

Mr. Ralph Stein, Acting Associate Director
Office of Systems Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy RW-24
Washington, D. C. 20545

OCT 13 1988

Dear Mr. Stein:

This letter transmits the NRC staff's list of open items from documented NRC and DOE interactions on the Waste Acceptance Process (WAP) over the past six years. The NRC staff committed to providing this list to DOE by October 12, 1988, and your staff likewise committed to provide NRC with an open item list at this same time. This commitment was made at the last Technical Exchange Meeting on the WAP held September 29, 1988.

These open item lists were developed so that the NRC and DOE staffs could track WAP progress. The next meeting we have should focus on development of an agreed-upon list of open items which will be tracked and jointly amended as necessary by NRC and DOE throughout the WAP. In addition to reaching the agreement on a list of open items, DOE should provide a proposed approach and schedule for resolution of each open item on this list.

The NRC staff would like to propose December 12 and 13, 1988, for the WAP open item resolution meeting to be held at NRC Headquarters in White Flint.

Should you have any questions concerning this matter please contact Wayne Walker of my staff on FTS 492-0447.

Sincerely,

ORIGINAL SIGNED BY

John J. Linehan, Chief
Project Management and Quality
Assurance Branch
Division of High-Level Waste Management

Enclosure: As stated

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ENCLOSURE OF NRC STAFF'S LIST OF OPEN ITEMS

FROM DOCUMENTED NRC AND DOE INTERACTIONS ON THE WASTE ACCEPTANCE

PROCESS OVER THE PAST SIX YEARS

- (1) The vast majority of tests supporting glass as a waste form have not been conducted using the water, temperature and radiation environment likely to be encountered in a repository. Is this still the case? (11-4-82 Ltr. Martin to Hindman)
- (2) There is uncertainty regarding how the glass will interact with the other repository components. (i.e. the engineered barrier system.) Has some or any of this uncertainty been addressed? (11-4-82 Ltr. Martin to Hindman)
- (3)
 - a. The range of physical and chemical properties incurred in the glass monolith should be demonstrated. Also, corrosion/leach test data should show that glass within the demonstrated range of physical and chemical properties will have acceptable degradation rates under repository conditions. (2/85 Ltr. Clark to Hannum)
 - b. The NRC will provide comments on the waste composition test matrix before WVDP begins confirmatory testing. When would this be needed? (2/85 Ltr. Clark to Hannum)
- (4) The pour canister should be compatible in service with that of the overpack so that the overpack is not degraded during service by reaction with the pour canister, e.g. enhance degradation of the overpack after breach of containment due to galvanic corrosion. (2/85 Ltr. Clark to Hannum)
- (5) Designers should also assure that mechanical interactions between the pour canister and the outer liner do not have an adverse impact on the outer liner during shipment. (2/85 Ltr. Clark to Hannum)
- (6) Designers should assure that sufficient material margin exists in the pour canister to withstand the interim storage for a conservative period of time (perhaps 30 years). (2/85 Ltr. Clark to Hannum)

NOTE: DOE should complete the following six activities before design of the waste form is finalized. (12/16/85 Ltr. Miller to Stein)

- (7) Establish a Quality Assurance Program.
- (8) Allocate performance, i.e., specify the design objectives of the waste package and its component parts. The design objectives should include the environmental conditions that the waste package will experience and the design degradation rates of the individual components.
- (9) Select a design reliability target for the waste package and its component parts. This should be supported by an analysis of the consequences of excessive rates of degradation from some fraction of the waste packages.
- (10) Specify a method for assessing the performance of the waste package and its component parts.
- (11) Identify the data base required to support the performance assessment and the data base that exists.
- (12) Identify a plan and a schedule for acquiring additional data that may be needed. This plan should clearly identify which DOE organization is responsible for the acquisition of the data.

