



## **SRS Citizens Advisory Board**

### **Nuclear Materials Management Subcommittee**

#### **Meeting Summary**

August 26, 1999  
North Augusta Community Center  
North Augusta, SC

---

The Savannah River Site Citizens Advisory Board (SRS CAB) Nuclear Materials Management (NMM) subcommittee held a meeting on Thursday, August 26, at the North Augusta Community Center to discuss the Nuclear Material Integration (NMI) and canyon feed update, progress on the melt and dilute treatment for aluminum-based spent nuclear fuel and DOE's response to the Defense Nuclear Facilities Safety Board (DNFSB) TECH-22 report on stabilizing DOE-owned spent nuclear fuel.

#### **CAB Members**

Tom Costikyan  
Earnest Marshall

#### **Stakeholders**

Mike French  
Lee Poe  
Bill McDonnell  
Bob Overman  
Chuck Keilers, DNFSB  
Todd Davis, DNFSB  
Paula Austin  
John Austin  
Russ Messick  
Thad Adams  
Marshall Miller  
Andrew Duncan  
Brandon Haddock, Aiken Standard  
Douglas Leader  
Carl Mazzola  
Ernie Chaput  
C. Armitage  
Jim Oliver  
R.T. Davis

#### **DOE/Contractors**

Randy Ponik, DOE  
John Anderson, DOE  
Charlie Anderson, DOE  
Charlie Anderson, DOE  
Jim Giusti, DOE  
Drew Grainger, DOE  
Donald Bridges, DOE  
George Mishra, DOE  
C.E. Sessions, DOE  
Marc Woodworth, DOE  
Dave Huizenga, DOE-HQ  
Howard Eckert, DOE-HQ  
Jay Bilyeu, DOE  
Chuck Goergen, DOE  
W.F. Swift, WSRC  
Mark Schmidt, WSRC  
Craig Martin, WSRC  
Donna Martin, WSRC  
Mark Barlow, WSRC  
John Dickenson, WSRC  
Mark Dupont, SRTC  
N.C. Iyer, SRTC

## **Introduction**

Tom Costikyan, CAB NMM chair, opened the meeting with a brief summary of the CAB's stance on keeping the SRS canyons in operation until an alternate technology is proven for stabilization of spent nuclear fuel. Costikyan said the CAB has made several recommendations to DOE in support of the canyons, including the most recent recommendation endorsing a DNFSB report suggesting that DOE maximize the use of the canyons while they were still in operation. This recommendation resulted from a DNFSB presentation on July 22 to the CAB NMM subcommittee and review of the Tech-22 report. He said the CAB NMM subcommittee scheduled the August 26 meeting to hear more details on Nuclear Material Integration activities, the melt and dilute technology and DOE's response to the DNFSB report.

## **Nuclear Material Integration and Canyon Feed Update**

Don Bridges, DOE-Materials and Facility Stabilization, provided the first presentation of the evening that provided details on potential additional nuclear materials throughout the DOE complex possibly requiring processing in the SRS canyons. Bridges explained that in 1997, DOE began an effort to identify all nuclear materials in the complex and the proposed disposition paths of the materials. The first effort was the Processing Needs Assessment Study that focused on identifying only DOE materials compatible with the canyons for processing and those requiring additional review. The latest project, the Nuclear Material Integration project, still ongoing, will identify all nuclear materials in the complex and the desired endstates.

Bridges emphasized, however, that utilization of the canyons is based on the Phased Canyon Strategy endorsed by the Secretary of Energy in July 97 and on the *SRS Paths to Closure* plan.

Bridges then focused on the NMI effort and said the NMI team had identified 1000 nuclear material pieces in the DOE system, with 60% having a defined disposition path and 40% with the remaining paths to be identified. Bridges said DOE has essentially identified all canyon eligible material and is screening the remaining 40% for potential canyon feed. DOE-SR's responsibility now is to see how additional materials suited for canyon processing would impact the canyon schedules.

When the first canyon utilization roadmap was developed in December 1998, several firm and proposed missions were identified. Those include materials in the original SRS stabilization program (2/95), emergent needs (4/97), material identified in the Rocky Flats Residue EIS (11/98), material added due to the 94-1 Implementation Plan 'revision 1' (12/98), future materials expected from decisions in the SRS SNF EIS (12/99) and materials expected from the uranium off-specification fuel project (10/99).

