

WIPP: EPA'S TRU WASTE GENERATOR SITE APPROVAL PROCESS

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ABSTRACT

The U.S. Environmental Protection Agency (EPA or the Agency) certified the Waste Isolation Pilot Plant's (WIPP) compliance with EPA's disposal regulations for transuranic (TRU) waste in May 1998. EPA's decision imposed four conditions on the certification. Condition 3 requires that the U.S. Department of Energy (DOE) demonstrate, for any sites wishing to ship TRU waste to the WIPP for disposal, that they possess adequate process knowledge of the TRU waste proposed for disposal in the WIPP. Condition 3 also requires DOE to implement a system of controls at TRU waste sites to ensure that, once emplaced, the actual WIPP waste inventory will comply with the assumptions underlying the analysis of WIPP's performance (the WIPP Performance Assessment, or PA).

Because of the developing, state-of-the-art nature of TRU waste characterization, DOE had implemented the commitments to waste characterization made in the WIPP Compliance Certification Application (CCA) only for debris waste at Los Alamos National Laboratory. EPA has enforced the requirements of the waste characterization condition through an independent and rigorous, but flexible and cooperative effort with DOE.

This paper briefly discusses the regulatory basis and background behind EPA's implementation of the requirements of the waste characterization condition (Condition 3). The central focus of this paper is an explanation of the technical requirements and regulatory process used to verify a site's suitability to characterize waste destined for the WIPP. Finally, the paper summarizes EPA's progress to date and our goals for the evolving work on waste characterization at TRU waste sites.

INTRODUCTION: REGULATORY BASIS FOR SITE INSPECTIONS

EPA began its involvement in the WIPP project as a result of the WIPP Land Withdrawal Act, signed into law in the fall of 1992 (5). The Land Withdrawal Act called for the Agency to finalize, among other things, site-specific compliance criteria for the WIPP that implemented EPA's general radioactive waste disposal standards at 40 CFR Part 191. The WIPP Compliance Criteria, promulgated in February 1996, established requirements for DOE to follow in multiple areas, including waste characterization, quality assurance, and performance assessment (2).

Because the performance assessment (and related compliance assessment) established at 40 CFR 191.13 are only predictions of performance based in many cases on broad assumptions, EPA

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determined that a quantitative measurement of waste would strengthen the assumptions of the PA modeling, and thus support the computer predictions. DOE used information on waste characterization rolled up into a Baseline Inventory Report (BIR) and then analyzed in CCA Appendices such as Appendix WCA (Waste Characterization Analysis) as a basis for source term content in the PA (1). The inventory data in the BIR, which were based largely on assumptions and predictions, became de facto limits on the WIPP repository inventory.

The Compliance Criteria required DOE to describe the radionuclide content of WIPP waste, non-radioactive components of the waste, and the characteristics of the waste components (such as solubility) that could effect waste containment. In addition, DOE had to demonstrate that it could control and track the waste going into the WIPP.

When evaluating the WIPP program's compliance with EPA's waste characterization regulations during the certification rulemaking, the Agency recognized that DOE was faced with a cart and horse dilemma when it came to approving waste sites to ship waste to the WIPP. The WIPP Compliance Criteria required DOE to demonstrate that an adequate waste characterization program had been properly implemented (2). Yet no site could responsibly allocate the resources to characterize *all* waste destined for WIPP prior to the WIPP's opening, especially since in many cases the waste did not yet exist. While DOE had developed measurement systems at some waste generator sites that could support EPA's requirements, DOE could not demonstrate compliance at all sites.

EPA's review was therefore focused on waste characterization activities at Los Alamos National Laboratory (LANL), which was able to demonstrate the ability to characterize waste in accordance with the requirements established by DOE for legacy debris waste during EPA's certification rulemaking. The applicable DOE requirements were contained in the Waste Acceptance Criteria (WAC), Waste Analysis Plan (WAP), and Quality Assurance Program Plan (QAPP). These documents formed the basis for EPA's certification decision regarding the overall acceptability of DOE's waste characterization program.

