ISSUES IN RADIOACTIVE MIXED WASTE COMPLIANCE WITH RCRA: SOME EXAMPLES FROM ONGOING OPERATIONS AT THE IDAHO NATIONAL ENGINEERING LABORATORY*

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ABSTRACT

Radioactive mixed waste is subject to regulation under both the Resource Conservation and Recovery Act (RCRA) and the Atomic Energy Act (AEA). The regulation of such waste is the responsibility of the Environmental Protection Agency (EPA) and either the Nuclear Regulatory Commission (NRC) or the Department of Energy (DOE), depending on whether the waste is commercially generated or defense-related.

The recent application of the RCRA regulations to ongoing operations involving radioactive mixed waste has resulted in numerous compliance issues that require resolution. This paper discusses general issues in radioactive mixed waste compliance. Specific issues encountered in ongoing operations at the DOE's Idaho National Engineering Laboratory (INEL) are described in greater detail.

INTRODUCTION

In 1976, Congress passed the RCRA to control the management of solid waste, including hazardous waste. The Hazardous and Solid Waste Amendments (HSWA), passed in 1984, strengthened the RCRA in several respects.

Pursuant to the RCRA and the HSWA, the EPA has promulgated very comprehensive regulations. The regulations cover such items as waste identification; classification; packaging and shipping; design, operation, and closure of treatment, storage, and disposal (T/S/D) facilities; recycling; emergency response; environmental monitoring; and permitting. Federal agencies are required by Section 6001 of the RCRA to comply with the requirements "in the same manner, and to the same extent, as any person is subject to such requirements."

Confusion and uncertainty initially surrounded the application of the RCRA to radioactive mixed wastes -- hazardous wastes that also contain radioactive materials. Radioactive wastes, when occurring in the absence of hazardous waste, are regulated under the AEA by the NRC, for commercial nuclear activities, or by the DOE, for its own activities. The uncertainty stemmed from the express exclusion of radioactive "source, special nuclear, or by-product material as defined by the Atomic Energy Act, as amended" from the definition of "solid waste" in Section 1004(27) of the RCRA.

In 1984, the DOE and the EPA signed a Memorandum of Understanding (1) on their respective responsibilities for managing radioactive mixed waste (hereafter referred to as mixed waste). However, the courts invalidated the Memorandum of Understanding to the extent that it sought to create a program comparable to the requirements of the RCRA.

Two statements were issued later to address the question of regulatory jurisdiction over mixed waste. One was a joint statement issued by the EPA and the NRC (2). The other statement was an interpretative rule issued by the DOE, referred to as the "by-product rule"(3). Both statements had the same thrust: mixed waste was to be regulated under both the RCRA and the AEA. Thus, a single stream of mixed waste is now subject to regulation by two separate federal agencies--either EPA and NRC, or EPA and DOE.

The joint regulatory jurisdiction is divided as follows. The actual radionuclides in the waste substance are regulated under the AEA. The nonradioactive, chemically hazardous components of the waste substance are regulated under the RCRA. This regulatory division applies, regardless of further subclassification of the radioactive constituent, as high-level waste (HLW), low-level waste (LLW), transuranic (TRU) waste, etc.

GENERAL ISSUES

The two forementioned statements ended the confusion about regulatory authority over mixed waste. However, some of the uncertainty about compliance requirements has continued, partly because of the complexity of applying RCRA regulations to situations not envisioned at the time of original promulgation.

One complicating factor is the distinct difference between radioactive waste operations and hazardous waste operations. Another complicating factor is the impact of

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radiation exposure potential on the selection of sound waste-management practices. The AEA is implemented while requiring radiation exposure to be kept as low as reasonably achievable (ALARA). The ALARA philosophy sometimes results in opposing goals when trying to bring existing facilities into compliance with RCRA regulations.

A third complicating factor is the enormous impact of retroactively imposing a comprehensive body of regulations on a large complex of operations that were designed and constructed to function under the very different requirements pursuant to the AEA.

The regulatory philosophy behind the RCRA was directed almost entirely toward controlling chemical hazards. Little thought was given for flexibility in the regulations to allow weighing the damage potential of chemical hazards against that of radioactive hazards. (Section 1006 of the RCRA does allow some flexibility by allowing an override to certain provisions of RCRA if they are inconsistent with the AEA requirements.)

RCRA regulations require prompt treatment or disposal of wastes to prevent indefinitely storing the material and thereby avoiding treatment and disposal costs. These regulations do not consider the situation for mixed wastes, for which comprehensive treatment and disposal options may be a decade away. The present political climate has made it very difficult to site and operate any radioactive-waste or mixed-waste treatment, storage, or disposal facility. To comply with the RCRA, operators of mixed waste sites will have to learn how to work effectively within the current climate of public opinion.