As DOE conducted the NMI effort, canyon eligible materials were listed as a "first level or second level contingencies". The group of materials in the first level contingency includes the following:

- Off-specification highly enriched uranium (HEU)  
Approximately 1.7 MT (Metric Tons) at four sites
- HEU/Plutonium (PU) classified components  
85 items at Rocky Flats
- HEU components with Pu contamination  
Approximately 250 items at Rocky Flats
- HEU contaminated with Pu  
Approximatley 260 kg at six sites
- Irradiated EBR II and Fermi 1 Blanket Material  
Approximately 260 kg of Pu
- LAMPRE Fuel  
Small quantity at Hanford

Several members of the public said the HEU should have been identified earlier. Dave Huizenga, Associate Deputy Assistant Secretary of Fissile Materials and Facility Stabilization, agreed but explained that it was not until the NMI effort that DOE went beyond the Environmental Management (EM) borders and looked at materials owned by Defense Programs (DP), Materials Disposition (MD) and universities stored at EM sites or expected to come to EM sites. He also said DP does have a disposition program for HEU but it could not handle the plutonium-contaminated HEU. As a result, processing is one of the few options left for DP to pursue.

Bridges also explained canyon processing serves as a "backup" for both the first level and second-level contingency materials identified in the NMI. He said there are no current plans to process the materials through the canyons. Lee Poe, public, asked for the amount of time added to the canyon schedule if the first level materials were processed through the canyons. John Dickenson, WSRC Nuclear Materials Storage and Stabilization Division 94-1 manager, said first level contingency materials would not add a considerable amount of time.

Some of the second level contingency materials (see slides 9, 10, 11) such as the 1.4 MT of uranium-233 at Oak Ridge would significantly impact the canyon schedule. Bridges said, however, technical aspects would drive DOE's decision to process some of the second level material in the canyons. For example, DOE would prefer not to make significant changes to the canyon process in order to stabilize materials.

Concerning the U-233, Poe said SRS produced the material in its production reactors. Bridges also confirmed that the U-233 was the vulnerable material identified in the DNFSB's Recommendation 97-1. Huizenga added that DOE might choose to save the material as a national resource.

Many of the materials in the second level contingency do have a disposition path, Bridges pointed out. Sand, slag and crucibles originally slated for stabilization in the canyons are now being sent directly to the Waste Isolation Pilot Plant (WIPP). Much of the low-grade plutonium residues (20% - 30%) may be accepted by the MD program, commercial vendors may accept the off-specification U-236 and the high-purity plutonium metals and oxides will likely be converted to mixed oxide fuel.

The 2100 MT of uranium-core N-reactor spent nuclear fuel at Hanford will likely be directly disposed of in the geologic repository, Huizenga added. He said major modifications would have to be made to the canyons if the fuel was considered for processing at SRS.

Poe asked Huizenga if DOE was confident that the N reactor fuel could be directly disposed of in the repository—was DOE years or months away from knowing? Huizenga said DOE was years away but working constantly with the Office of Civilian Radioactive Waste Management (OCRWM) and the Nuclear Regulatory Commission (NRC). He said DOE is currently focusing on quality assurance issues.

Concerning the high purity plutonium from plutonium pits, Poe asked if the issue of impurities in the pits was resolved. Ernie Chaput, public, said a liquid finishing/polishing process is planned to remove gallium from the pit material. Poe then asked if the canyons would be used to prep the plutonium for mixed oxide. Chaput said he understood that smaller scale facilities would be used to conduct the finishing. Huizenga asked how the canyons would be impacted if MOX prep operations were conducted there. Dickenson said DOE conducted several studies of existing, greenfield and a combination but the final decision has not been made.

In reviewing the canyon schedules again, Bridges said only two to three years would be added to H Canyon and less than six months to F Canyon if the first level contingency materials were added. Poe asked why the U-233 was not included in the revised schedule. Bridges said Oak Ridge had a vigorous stabilization program and it may be able to accommodate the U-233. In addition, Huizenga said much of the material may be used for medical isotopes.