To address the need to approve other sites in the future, EPA established a process that tracks DOE's own site approval process (see below). EPA adopted an approach, based largely on Element 8 of NQA-1 (4), whereby we perform inspections that focus on qualifications of technical personnel, procedural implementation, and capabilities of the processes and equipment used to identify and measure important waste components. Our main concern is the "system" used to characterize the waste, ranging from data and historic records to nuclear materials measurement. In all cases, EPA must examine a site's system of waste characterization in light of its applicability to waste groupings specified by DOE (such as the debris waste at LANL). EPA uses its authority as the WIPP's independent regulator to search out the technical rationale behind a waste characterization system.

Our decisions to approve LANL to ship debris waste, and to establish a process for inspecting TRU waste sites, were open to extensive public scrutiny through the WIPP certification notice and comment process (3). The issue was reopened through a lawsuit filed against EPA, in which

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plaintiffs specifically cited the issue of waste characterization in their brief. EPA's final certification decision was upheld by the U.S. Court of Appeals.

EPA'S INSPECTION PROCESS

In the CCA, DOE identified several items that must be limited, either with a minimum or a maximum level, because of their potential effects on the containment of waste in the WIPP disposal system. These limited items are: 10 radionuclides (maximum limit); cellulose, plastics, and rubbers (maximum limit); ferrous metals (minimum limit); non-ferrous metals (minimum limit); and water content (maximum limit). EPA agreed with DOE that the water content of the waste was not an issue because it was inventory-limited and would be excluded by the Waste Acceptance Criteria (WAC). Additionally, the minimum limits on ferrous and non-ferrous metals would be met easily by the steel drums used as waste containers, so no additional quantification or tracking was necessary. With respect to the 10 radionuclides and cellulose, plastics, and rubbers, a defensible quantification is required by EPA to ensure that the inventory limits will not be exceeded.

EPA determined that on-site inspections of the processes used to characterize waste were the best mechanism for determining the adequacy of the personnel, procedures, and equipment used in waste characterization. To ease the logistical burden on sites and DOE, EPA decided perform its approval inspections simultaneous with the approval audits of the DOE Carlsbad Area Office (CAO), who run the WIPP and the national TRU waste program. In this way, EPA could be certain that CAO was adhering to the rigorous auditing program described in the CCA while simultaneously evaluating a site's implementation of a waste characterization process.

EPA refers to any site inspection of either waste characterization or quality assurance programs as a "Section 194.8 inspection" (or "dot eight") if the outcome requested by DOE is an approval from EPA to ship additional TRU waste from the site under authority of Section 194.8 of the WIPP Compliance Criteria (2). Inspections performed under Section 194.8 are separate from those conducted under EPA's other inspection authorities at 40 CFR parts 194.21, 22(e), and 24(h)(2). These other sections of 40 CFR Part 194 authorize EPA to gather information or monitor DOE's implementation of CCA commitments regarding waste characterization, QA, or other areas, without reference to approvals to ship waste.

As mentioned above, EPA modeled our approach for implementing the waste characterization condition after Element 8 of NQA-1 (1989), whereby the quality of a particular product cannot be determined through direct examination (a weld is given as an example in the NQA guidance) (4). This approach, often called the "black box" method, relies on the qualifications of the personnel producing the product, the procedures that govern the production of the product, and the capabilities of the equipment used to produce the product. The product, in this case, is waste characterization data.

EPA has another certification condition (Condition 2) that requires TRU waste sites to establish and execute quality assurance (QA) programs. Conditions 2 and 3 are implemented similarly by EPA. For waste characterization and QA, EPA develops checklists derived from the governing

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implementation documents for sites: for QA, NQA-1 (1989), the CAO Quality Assurance Program Document (QAPD), and the site's Quality Assurance Project Plan (QAPjP); for waste characterization, Chapter 4 of the CCA and associated documents such as the Waste Analysis Plan, the WAC, the Site Certification Plan, and individual site implementing procedures (1, 4). The principle difference in the manner in which EPA verifies compliance with the two conditions involves the need to make multiple trips to the site. In the case of QA, once EPA has reviewed and approved a site's QA program, no additional formal approval from EPA under Section 194.8 is necessary for future waste shipments. In the case of waste characterization, more than one Section 194.8 approval may be required because of differences in the site's technical processes, as discussed below.

EPA's inspection process is broken into three phases common to the routine performance of QA audits and technical inspections, with some unique opportunities for public involvement and flexibility of decision making: pre-inspection planning and public notice; on-site activities; and post-inspection follow-up.