The EPA may need to reconsider the compliance strategy for mixed waste. Rather than negotiating point-by-point variances or employing enforcement discretion for difficult situations, a separate waste-code classification and/or regulatory strategy could be pursued for mixed wastes. This new strategy would take into account the chemical and radioactive hazards present to personnel and the environment.

The remainder of this paper discusses some of the issues encountered in bringing the ongoing operations involving INEL mixed waste into compliance with the RCRA. The mixed waste issues encountered at the INEL are similar to those encountered elsewhere in the DOE complex. Examples have been cited in several publications (4,5,6). This paper will emphasize the technical and managerial aspects of the issues, rather than a detailed chronology of the ongoing negotiations among the federal and State agencies involved.

INEL PROGRAMS DEALING WITH MIXED WASTE

The INEL is a large, multiprogram DOE site in southeastern Idaho. INEL activities generate radioactive waste, hazardous waste, and mixed waste. The mixed waste includes that for which the radioactive component is HLW, LLW, and TRU waste. The mixed waste falls under the jurisdiction of the Idaho Operations Office of the DOE and Region X of the EPA. In addition, the State of Idaho is expected to receive primacy soon under the RCRA.

Some activities at the INEL generate the mixed waste. The Idaho Chemical Processing Plant (ICPP) produces mixed HLW from the dissolution of reactor cores. The INEL has received mixed TRU waste and mixed LLW from other DOE sites for storage while treatment and disposal options are being developed. The INEL also generates mixed LLW from reactor operations, decontamination and decommissioning, and sampling or research activities.

Large quantities of mixed HLW, mixed LLW and mixed TRU waste are in storage at the INEL. Several facilities are in operation for treatment and storage of the mixed waste. The ICPP calcines liquid mixed HLW and stores it in underground tanks. The Mixed Waste Storage Facility and the Radioactive Waste Management Complex classify and store mixed LLW and mixed TRU waste, respectively, until treatment or disposal options can be developed. The Waste Experimental Reduction Facility has begun incinerating small quantities of mixed LLW and is solidifying mixed LLW (incinerator ash).

The INEL is developing treatment and/or disposal options for mixed waste. Examples are refining of contaminated lead to produce commercially acceptable lead, incineration of mixed LLW and mixed TRU waste, processing of calcined mixed HLW into a ceramic matrix, and stabilization of leachable waste. Figure 1 shows development activities for the stabilization of INEL incinerator flyash, most of which is a characteristic mixed waste.

For ongoing operations, RCRA compliance activities at the INEL are integrated with the respective operations. For remediation activities, three separate but related programs have been established. Mixed-waste compliance issues in the remediation programs will be discussed in a separate paper.

MIXED-WASTE COMPLIANCE ISSUES ENCOUNTERED INONGOING OPERATIONS AT THE INEL

Each type of mixed-waste operation presents its own set of issues in simultaneously complying with the RCRA and the AEA. Several issues are discussed in the following paragraphs. Current approaches for resolving the issues are also discussed.

Waste Characterization

Waste characterization can be one of the most challenging issues of compliance with RCRA regulations, particularly if the regulations are applied retroactively to large numbers of containers of mixed waste already in storage.