Poe asked if Oak Ridge had a processing capability and/or facility. Huizenga said Oak Ridge does not but a consortium of organizations may consider building one. Huizenga emphasized that DOE is also considering using the canyons and melt and dilute to stabilize the U-233.

In discussing the current canyon schedule, Bridges displayed a slide (Slide 13) that depicted the canyon schedule impacts from the DNFSB Recommendation Implementation Plan with the potential first level contingency plan. Todd Davis, DNFSB site representative, asked if the decision to send Rocky Flats sand, slag, and crucible was included in the chart. Dickenson said the schedule would have to be renegotiated to reflect the change in decision.

Chaput said DOE-SR's draft July 1999 *Paths to Closure* document laid out two to three different schedules—one consistent with funding and the other stating SRS's needs. He said it appears canyon operations would be compromised if the funding becomes limited.

Huizenga said he is committed to find the funding for both canyons, but stated the schedules have already slipped due to earlier funding losses. He said the original canyon baseline of December 1998 is no longer a reality. For example, the stabilization of americium/curium would likely slip by six months or more. Huizenga said there was significant disconnects between planning and funding.

Bob Overman, public, asked how the canyons would be impacted if the stabilization of the 18 MT of foreign and domestic SNF was included in the schedule. Dickenson estimated about nine years would be added to the canyon schedule. The extended schedule would result from the volume of the SNF and the period of time it will take to come to the site.

Huizenga said this explains the linkage to melt and dilute. DOE has no plans to operate the canyons for an additional nine years (or 2019) at \$100 million per year just to stabilize the foreign and domestic fuel. He said it is vitally important to bring another technology on line.

Bill McDonnell asked what occurs with the canyon schedule if the second contingency level is included. Bridges said the second contingency list includes a significant amount of material and would greatly extend the canyon schedule.

McDonnell then asked if there is a potential to stabilize some of the SNF. Chuck Keilers, DNFSB site representative, said he would like to address that question. As he pointed in his July 22 presentation to the CAB NMM subcommittee, the DNFSB suggested through a letter and report that DOE maximize use of the canyons. He said SRS would achieve a greater risk reduction by stabilizing the foreign and domestic reactor fuel containing higher fission products before stabilizing material with negligible fission products. Another suggestion included accelerating shipments of Idaho SNF fuel to SRS and processing it before 2010.

Poe asked if DOE had considered using F Canyon along with H Canyon to stabilize materials SNF. Dickenson said SRS historically processed the material with higher fission products in H Canyon, although DOE-SR has looked at a number of scenarios including one in which only F Canyon operates. In the F Canyon case, Dickenson said the assumption included a potential desire for DOE to blend down the HEU and sell it to commercial facilities. Poe said economic advantage is a benefit the canyons offer that melt and dilute does not offer.

When concerns on bringing the melt and dilute online in a timely fashion were voiced by several members of the public and CAB, Huizenga said despite all efforts, schedules continue moving to the right. For example, he said the 2000-2001 window to have melt and dilute technology tested and operational is no longer achievable. In fact, he emphasized that the entire canyon schedule has changed dramatically since the 94-1 Implementation Plan because DOE had not started the Processing Needs Assessment Study or the Nuclear Material Integration project. Huizenga said he does not believe there will be any nuclear disposition path surprises at this point.

McDonnell again asked if there is room in the canyons schedule to stabilize some SNF. Huizenga said even if DOE processes the material listed in the first contingency schedule, the canyons would operate until 2019 and DOE has no plans to operate the canyons for that length of time. He said DOE must find a technology other than the canyons. Poe said DOE could possibly consider a new chemical process.

Costikyan said the CAB never said it did not have faith in the melt and dilute technology, particularly since the Board heard from Milt Levenson of the National Academy of Sciences that the technology was promising. Rather, the CAB asked DOE not to abandon the one "life preserver"—the canyons.

In closing, Bridges stated that DOE currently has no plans to process first or second level contingency materials listed in the NMI in the canyons. The path forward includes developing an action plan to ensure appropriate actions are being taken for those materials. In addition, DOE must develop a policy on how materials will be used (as a national resource or be dispositioned), and integrate NMI with other DOE programs. Most importantly, Bridges said, DOE would be specific on when the canyons will be used.

