

# THE U.S. DOE'S WASTE ACCEPTANCE PROCESS

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## ABSTRACT

The U.S. DOE developed the "Waste Acceptance Process" to ensure that high level waste forms (other than spent fuel) produced for repository disposal would be compatible with repository licensing requirements. The Waste Acceptance Process defines a sequence of documents and activities by repository designers and waste producers which provide the necessary waste form characteristic and repository performance data to support preparation of the repository license application.

Key to the success of the Waste Acceptance process have been the Waste Acceptance Committee, which is responsible for ensuring the technical adequacy of the specifications and requirements developed in the process, and frequent consultation with the NRC technical staff to ensure that regulatory concerns are properly addressed. The fundamental principal which is guiding the Waste Acceptance Process Activities is that waste producers are responsible for producing quality waste forms to meet repository specifications; the repository program is responsible for demonstrating that waste forms so produced will perform acceptably in the repository to allow regulatory requirements to be satisfied.

## BACKGROUND

The Nuclear Waste Policy Act of 1982 (Public Law 97-425 of January 7, 1989) required the President to evaluate the disposal of high level waste resulting from atomic energy defense activities in a civilian repository. The Department of Energy performed the necessary evaluation of the factors prescribed in the NWPA and recommended to the President that these defense wastes be disposed of in the civilian repository. The President approved this recommendation and directed the Secretary of Energy to proceed with development of the repository on that basis.

For many years prior to the passage of the NWPA, the DOE's Office of Defense Programs had been active in developing processes and waste forms to stabilize the high level wastes from defense activities. Initial emphasis was on the waste at the Savannah River Plant with longer range plans to address wastes at Hanford and the Idaho National Engineering Laboratory. In a parallel effort, DOE's Office of Nuclear Energy, as part of its remedial action efforts at the former spent fuel reprocessing plant at West Valley, New York, was developing a process and a waste form to stabilize the high level wastes presently stored in tanks at that site. Borosilicate glass was chosen as the preferred encapsulation medium for both Savannah River's Defense Waste Processing Facility (DWPF) and for the West Valley Demonstration Project (WVDP), and development work was proceeding on that basis at both facilities.

Although it was well recognized that the stabilized high level waste forms to be produced at these facilities would eventually be disposed of in a geologic repository, and informal cooperative activities among the scientists at the waste producer facilities and those working on the repository projects were being routinely conducted, it was not until the President's action discussed above that the need for a formal, disciplined process to ensure that waste forms produced at DWPF and West Valley would be

acceptable for disposal in a repository was acted upon. It was also recognized that the schedules (The current schedule is shown in Fig. 1) for completion of facilities at DWPF and at West Valley would result in production of waste forms several years before the repository license application was to be submitted. Because of this, the DOE would be proceeding at the risk that waste forms produced at these facilities may not be acceptable for disposal under the repository license. Furthermore, key process design and development decisions (principal among them being the selection of borosilicate glass for the waste form matrix) had already been made at both facilities, and substantial commitments of resources based on these selections had also already been made. Because of these, the development of requirements and specifications for acceptable waste forms by the repository program was constrained to recognize these choices and provide sufficient flexibility to accommodate the more advanced waste producers.

On the other hand, there were waste producers who were only in the early stages of development, (i.e. HWVP) and only in the most preliminary stages of planning (i.e. INEL). The concerns of these producers were that requirements established based on consideration of the more advanced producers might be overly restrictive to their own programs, and unnecessarily eliminate design and process options prematurely. The preference of these producers was that only the minimum set of "absolute must" requirements be specified to permit their design and development work to proceed.

At the same time, DOE was evaluating three geologic media (salt, basalt, and tuff) for the first repository and different media (granite, shale) for a second repository. Because of the fundamental differences in the media under consideration, the perceived requirements for waste form acceptability at each of the projects were fairly diverse, as were the strategies for compliance with regulatory requirements then being developed by the repository projects.