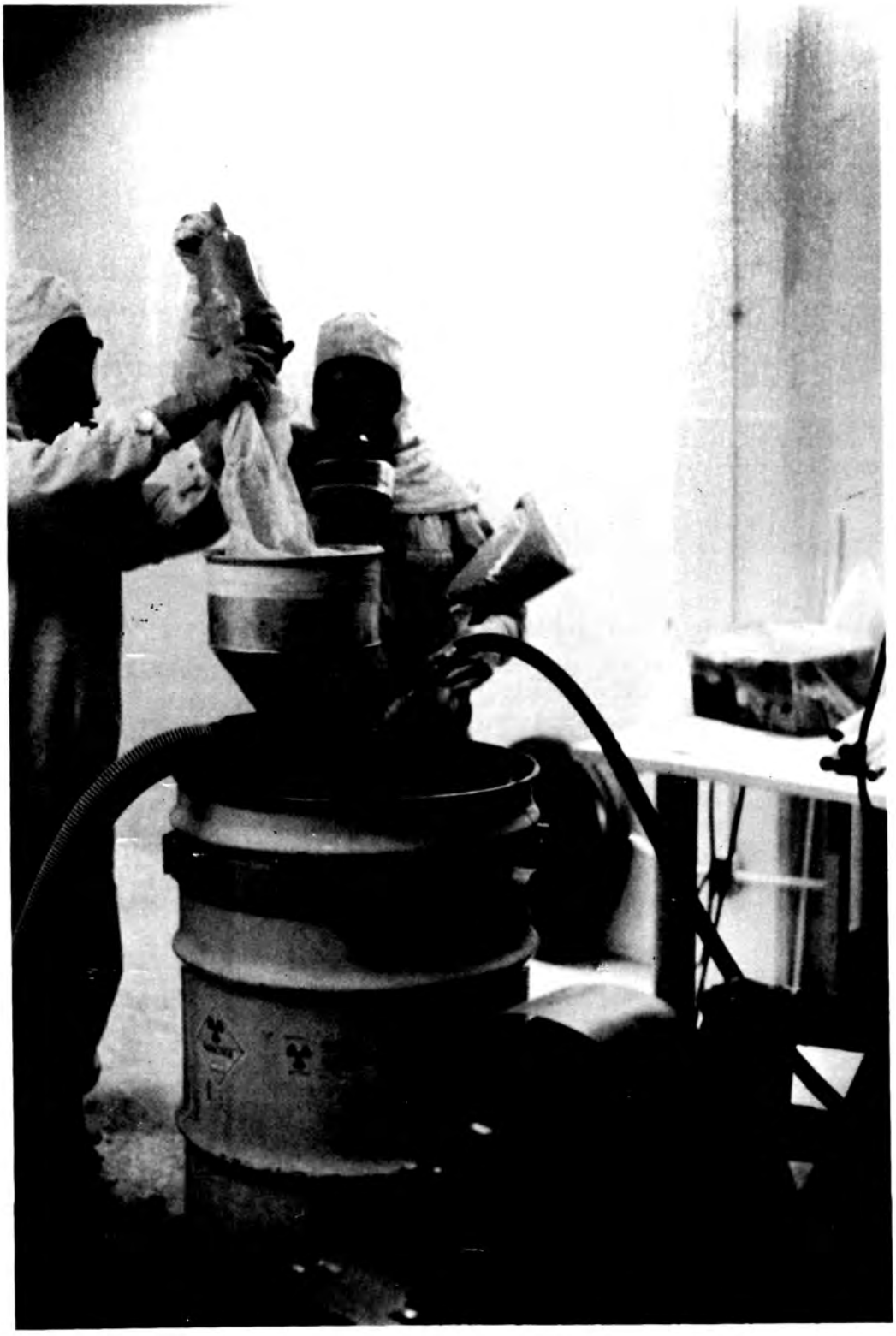

Fig. 1. An INEL Process has been Developed to Solidify and Stabilize Certain Mixed Wastes, such as the Incinerator Flyash Being Treated Here.

Section 40 CFR 264.13 requires that operators of T/S/D facilities obtain "a detailed chemical and physical analysis of a representative sample of the waste." For mixed wastes, key concerns in waste characterization include radiation exposure to personnel involved with sampling and analysis of wastes, lack of facilities to open and sample wastes (a concern for previously stored wastes), and a shortage of laboratory capability to perform the required analyses.

The INEL approach to this issue is to consider alternative characterization methods, in lieu of sampling many thousands of individual waste containers. These methods include: (1) using knowledge of the operating processes, (2) using limited data from past characterization studies, and (3) developing a statistically-based sampling program. Use of a statistically-based program reduces the number of waste containers requiring sampling, and reduces personnel radiation exposure and costs. Sample sizes were determined based on the inventory of mixed waste in storage. A 95% confidence level was selected to determine the number of representative samples required for each waste type. Use of the statistically-based approach to sampling is focused on contact-handled TRU mixed waste and on former TRU waste that has been reclassified as LLW (< 100 nCi alpha activity/gram waste), following state-of-the-art assay.

Studies have been completed to review past records, evaluate waste-generating processes, and obtain waste generator-supplied information to support characterization activities. Recently, generators have been required to submit Waste Profile Statements concerning the characteristics of their waste. These statements include analysis of the waste for listed or characteristic materials. The generator may supply these data based on knowledge of the process or by chemical analysis. If the Waste Profile Statements indicate the waste is suspect, sampling is required to verify the absence of hazardous materials.

Evaluations are underway to establish opening and sampling capabilities at the INEL for contact-handled LLW and TRU waste. A sampling and analysis plan has been developed, based on EPA characterization guidance documents (7,8) to ensure the quality and defensibility of the sample analysis data. The approach to sampling involves using past waste characterization studies to provide data that support the stratification of wastes into discrete waste types. Based on these data and on past opening and verification studies, a statistical approach was used to obtain representative samples. Sampling of wastes is projected to begin after modification of an existing hot-cell facility.