- (13) Restatement of concerns from 2/5/85 letter Clark (NRC) to Hannum (DOE).
- a. What tests have been performed on the borosilicate glass and what are the results of those tests or waste properties?
 - b. Also we have stated the need to review preliminary waste package performance assessments, the specifications for the solidified product and sampling procedures including a quality control plan for production and sampling.
- (14) We continue to encourage DOE to complete the six activity items recommended in our letter of December 16, 1985, before producing the WVDP and DWPF high-level waste forms. We believe that such a course of action would minimize the risk of producing waste forms that would not be accepted by the repository. (5/30/86 Ltr. Greeves to Linehan transmitting staff comments on WAPS.)
- (15) DOE should plan to interact with NRC on the Waste Form Compliance Plan, the Waste Form Testing Programs, and the Specific Waste Form Qualification Reports (5/30/86 Ltr. Greeves to Linehan).
- (16) Each specification for waste form should contain a section on references the documents that support the various sections of the WAPS should be cited. (5/30/86 Ltr. Greeves to Linehan)

NOTE: Items 17-21 are from Technical Exchange Between NRC/DOE 8/1/86.

- (17) DOE/RW will provide the following Waste Acceptance Process documents to the NRC for review when they are completed:
- a. Waste Acceptance Requirements (WAR)
 - b. Waste Compliance Plans (WCP)
 - c. Waste Qualification Reports (WQR)
 - d. Preliminary Specifications without the reserved items resolved as revised as per NRC comments, 6/30/86
 - e. Waste Form Descriptions for DWPF (DP-1606, Rev 1) and WVDP.
- (DOE/RW is the NRC contact point for the Waste Acceptance Process)
- (18) DOE/ID will meet with the NRC at West Valley to exchange technical information relevant to the WVDP. DOE/SR will explore mechanisms to exchange technical information with the NRC and contact the NRC by 8/8/86.
- (19) DOE/RW agrees to consider the NRC's list of proposed issues for discussion at a DOE/NRC Generic Waste Package Meeting and get back to NRC by the end of August 1986.
- (20) DOE/RW will provide the NRC with an updated copy of "Generic Requirements for Mined Geologic Disposal Systems" (GR-MGDS) when available.

- (21) NRC will consult with the NRC Office of General Counsel regarding the DOE proposal to submit the WAPS with the reserved items resolved based on NRC's concurrence, including the NRC Office of General Counsel, on the approach and testing program for qualifying glass for disposal in the repository. The NRC review of the approach and testing program would include consideration of the information provided in the SCPs, the performance allocation to be proposed by DOE and the qualification programs described in the WCPs.
- (22) DOE-OCRWM committed to provide certification of the QA programs for the waste producers and the basis for the DOE certification. Do we have this? (8-1-86 DOE Observation).
- (23) Waste producers QA plans (following DOE approval) and administrative procedures. Do we have them? (8-1-86 DOE Observation).
- (24) Reports of DOE audits of the waste producers and their contractors. Do we have them? Are we planning any observation audits of DOE and contractors? Has DOE conducted any audits of the waste procedures and their principal contractors? (8-1-86 DOE Observation).
- (25) Specification 1.3 (Radionuclide Release Properties) - This is a reserved item in the April 1987 issue of the WVDP WAPS. When will these specifications be developed? Performance allocation has been specified for the waste form in the CDSCP and these specifications were to be developed in parallel. We also need to interact on performance allocation test plans and procedures. (8-1-86 NRC Observation).
- (26) NRC staff position on production glass sampling is that it's necessary and needed in view of observed problems with low-level waste process control programs. DOE will consider production sampling in the development of the WCPs. The May 1987 WVDP WCP indicates some level of production glass sampling. (8-1-86 NRC Observation).
- (27) QA Programs - We have questioned DOE that we need to be involved in the audit process. (8-1-86 NRC Observation).
- (28) Has NRC reached an agreement on sampling of radioactive production glass from the melter? (12-11-86 Mtg. Objectives)
- (29) Has agreement been reached on the basic elements on scope of the DWPF process control program? (12-11-86 Mtg. Objectives)
- (30) Has agreement been reached on interim glass testing objectives (e.g. release rate) while the reviewed items in the WAPS are being researched? (12-11-86 Mt. Objectives)
- (31) Has agreement been reached on NRC QA audits? (12-11-86 Mtg. Objectives)
- (32) Has a list and tentative schedule for future interactions been made? (12-11-86 Mtg. Objectives)
- (33) Has input been provided on current DOE WAP document preparation schedule? (12-11-86 Mtg. Objectives)