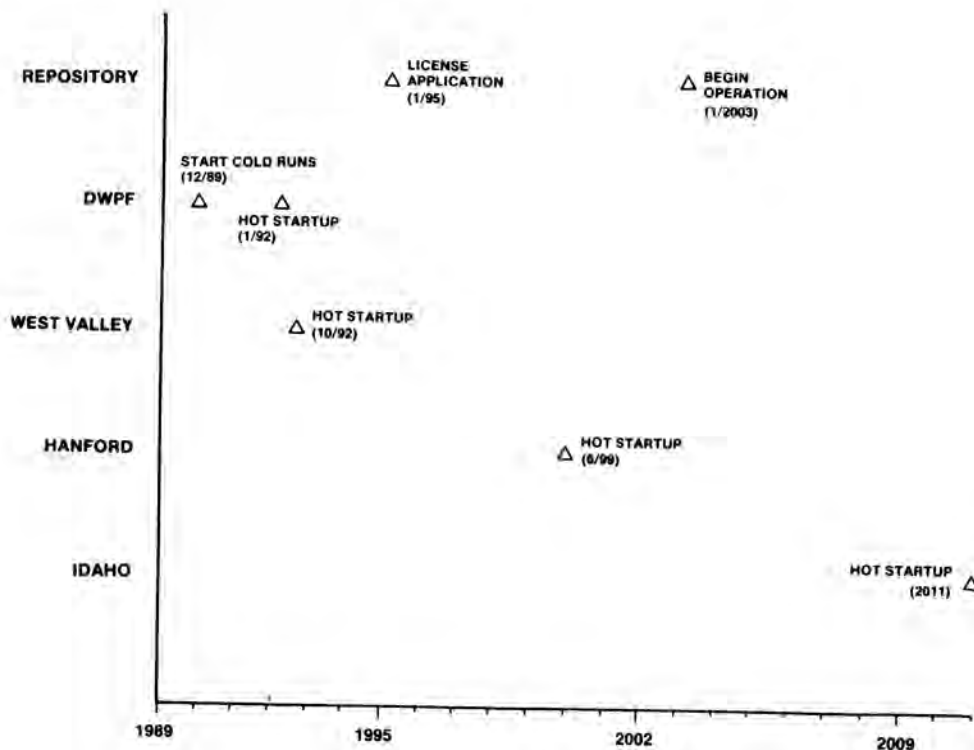


Fig. 1. Key Milestone Schedule.

Furthermore, only conceptual design work on repositories and waste packages had been completed, with the second repository having not even that; consequently, there was little deep insight into requirements beyond the performance goals and design criteria of 10 CFR 60. There was an obvious need for a formal disciplined process to ensure that waste forms produced are consistent with repository licensing requirements and to develop and implement this process consistent with the imminently urgent DWPF and WVDP schedular needs. It was to meet these needs that the DOE developed the Waste Acceptance Process.

**THE WASTE ACCEPTANCE PROCESS**

The Waste Acceptance Process (WAP) (Fig. 2) defined a document hierarchy and an orderly sequence of activities for the communication of repository disposal requirements to waste producers and for development and communication of waste form characteristics and production process information needed to support preparation of a repository license application and subsequent repository acceptance of wastes. In parallel, the repository program develops the necessary waste package design and site specific waste form performance information needed for the license application.

The six key documents required by the Waste Acceptance Process are:

1. Waste Acceptance Requirements (WAR) Describes minimum technical requirements for waste form

acceptability and identifies documentation necessary for incorporation of a waste form into the repository planning base.

2. Waste Form Description Document (WFD) Provides information required by WAR on a specific waste form to be considered for repository disposal.
3. Waste Acceptance Specifications (WAS) Specifications for acceptance of specific waste form for disposal.
4. Waste Form Compliance Plan (WCP) The waste producer's plan for compliance with specifications in the WAS.
5. Waste Form Qualifications Report (WQR) A compilation of test results and analyses which confirm that a specific waste form, when produced in a controlled fashion, will comply with WAS specifications.
6. Production Records Documentation containing information on product characteristics obtained from actual production waste forms which verify that they have been produced, handled, and stored in accordance with WAS requirements.

Since the implementation of the Waste Acceptance Process, many of the things just described have changed somewhat. The Nuclear Waste Policy Act Amendments of 1987 eliminated two of the first repository candidate sites from further consideration, leaving only the Yucca Mountain Site to be characterized for the first repository. Work