Once DOE has determined that a site can meet both CAO and EPA requirements, DOE requests that EPA approve the site. From the time of notification and no later than 30 days prior to the inspection, DOE must provide to EPA the top-level site plans, such as the QAPjP and the Site Certification Plan. These documents guide EPA's preparation for the inspection and the public's development of comments for input into the inspection. Upon receipt of the site documents, EPA prepares and publishes a *Federal Register* notice announcing the dates of the inspection, its general scope, and the availability of the documents in EPA's docket for review and comment. EPA also notifies radiation program managers in the EPA Region where the inspection will take place, the State of New Mexico Environment Department, and the New Mexico Environmental Evaluation Group, while also placing notices on EPA's WIPP home page and EPA's WIPP information line (1-800-331-WIPP).

EPA then prepares an inspection plan and checklists based on the top-level site plans, as well as our review of specific site procedures. If appropriate, EPA revises the inspection plan and checklists to ensure that public concerns raised during the comment period will be addressed during the inspection. EPA may share its checklists with CAO and the site in advance to facilitate their preparation.

On site, we focus our review on what the site identifies as the "system of controls" used to characterize waste. EPA must review and approve a specific system of controls in light of the waste groupings for which the particular system is applicable. Section 194.8(b)(1) of the WIPP Compliance Criteria requires EPA approve a system of controls "for each waste stream or group of waste streams" (2). Consequently, EPA may have to make multiple trips to a single waste generator sites to approve different "systems" if they apply to different groupings of waste.

It is essential that all critical elements of the system of controls be operational, so that EPA inspectors may review actual measurement data and complete any necessary tests or demonstrations. In all cases, some form of historic records, either acceptable knowledge (AK) or process knowledge, must be assembled and reviewed to establish some of the base assumptions

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for further characterization of the waste. These base assumptions might include the potential plutonium gram loading, which may dictate which nondestructive assay system must be employed or whether an active matrix correction scheme must be employed.

The system of controls also usually employs some form of radiography to determine the physical contents of the container. Radiography is often monitored and controlled by visual examination of a statistically determined, random selection of drums. Radiography results are also monitored by control or surrogate drums sent through the system.

The system of controls also always includes a technique for assaying the radioactive isotopes in the waste. To date, EPA has inspected systems that:

- use gamma spectroscopy or AK-determined isotopic ratios and a passive and/or active neutron assay system to measure the quantity of a particular isotope;
- use a gamma transmission matrix correction techniques, coupled with a gamma spectroscopy system, to obtain isotopic quantities directly from gamma ray measurements (both segmented gamma scanners and tomographic gamma scanners); and
- use AK-determined isotopic ratios and calorimetry to correlate heat produced with specific isotopic loadings.

All data must then receive a thorough technical review to interpret and detect any anomalous outputs, ensure that waste material parameters (WMPs) and waste matrix codes (WMCs) have been properly assigned, and feed back any quality improving results that could improve the AK or better inform the radiography or NDA operators. Finally, all systems of controls conclude with proper and consistent data reporting into the WIPP Waste Inventory System for shipping approvals and tracking.

PAST AND FUTURE PROGRESS

To date, EPA has performed over a dozen inspections of waste characterization systems at TRU waste sites, including three each at the Rocky Flats site and LANL, two each at INEEL and the Nevada Test Site, and one each at the Savannah River site, the Hanford site, and Lawrence Livermore National Laboratory. Inspections conducted under authority of Section 194.8 have resulted in five approvals (see Table I below). Of the sites where we have performed Section 194.8 inspections, only the Nevada Test Site has not yet been approved to ship waste by either EPA or CAO.

Table I
Section 194.8 Inspections to Date

EPA Inspection No. (Section 194.8)	Date of Inspection	Approved to ship?
EPA-RFETS-11.99-8	11/16-18/99	Y
EPA-NTS-6.99-8	6/7-11/99	N
EPA-LANL-6.99-8	6/14-18/99	Y
EPA-INEEL-5.99-8 (not completed)	5/17-21/99	n/a
EPA-RFETS-4.99-8	4/27-29/99	Y
EPA-INEEL-7.98-8	7/28-30/98	Y
EPA-RFETS-6.98-8	6/22-25/98	Y

EPA intends to provide the broadest appropriate approval for a site. To that end, EPA has encouraged DOE and the generator sites to explore the potential applicability of their system of controls to multiple groupings of waste streams prior to EPA's Section 194.8 inspections. In most cases, the nondestructive assay system has been the factor defining the limits of applicability of any system. EPA prefers to perform the approval inspections as late as possible after the system has been fully implemented, but with sufficient time to complete the necessary review and render a decision. While strongly desiring not to serve as an impediment to waste shipments, EPA also wants the maximum amount of information to be available for review at the time of an approval inspection so that the broadest possible applicability of a system of controls can be supported.