- (34) Has the detailed strategy for determining the frequency of sampling and testing been provided in the WCP? (12-11-86 Mtg. Agreements)
- (35) Has the frequency for initial sampling and testing and supporting data been provided in the WQR? (12-11-86 Mtg. Agreements)
- (36) Implementation of QA document and related NRC oversight role remains open. (12-11-86 Mtg. Agreements)
- (37) Was a bibliographic list of Savannah River reports related to glass technology transmitted to NRC, States and Indian Tribes? (12-11-86 Mtg. Agreements)
- (38) Was NRC placed on glass technology report distribution? (12-11-86 Mtg. Agreements)
- (39) Has DOE's concern been resolved in regard to NRC's regulatory basis for expecting DOE to provide information on level of sampling, process control, QA etc. on waste form production regardless of how much performance is allocated to the canistered waste form. (12-11-86 DOE Observation)

NOTE: NRC Observations 12/11/86 Mtg Items 40-50.

- (40) The thermodynamic studies will be helpful in developing an understanding of the mechanisms of degradation (i.e., release mechanisms) of borosilicate waste glass. It is unclear to the NRC, however, that two of the assumptions on which the studies are based will be verified. These assumptions are: 1) that the hydration reactions occur congruently; and 2) that it is the sum of reactions of components, weighted by mole fraction.
- (41) Long-term testing of borosilicate waste glass should be considered in order to ensure that release mechanisms remain unchanged.
- (42) The in-situ testing at WIPP will be helpful. The same types of tests should be considered in the repository site characterization plans.
- (43) The DWPF canister closure weld process appears to be capable of producing high-quality welds. However, non-destructive examination issues need to be evaluated.
- (44) The site-specific leach tests should be performed under a suitably conservative range of repository conditions as defined in the site characterization plans because waste form production will start before the sites are characterized. For example, leach rates should not be based on saturation but on a conservative flow regime. Also, it is possible that defense waste will be co-mingled with spent fuel; therefore, higher test temperatures should be considered.
- (45) DWPF plans to use process control and sampling as the basis for acceptance of the waste form. In order to do this, process variables and samples at various points in the process should be correlated with destructive testing of full-size non-radioactive glass monoliths.