Poe asked who was involved in the NMI effort. Bridges said the DOE-Albuquerque and DOE-SR offices were supporting EM-60. Huizenga said it was the first time DOE conducted a complex-wide sweep of materials and their disposition paths.

Chaput then asked if a technology has to be proven before it could be considered a viable disposition path or before a facility such as the canyons would be shut down. Huizenga said it would be foolish to shut down the canyons if DOE was faced with some big uncertainties. Overman said shutting down the Purex Process at Hanford was one example of DOE making a bad decision.

Chaput said the biggest issue with South Carolina stakeholders is that they do not want material to come into the state and not have a route out. He added the state must have confidence that the technology and waste form will be acceptable.

Huizenga said he believes DOE can say that the form from melt and dilute will be acceptable. Chaput said the CAB could possibly ask DOE to put such statements in writing.

### **Melt and Dilute Treatment for Aluminum SNF/Response to DNFSB Tech 22 Report**

Natraj Iyer, Materials Technology manager, SRTC, said his responsibility at SRS is to work with all operating divisions in developing materials technology plans and to lead the alternate technology program for aluminum-based SNF. Iyer said the melt and dilute technology dilutes the element to 20% or less of uranium. He explained most of the fuel elements were similar, with the typical element about 3 and ½ feet long and 3 and ½ inches square. The elements, clad with aluminum, have a uranium core. Four different types of SNF are slated for melt and dilute, while uranium metal core fuels will be processed through the canyons. Over 70% of the fuels overseas are high quality (no breaching) and when it arrives at SRS, the fuel elements are placed in wet basins consisting of high water quality. He added that the potential for radioactive releases of the majority of the fuel is so low that the U.S. DOT allows DOE to ship the SNF without placing it in a can.

Iyer said the SRS basin management program is so effective that the International Atomic Energy Agency (IAEA) is using the SRS program as an international ISO standard. SRS has not experienced corrosion in the basins since they were upgraded in 1996. The water quality is also very high, Iyer said. The Foreign Research Reactor (FRR)/Domestic Research Reactor (DRR) fuel could be stored for 10 to 15 years if necessary.

Overman asked how DOE ensures there is no surface contamination. Iyer said SRS uses a "sip" test to check for contamination. Poe asked if corrosion stops once fuel is placed in the high quality basins. Iyer said the corrosion does stop and added that the water is constantly circulated and chlorides are removed.

Iyer then described the melt and dilute process. The assemblies are placed in a standard induction furnace, melted and shaped into a crucible. The crucibles would be stacked in a 17-inch canister and placed in a shipping container for co-disposal with high level waste. A video showing the melting of an unirradiated element was shown. He said the furnace is enclosed and the only way radionuclides can leave the furnace is through the offgas system. Iyer emphasized that the National Academy of Sciences stated in its report on treatment of aluminum-based fuel, "All of the technologies necessary to make this system function successfully have been used in other applications, and it should be a relatively straightforward exercise to bring them together for aluminum fuel treatment."

Addressing concerns on the acceptability of the melt and dilute waste form, Iyer said DOE has a memorandum of understanding with NRC. In its review of the technology, NRC has stated that melt and dilute would be an acceptable waste form. Iyer added that the flexibility of melt and dilute will allow DOE to add material if necessary to meet requirements. Huizenga said that in the latest review of the technology by NRC, which was the week previous to the CAB NMM meeting, NRC again stated the waste form would be acceptable. The waste form testing is now an ASTM standard guide form.

Concerning criticality, Iyer said it could be easily managed with poisons. And as stated earlier, the content of the form can be as high as 20% uranium. He also added that melt and dilute reduces storage volume. Poe asked about the temperature required to melt the element. Iyer said the melting point is 646 degrees. The SRTC scientists have also evaluated some of the most badly damaged fuel in an instrumented test canister and no problems arose.

In response to specific comments about DOE's unsuccessful efforts at many new technologies, Iyer said SRTC is following a rigid project management improvement plan. In this plan, SRTC builds on the extensive fuel experience at SRS (target and fuel fabrication, Mark 31 slug manufacturing and basin management/upgrades). The process then includes bench scale to pilot scale tests and continuous waste form qualification testing.