EPA must render a pass or fail judgment of the entire system of controls that we inspect. We will not approve sites and systems on a piecemeal basis, nor will we limit the scope of applicability of a particular system beyond what the site has identified as the limitations. Possibly the best case for EPA is one in which the site has clearly identified the system's limitations within equipment specifications or the operating procedures. Beneficial practices that EPA has witnessed at some sites have been to limit the assay drum weight as a reflection of the systems inability to resolve isotopic quantities within high density matrices, or to limit the permissible plutonium gram loading to ranges where passive neutron counting is adequate in place of an active system

EPA has found that our familiarity with the basic functioning of a site's overall system of controls, as well as with specific assay or measurement techniques used either at that site or elsewhere, greatly facilitates the performance of subsequent inspections. As a specific example, EPA inspected and approved a system at LANL that uses a tomographic gamma scanner (TGS) as its central assay element. The TGS was subsequently move to Rocky Flats to perform assay work there. EPA's familiarity with this equipment meant that our review of its use at RFETS

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could focus less on its performance (which had been demonstrated previously) and more on how it was integrated into the Rocky Flats site's system of controls.

DOE has approached EPA with questions regarding the special case of mobile vendors who may seek approval for the use of truck-mounted equipment at one site and subsequently relocate to another site. DOE's concerns centered around the necessity and benefit of EPA's requirement to conduct multiple inspections of the same equipment. While the regulatory requirements do not allow EPA the flexibility to approve mobile vendors for all sites at once, to date this issue has not been significant. As with the case of the TGS equipment mentioned above, EPA has found that familiarity with a particular system enables EPA to focus on a narrower range of issues. For example, if EPA were to inspect and approve a mobile vendor at one site and later encounter that same vendor at another site with the identical system, our inspection might focus on the interface issues that frequently arise in vendor-M&O relationships.

EPA holds regular meetings with CAO staff to explain our regulatory approach and to understand better DOE's programmatic priorities. In no case has the lack of an EPA approval delayed any shipment of TRU waste to the WIPP. We have elected to perform a number of preliminary inspections at generator sites to prepare for Section 194.8 inspections, to ensure that the sites are familiar with our requirements and approach, and to keep ourselves apprised of the progress of system implementation. Flexibility in responding to DOE's evolving site approval process is one of our goals.

Future dialogue between EPA and DOE is likely to consider ways to balance priorities and resources as both agencies cope with an expanding number of waste characterization processes at TRU waste sites. As more and more sites successfully demonstrate their capabilities to EPA, we will begin to address the question of determining the point at which we may declare Condition 3 satisfied and eventually initiate a rulemaking to remove it.

CONCLUSION

EPA will maintain our close oversight of waste characterization at TRU waste sites as long as necessary to verify that waste in the WIPP is in compliance with our regulations and commitments in the CCA. DOE should act to maintain or even exceed the high level of rigor already incorporated into the waste characterization program, especially as new processes or assay techniques are added. The combined oversight of EPA and CAO over TRU waste sites will serve to promote confidence in the accuracy of the CCA's predictions about the long-term safety of the WIPP.

REFERENCES

1. U.S. Department of Energy. 40 CFR Part 191 Compliance certification application for the Waste Isolation Pilot Plant, containing Vols. I - XXI and references. Carlsbad Area Office. October 1996.

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2. U.S. Environmental Protection Agency. Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations: Final Rule (40 CFR Part 194). 61 Federal Register 5224-5245. February 9, 1996.
3. U.S. Environmental Protection Agency. Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Certification decision (40 CFR Part 194, Appendix A). 63 Federal Register 27353-27406. May 18, 1998.
4. American Society of Mechanical Engineers. Quality Assurance Program Requirements for Nuclear Facilities, ASME NQA-1. 1989.
5. 1992 WIPP Land Withdrawal Act, Pub. L. 102-579, as amended by the 1996 WIPP LWA Amendments, Pub. L. 104-201.