- (46) If the DOE decides to take no credit for the waste form in controlling release of radionuclides, it will still be necessary to characterize the waste form. For example, a performance assessment of any failed waste packages should be based on supportable estimates of radionuclide release from the waste form. However, the sampling requirements may be lower than if the performance assessment were based on the waste form alone meeting the performance objectives. The DOE performance assessment should determine the level of sampling required to support it.
- (47) The NRC considers Eh and oxygen fugacity as a subject that still has not been resolved. This subject should be on the agenda for future waste package meetings of the repository projects.
- (48) DWPF discussed methods to measure properties of the waste form indirectly by microwave and by infrared techniques. DWPF indicated that the success of these indirect methods could affect the sampling program. DWPF asked if this would modify the need for production sampling. The NRC staff reply is that production sampling would still be required for process control and to obtain direct correlations with process qualification testing, although frequencies might potentially be modified.
- (49) In the July 31, 1986 meeting between the DOE and the NRC on the Waste Acceptance Process, the NRC expressed concerns about the limited QA oversight by the NRC proposed for DWPF (see NRC Observation #3 in the 7/31/86 meeting minutes). The same approach was described in this meeting and the staff continues to have the same reservations. The DOE proposed oversight consists primarily of NRC review of the QA plans and results of the DOE audits of the QA program. This approach differs from that to be utilized for the OCRWM repository projects where the NRC will independently audit participants to gain confidence in the adequacy of the QA program. The staff continues to believe that its ability to make findings on the adequacy of the QA program at DWPF as it applies to items and activities which affect the performance of the waste form in a repository would be impaired by the approach DOE has proposed.
- (50) The DOE indicated that a number of applicable QA requirements will apply to DWPF including NQA-1, the NRC QA Review Plan, Appendix B of Part 50, and others. The NRC and the DOE-OGR staffs agreed that most of the QA Review Plan requirements should apply equally as well to DWPF as to the repository projects. The NRC staff is available to consult with the DOE on the adopted requirements and on deviations from the QA Review Plan.
- (51) The NRC requested that formal points of contact be established for the WVDP and DWPF programs to interface with the NRC staff. The DOE indicated that it would consider establishment of points of contact. However, the DOE felt that a formal written agreement may be required to establish the points of contact. The DOE would discuss this matter with their management at a meeting. (12/11/86 Mtg. Open Item)
- (52) DOE-NE agreed to provide copies of Material Characterization Glass Technology Data Base reports to NRC, affected States and Indian Tribes through DOE-OGR. Has this occurred? In addition, DOE-NE agreed to place NRC and NBS on distribution lists for subsequent reports and forward such reports to the affected States and Indian Tribes through the existing DOE-OGR procedures. (2/18/87 Mtg. Agreements).

DOE Observations: 2/18/87 Mtg. Items 53-55

- (53) Durability testing of WVDP glass formulations by Catholic University of America (CUA) suggests that the presence of carbon steel, bentonite, high pH, and reducing conditions tend to reduce the durability of glass (i.e., increase the leachability). Carbon steel and bentonite are candidate materials for repository waste package designs, and high pH and reducing conditions are expected in some repository environments.

DOE notes that integrated testing of glass waste forms in repository environments is to be carried out under the cognizance of the repository projects. Some testing is underway and comprehensive plans for integrated testing will be discussed in Site Characterization plans now being prepared. These plans will be discussed in the context of the performance allocated to the various components of the engineered barrier system and the demonstration of compliance with the regulatory requirements.

- (54) The West Valley Demonstration Project has provided technical reports and other documentation to the NRC for their information and review; this practice will continue to be implemented as defined in the Memorandum of Understanding (MOU) between the US DOE and US NRC for the WVDP. Additional information desired by NRC's Division of Waste Management should be handled through the existing mechanism.
- (55) DOE notes that the high-level waste pour canister, including the final closure weld, provides only a contamination control function at the repository during the pre-closure period prior to insertion in the disposal container component of the repository waste package. The waste canister will provide no post-closure waste isolation function.

NRC Observations: 2/18/87 Mtg. Items 56-62

- (56) The final closure design for the canister is yet to be selected. The canister configuration and design of the final closure should be resolved prior to production processing. The design of the final closure should be established so that the canister can be machined or otherwise prepared or shaped before being loaded and, therefore, minimize the necessity for future remote operations.
- (57) Envelope conditions that bound the significant environmental parameters should be established for each of the candidate repository sites. The degradation behavior of WVDP glass should be determined under these envelope conditions. The envelope conditions from the salt and basalt sites should include the presence of iron in the groundwater that will result from the corrosion of carbon steel overpacks.
- (58) Glass density determinations can serve as sensitive indicators of compositional changes. Changes in density of ± 0.0005 (gram/cm³) can be used to signal compositional changes on the order of ± 0.5 to 1.0% by weight in certain oxides. Offsetting changes in certain oxide components can, however, produce no change in density. For that reason, density could be only one of several methods used to monitor compositional constancy. Slurry feed viscosity may be useful as would composition analyses on the finished product.

Density determinations could be performed on each and every log, whereas compositional analyses could be performed on a corroborating sampled basis. Samples for both the above determinations could be obtained from shards from the top surface of each canister.

