on the east or lower block,
 - Minimum of four accesses,
 - Early east-west drift across the block for vertical variation and representation of the characterization data,
 - Offset to Ghost Dance fault and faulting in southeast quadrant,
 - Implementation of test program:
 - Location and required dip of the east-west drift,
 - Potential for emplacement near the bottom of the TSw2 ^{horizon}
 - East-west repository step and the introduction of perturbations in performance of the system, and
 - Effective design-control program to manage changes.

TECHNICAL DOCUMENT HIERARCHY TRANSITION
Videoconference Meeting - YMPO in Nevada and TRW in Virginia
June 25, 1993

The meeting was held in the 6th floor videoconference facility at TRW offices in Vienna, VA, June 25, 1993. Copies of the available handouts are in the WESTON GDD files.

The substance of the meeting was contained in two presentations from YMPO:

- 1) Status of MGDS Design-Requirements Documents (DRD^s) and Preliminary Impact Analysis by Tom Geer (M&O/Duke), and
- 2) Prerequisites for Hierarchy Implementation by Sam Rindskopf (M&O/TRW).

OCRWM Requirements Document (CRD), MGDS Requirements Document (MGDS-RD), and the Site Design & Test Requirements Documents (SD&TRD) have all been approved by the Change Control Board (CCB). The ESF Design Requirements (ESFDR) and the Surfaced-Based Test-Facility Design Requirements (SBTFDR) should be approved by the CCB by July 12, 1993, one week before the start of the 90% design review of ESF packages 2A and 1B. Preparation for Basis for Design (BFD) for these two packages will coincide with review dates. Requirements staff and ESF designers are working together to ensure that the BFD and ~~the~~ designs for both packages are responsive to the new ESFDR. CCB approval of the Engineered-Barrier Design Requirements (EBDR) and the Repository Design Requirements (RDR) are expected by the end of July, 1993. The initial BFD for the RDR is slated for the end of September, 1993.

A preliminary impact analysis was performed for the new SD&TRD, ESFDR and SBTFDR. Thirteen areas of potential impact were assessed and the following preliminary conclusions made:

- Document preparation and review process did not identify any new requirements in the areas of radiological safety, waste isolation, occupational health and safety, or environmental.
- No technical changes to completed work are required.
- Pending completion of the QAP 6.2 reviews and CCB actions for the ESFDR and SBTFDR, the new hierarchy should be made effective for those documents to support the 90% design reviews of packages 1B and 2A.

STATUS OF MGDS ISSUES

1) What are the SD&TRD issues?

The issues involved SD&TRD traceability checks, which revealed clerical errors, such as paragraph references being incorrect but no substantive errors or omissions, which might effect QA traceability were found.

2) How will the 90% design review be done without having the new hierarchy requirements in place?

Based on the expected CCB approval dates for ESFDR and SBTfDR and preparation of the associated BFD's, the 90% design review for ESF packages 2A and 1B will be done against the new hierarchy requirements. Since no new technical requirements have been identified, except for specialty engineering requirements, the GROA design requirements are essentially the same as in the old baselined Repository Design Requirements..

The associated issue of NRC review of the design process will be addressed separately in a Technical Interaction with the NRC on July 27, 1993 in Las Vegas. CANCELLED!

Part of the transition effort has involved insuring traceability of these items, as well as identifying paragraph numbers between the two generations of documents that do not match, and creating matrices to show how various parts do match.

Since no new technical requirements have been identified, except for specialty engineering requirements, and known impacts are minor (mostly editorial), construction work should not have to be interrupted to effect the change to the new hierarchy.

3) Study-Plan issues

Assessments of the technical adequacy of study plans must be made by technically qualified persons who have QA training necessary to assure that quality assurance concerns are satisfied. (Example cited: Vince Iorii cannot sign-off on study plans; Dyer or someone with his technical qualifications, ~~has~~ to do this.)

An associated issue is how to handle procedures of the national laboratories, USGS, and other participants, which have their own specialized procedures. The decision on this issue is pending completing reviews with the participants.

Reviews completed indicate that some revisions may be necessary, but the identified impacts and likely effects are mostly editorial and not substantive.

4) Basis for Design issues

The thinking is that the basis for design need not be complete for the 90% design review, but it does need to be complete by the time underground construction starts.

Basically, for the ESF and SBTf design and construction, the designs of these facilities contain no technical changes; so, no changes are anticipated in construction. The only exceptions to this are in the Raytheon Services Basis for Design for design package 1A of the SBTf. At this point there is no estimate of the magnitude of the impacts.

PREREQUISITES FOR HIERARCHY IMPLEMENTATION

- 1) Vertical traceability has been established for all requirements from the appropriate parent documents.
- 2) Horizontal traceability has been established for all requirements between the documents and the current baseline. This horizontal traceability has been done at all levels.

It appears that the requirements for each system-component, as well as the system, have been completed satisfactorily. In terms of packages 1B and 2A, no technical impacts have been identified. Furthermore, the performance specifications are unchanged between the old and new hierarchies, and the changes involve technical, engineering requirements, which, as noted, do not affect packages 1B and 2A.

3) Hold-point issues

Elimination of the QA hold-point is apparently necessary to begin the 90% design review. This will probably be done with a letter from Gertz to Shelor, detailing exactly what has been done to effect the hierarchy transition. In effect, the letter will honor the requirements of the hold-point by default, because all of the hold point requirements will have been fulfilled and described in the letter. Some discussion between RW-30 and YMPO ensued, because of questions of who's responsible for doing what, and RW-30's desire for exact descriptions of what was done to establish vertical and horizontal requirements-links and analyze the impacts of the transition on ongoing operations.