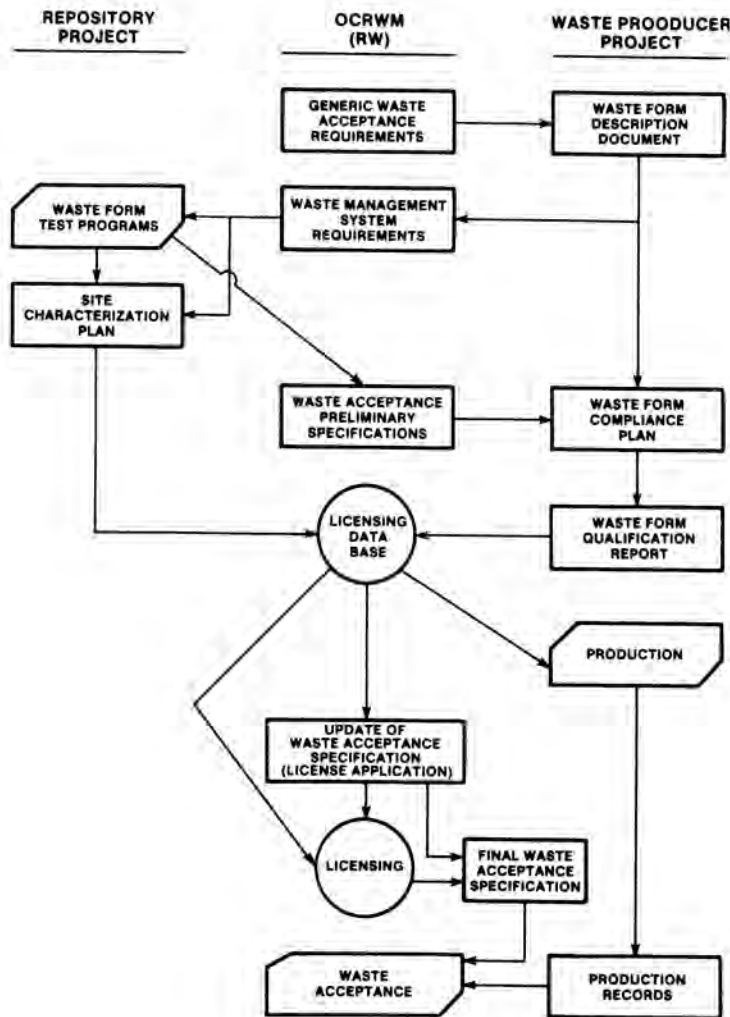


Fig. 2. Waste Acceptance Process.

to identify a second repository site was suspended, with DOE to make a recommendation on the need for a second repository after 2007. However, although the project schedules for both DWPF and West Valley have suffered some slippage, both facilities' schedules still call for production to begin before submittal of the repository license application.

Despite these changes, however, the basic Waste Acceptance Process, first implemented in 1985, is still considered to be sound and is still the plan being followed.

The implementation and the success to date of the Waste Acceptance Process has emphasized two key

features:

- The Waste Acceptance Committee
- Frequent consultation with the NRC staff.

The Waste Acceptance Committee (WAC) is composed of DOE contractor representatives with technical knowledge of repository or waste producer project requirements. (The organization of the WAC is shown in Fig. 3). The WAC is responsible for ensuring the technical adequacy of the Waste Acceptance Process documents produced, and for ensuring that the documents properly address or accommodate each project's individual interests. Where inevitable conflicts arise, these are referred to DOE's Materials Steering Committee (MSC) (which directly oversees the WAC activities) for resolution. The MSC is composed of representatives from the Offices of Civilian Radioactive Waste Management (RW), Nuclear

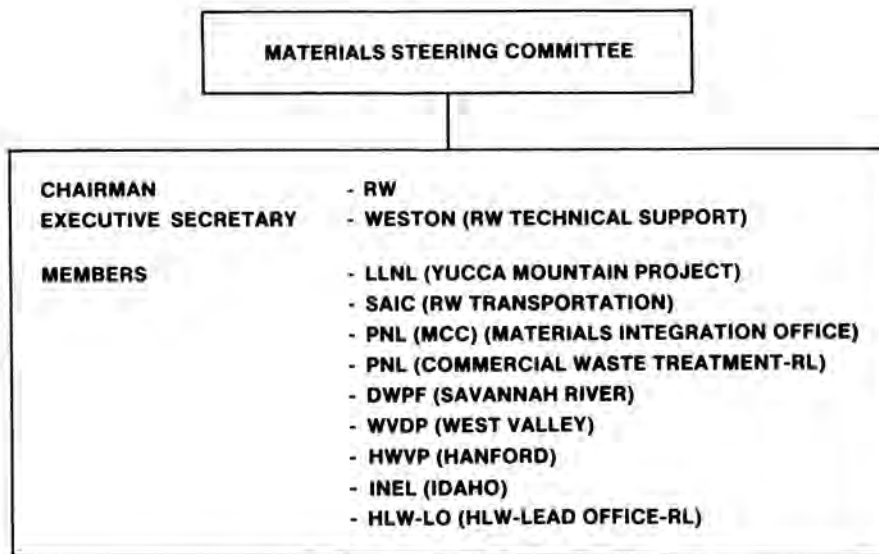


Fig. 3. Waste Acceptance Committee Organization.