A target density could be established for a desired composition. If that composition were to change, a new target would then be established.

- (59) West Valley noted that a small percentage of the total glass log production might be outside the waste acceptance specifications. Perhaps the greatest concern is that the durability of the logs might be lower than targeted. Discussions with the repository organizations should be initiated to identify whether these are a problem and, if so, to outline an approach to dealing with it.
- (60) Some glass compositions will degrade more rapidly when exposed to high humidity (e.g., 75% RH) than when totally wet (e.g., 100% RH) or relatively dry (e.g., <50% RH). If such a condition alternates with a wet (washing) condition, the long-term degradation may be enhanced. It is suggested that this phenomenon be studied.
- (61) Leach test programs at CUA and PNL involve testing some samples of the same composition at both laboratories. This interlaboratory cross testing offers an important validation of leach rates and other glass properties. The NRC staff encourages use of this approach in DOE test programs.
- (62) Under contract from the NRC, the NBS has a Data Base Management System (DBMS) for use in compiling reviews of DOE waste package test data. Software is being written to adapt the DBMS to the requirements of this data base. The experiences of the NBS workers may serve the Materials Characterization Center in the current database activity being undertaken.

NRC Observations: 2/3/88 Mtg. DOE/NRC Items 63-65

NOTE: Certain agreements made by the NRC at the Technical Exchange last year are apparently still open items, they are:

- (63) A preliminary plan for the frequency of sampling of the melter feed product will be provided in the Waste Compliance Plan currently scheduled for release in September of 1988. WVDP is coordinating input from Savannah River with regard to the Waste Compliance Plan and resolution of WAPS.
- (64) Sampling Capability

The capability for sampling glass shards from the top of the production canisters is included in test plans.
- (65) The effect of iron corrosion products in the groundwater on leaching behavior of glasses has not yet been assessed.

- (66) OCRWM integrated schedule and milestones for all of the WAP-related activities at the DWPF and the WVDP. This should include production, compliance demonstration, technical review, and qualification activities for both technical and quality assurance efforts. (10/12/88 Ltr. Linehan to Stein transmitting Mtg. Minutes)

Note: Meeting observations and actions from 9/30/88 Technical Exchange Meeting between NRC and DOE transmitted to DOE on 10/12/88. Items 67-74

- (67) NRC requested that DOE provide a description of the integration between waste producer specifications for the waste form and the performance allocation assigned to the waste form in the SCP.
- (68) Toward the end of the Waste Acceptance Process, the NRC staff would like to see a preliminary performance assessment for the waste package, including the waste form. This would be an integrated look at the performance of the entire waste package, using the most up-to-date tests and information including available site characterization data and taking into account the site specific anticipated process and events.
- (69) OCRWM proposed a process and milestones for the NRC review of the Waste Acceptance Documents. The staff will provide feedback on the proposal within one month of receiving an integrated, OCRWM-approved process and schedule.
- (70) The schedule for quality assurance reviews presented by OCRWM was inconsistent with previous plans for NRC review coordinated between the staff and OCRWM. The staff will continue to follow the present schedule unless changes in priorities are formally requested by OCRWM.
- (71) The staff needs to evaluate OCRWM's plan for qualifying the DWPF and WVDP QA programs. QA qualification should include document review, and audits by OCRWM. In order for the NRC staff to have confidence that OCRWM is qualifying these programs, NRC involvement would at least consist of observation audits. OCRWM agreed to allow the staff to participate as observers.

Besides the observations discussed above there were several other items requiring actions by DOE:

- (72) OCRWM will provide by November 30, 1988 the schedule and method of documentation to describe the DWPF Process Control Program (PCP).
- (73) OCRWM will provide NRC with a statement and supporting documentation as to how, in developing the performance allocation, OCRWM considered anticipated performance characteristics of the DWPF glass in the repository environment.
- (74) OCRWM will request by letter NRC review of the revised WAPS and WCP within two weeks. At the meeting OCRWM requested that NRC initiate these reviews promptly.