Overman asked if anyone from outside SRS played devil's advocate. He said DOE does not have enough independent review of projects. Iyer said they are working very close with the DNFSB and Keilers agreed. Keilers added, however, that the DOE response currently being discussed is a draft response. At this time, the DNFSB has not received a formal response from DOE. Iyer also stated that the program was reviewed by the National Research Council of the National Academy of Sciences and will be continuously reviewed by NRC.

Iyer then described the melt and dilute process validation that involves SRS, Argonne National Laboratory, USC-Columbia, Idaho National Environmental and Engineering Laboratory and the DOE Office of Radioactive Waste Management. The bench-scale testing of a few pounds is conducted first. Next a small scale testing using 1 materials test reactor (MTR) element is done followed by a bench scale test of an irradiated coupon. After a small scale irradiated MTR is successfully conducted, design will begin. If DOE had stayed on schedule, Huizenga said, the project would have been completed in 2005 or 2006. Two to three years have now been added to the schedule.

In Iyer's final slides, he addresses the technical challenges identified by the DNFSB in the Tech-22 report. Huizenga also pointed out at this point that the public should consider the DNFSB as an outside organization or devil's advocate responsible for reviewing the technical aspects of melt and dilute.

Poe asked how the cesium is captured from the melting process. Iyer said it is captured in a filter and the filter may be placed in SRS's high level waste process. SRS is already managing cesium and zeolite. In response to a question from the audience, Iyer said they do not intend to capture the noble gases, which he added were below the national limit for releases.

Keilers said one of the DNFSB's concerns is that the emissions go into the building and not directly out of the stack because the building does not have adequately reliable confinement and ventilation. Keilers

added that Building 105-L may not be an appropriate location for such a facility, given its age. He stressed the DNFSB is looking for a deliberative process using a systems approach to design the facility and considering inputs and outputs. Poe said the release of the noble gases in the canyons is no different from what is being proposed. SRTC scientist Harold Peacock said the entire issue has been reviewed by SRS safety and that a huge canyon building is not needed for the melt and dilute process because very little noble gases are released.

Huizenga said DOE would not have spent millions of dollars if they did not have confidence in the scientists and the technology. McDonnell said DOE must still conduct a risk analysis and determine what are the real technical challenges. Iyer said the Westinghouse Safety Management Systems organization, an independent company, has already conducted many audits and it serves as devils advocates. McDonnell said he still has concerns whether the form will be acceptable in the repository. Huizenga said the amount of fuel is so small in context with the commercial fuel he does not believe DOE is going to have issues with the waste form.

Poe asked why melt and dilute was considered as an alternative in the treatment of sodium-bonded fuel at Idaho. Huizenga said the technology is viable if the fuel is decladded. He also said DOE is considering melt and dilute to stabilize Uranium-233.

As the meeting concluded, Costikyan said the CAB would not suggest abandoning melt and dilute. Keilers said the DNFSB is not opposed to developing new technology but believes that DOE should not build in a total dependence on a new, unproven technology. Poe questioned if pursuing a new technology is the best choice of funding, particularly if funds could be applied elsewhere to support a larger risk reduction. Costikyan said a delay in funding of the melt and dilute would be very worrisome for the CAB. Chaput reiterated an earlier statement that stakeholders could possibly want a formal commitment from DOE not to shut down the canyons until a technology is proven and a waste form qualified to the same level as high-level waste. If not, the state of South Carolina has to take on the risks.

McDonnell said DOE needed to pursue the new technology as well as process some SNF in the canyons. Huizenga said there would be no change in policy of using a combination of melt and dilute and some processing. He said it is most important, however, that DOE be prepared and have a stabilization technology for the future. He said many of the domestic research reactors would continue operating well into the next century. DOE must spend some money on melt and dilute to bring it online, he added.

*Issues:* Lack of funding and extending the schedules for melt and dilute, need for additional peer reviews of the technology, waste form qualification to the same extent as the high level waste.

*Actions:* Tom Costikyan to develop a recommendation based on suggestions from public attendees.

***Meeting handouts may be obtained by calling 1-800-249-8155.***