Energy (NE), and Defense Programs (DP) and also includes cognizant DOE field office representatives. The WAC is also responsible for identifying waste acceptance issues requiring management attention to the MSC.

The frequent consultations with the NRC staff ensure that the staff is well informed of the technical plans of DOE for ensuring the adequacy-for-disposal of waste forms produced prior to licensing. These interactions also provide the opportunity for valuable feed-back from the NRC staff of its concerns, and provide invaluable guidance to DOE in the formulation and conduct of its programs. These interactions with NRC and DOE's responses to the expressed concerns of the NRC staff will bolster DOE management confidence in support of decisions to start-up the DWPF and West Valley facilities in advance of repository licensing.

**STATUS OF DOCUMENTS**

Since the implementation of the Waste Acceptance Process, a number of the documents identified have been produced and work is underway on others. (Fig. 4 identifies the current status of WAP documentation). Initially drafted by the WAC, Waste Acceptance Preliminary Specifications (WAPS) have been produced for DWPF and West Valley and these have been submitted to the NRC for staff review and comment. In developing the WAPS for DWPF and WVDP, a delicate balance of responsibilities was struck, and this balance is expected to be the guiding principle for future Waste Acceptance Process activities: the waste producer is responsible for showing that he is producing his product in a controlled manner to meet the requirements of the repository's specifications; the repository project is responsible to show that waste forms produced in compliance with the specifications will perform acceptably under repository

conditions to allow compliance with regulatory requirements.

DWPF has prepared a Waste Form Compliance Plan (WCP), which describes the DWPF plans for complying with the WAPS. This document has been reviewed by the repository project and has also been submitted for NRC staff review. A West Valley WCP is in preparation. DWPF is currently preparing for the start of "cold runs" which will provide much of the data necessary to complete the Waste Form Qualification Report (WQR) for that program. In parallel with the Waste Acceptance Process activity to produce these documents, OCRWM prepared and issued the Site Characterization Plan (SCP) for the Yucca Mountain Project. The SCP includes a description of DOE's plans for testing and analysis to assure that the waste forms produced at facilities such as DWPF to meet the WAPS requirements will indeed perform acceptably in the repository environment.

Just underway is an activity to generate the generic Waste Acceptance Requirements (WAR) document. This document will provide guidance to potential high level waste form producers on the information necessary on a proposed waste form in order for it to be considered for disposal in a repository. The information to be provided will make up the Waste Form Description (WFD) document prepared by a prospective waste producer. Initial efforts on the WAR emphasize development of requirements for waste producers with relatively large quantities of waste (i.e., Hanford Waste Vitrification Project, and the Idaho National Engineering Laboratory); however, it may eventually be expanded to provide guidance to producers with only limited quantities of waste, and to other categories of wastes, such as TRU and GTCC, should this become necessary. It is also expected that the WAR will eventually evolve into a repository license technical specification which will

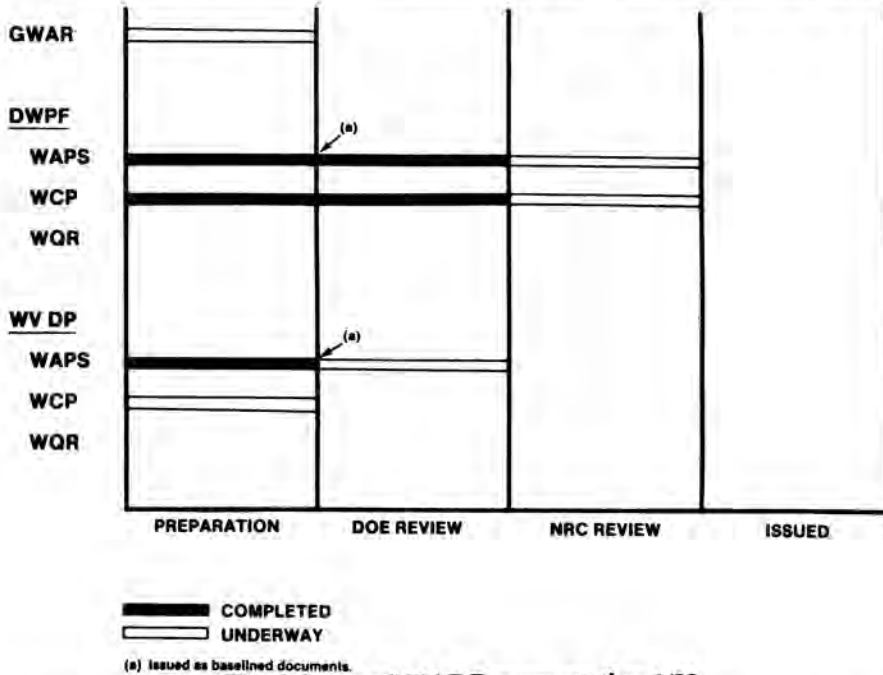


Fig. 4. Status of WAP Documentation-1/89.

define the requirements for the repository to accept wastes for disposal without the need for further regulatory review.

**WASTE ACCEPTANCE PRELIMINARY SPECIFICATIONS**

Development of the WAPS for DWPF and West Valley resulted in identification of four broad categories where requirements and specifications were needed:

- Waste Form
- Canister
- Canistered Waste Form
- Quality Assurance

Specifications-Contents]

Figure 5 provides the next level of detail on the specifications included in each of the first three categories. These categories define the information required to be provided by the waste producer in the WCP, the WQR's and in the production records. The Quality Assurance Specification, which is not further broken down, requires waste producers to implement quality assurance programs which are consistent with OCRWM's own for all activities which provide waste acceptance information in the WCP's, WQR's, and production records. To meet this requirement, for example, DOE's Office of Defense Waste and Transportation Management, Savannah River's DWPF Project Office, and the DWPF operating contractor have each prepared Quality Assurance Program Descriptions for DWPF's development and qualification program. These are currently undergoing OCRWM review.

**WASTE ACCEPTANCE AND FACILITY STARTUP**

Since the inception of the WAP, DOE has not linked completion and acceptance of the WQR (nor any other waste acceptance documentation) to a waste producer's decision for "hot startup" (i.e., the start of processing of

radioactive wastes). However, DOE recognizes that in order to make informed and prudent management decisions on the startup of major facilities such as DWPF and WVDP, selected waste form information should be available. DOE has preliminarily identified the following information needs:

**QUALITY ASSURANCE PROGRAM DESCRIPTIONS**

Process Control Program

The latter is to be based on sections of the WQR containing data produced during "cold" (i.e. non-radioactive) runs of the actual facility equipment. The selected information should show that waste forms will be produced under an adequate process control program with adequate quality assurance. This information supplements the waste producer's WCP which, as described above, provides detailed planning information on how each waste acceptance specification is to be complied with.

To address the issue of waste form performance under repository conditions, DOE plans to conduct preliminary repository performance assessments based on available waste form data. DOE believes that this information, together with the assurance of product quality obtained as discussed above, will provide the necessary and sufficient information to allow DOE to make sound decisions on "hot startup" of waste production facilities. DOE plans to interact with the NRC on this approach in the near future to assure timely regulatory feedback as DOE moves into full-scale hot operations on DWPF and the follow-on facilities.

**SUMMARY**

DOE believes that the Waste Acceptance Process provides a sound basis on which to develop the documentation and to plan the interactions and communications which will support the start of high level waste production at its various facilities and the preparation of the repository

- **WASTE FORM**
    - CHEMICAL COMPOSITION
    - RADIONUCLIDE INVENTORY
  - **CANISTER**
    - MATERIALS
    - FABRICATION AND CLOSURE
  - **CANISTERED WASTE FORM**
    - FREE LIQUIDS
    - GASES
    - EXPLOSIVENESS, PYROPHORICITY AND COMBUSTIBILITY
    - ORGANIC MATERIALS
    - FREE VOLUME
    - EXTERNAL RADIOACTIVE CONTAMINATION
  - **QUALITY ASSURANCE**
- RADIONUCLIDE RELEASE
  - CHEMICAL AND PHASE STABILITY
  - IDENTIFICATION AND LABELING
  - HEAT GENERATION
  - DOSE RATES
  - CHEMICAL COMPATIBILITY
  - NUCLEAR CRITICALITY
  - OVERALL DIMENSIONS AND WEIGHT
  - DROP TEST
  - HANDLING FEATURES

Fig. 5. Waste Acceptance Preliminary Specifications-contents.

license application. The process provides a firm basis for confidence that waste forms produced in advance of the repository license will ultimately be acceptable for repository disposal.

Significant progress has been made in the process in support of DWPF and West Valley, and a sound basis has

been established for planning future waste acceptance activities with producers such as HWVP and INEL.