Design Considerations

An additional RCRA compliance issue relates to the design of mixed-waste facilities constructed before the RCRA was passed. Many of the INEL waste management facilities were designed and constructed more than 20 years ago. Subsequent RCRA regulations included design requirements that required implementation.

Some requirements, such as additional monitoring and alarm systems, are readily accomplished. Other requirements are not readily implemented, given current system design and the hazards inherent in dealing with radioactive materials. One example is storage facilities whose design and internal configuration are based on dense-pack arrangements of containers to provide "self-shielding." Another example is the use of soil as protection and shielding for containerized waste in long-term storage.

The INEL approach to this issue is to evaluate alternative storage configurations for containerized waste. Of particular interest is identifying configurations that enable inspection and emergency response requirements (aisle spacing) to be met. Alternative methods to visual inspection are being identified and evaluated, such as enhanced air monitoring or use of remotely operated cameras. Ultimately, the result of these evaluations will establish a design approach that can be negotiated with EPA that will meet the intent of the RCRA requirements, and require a minimum number of major structural changes to existing facilities.

Laboratory Requirements

Another mixed-waste compliance issue relates to the requirements placed on existing laboratories. The INEL, like many other DOE facilities, needs to expand the current characterization and analysis program for mixed wastes. Current laboratory capacity is insufficient to handle the volume of TRU waste and HLW samples requiring analysis per EPA protocols and test methods.

The INEL approach to this issue is to evaluate modifications to EPA protocols as a means to address handling problems inherent with these waste materials. Statistical approaches to waste characterization are also being evaluated to determine whether such approaches will satisfy regulatory authorities, particularly with regard to measuring the concentrations of chemicals subject to land disposal restrictions.

Storage Requirements

An interesting conflict sometimes arises between RCRA requirements and AEA requirements when storage of mixed waste is involved. As depicted in Fig. 2, the INEL stores many thousands of containers of TRU waste that also contain hazardous constituents (mostly F-series solvents). This mixed TRU waste must be stored in a RCRA-permitted storage facility while awaiting either processing or shipment to a repository.

RCRA regulations (40 CFR 264.174) require that "at least weekly, the owner or operator must inspect areas

Fig. 2. The INEL Stores Many Thousands of Containers of Mixed TRU Waste in a Close-Packed Configuration.

where containers are stored, looking for leaking containers and for deterioration of containers...."

Inspection of nonradioactive hazardous waste in proper containers normally does not pose a health hazard to the inspector. Such inspections occur daily at facilities across the nation. Inspection of the mixed-TRU waste, however, poses a health risk to the inspector because of beta/gamma radiation emitted through the container walls by the radiological constituents.

DOE's ALARA policy regarding radiation exposure to workers results in rigorously restricting exposures to values far below the standards allowed by federal regulations. Workers are restricted to less than five rem of external penetrating radiation exposure per calendar year. Within the ALARA guideline, workers at the INEL are restricted to 500 mrem per calendar year, and year-to-year goals for reducing exposure are much lower. The ALARA policy obviously is in conflict with the RCRA storage inspection requirement.

To illustrate the magnitude of this conflict, projected radiation exposures have been calculated for inspecting the storage capacity to be constructed in support of INEL mixed-TRU waste programs. Weekly inspection of every drum contained in the six proposed storage modules (3800 drums in each module) would result in an annual exposure of 445 man-rem to the inspectors. To operate within ALARA guidelines, this would equate to using 890 workers each year to prevent exposing any one worker to more than 500 mrem per calendar year. For comparison, the total exposure to all EG&G employees in 1987, from all nuclear operations of any sort, was only 91 man-rem.

The INEL is pursuing a timely resolution to this conflict through techniques that will allow verification of waste container integrity while not posing an increased radiation threat to the inspector. One potential solution is conducting inspections by the use of remote and robotic vehicles and instrumentation. Another approach is improving the technologies for radiological and hazardous chemical monitoring instrumentation. Revised stacking arrangements of waste containers within the storage modules could involve inspections of groups of containers configured so as to benefit from self-shielding of radiation within the containers.

Land Disposal Restrictions

Another issue of concern to the INEL is the implications of the Land Disposal Restrictions (LDR), as applied to mixed wastes. Currently, LDR rules apply to the following mixed wastes: solvents, dioxins, and "California List" wastes. In May 1990, all mixed wastes will become subject to LDR.

One of the greatest impacts on the INEL would be the prohibition of storing mixed waste until treatment or disposal options are found and proven. Most INEL mixed TRU waste is planned for shipment to the Waste Isolation Pilot Plant (WIPP), but must be stored until WIPP is

opened. Under even the most optimistic scenarios, shipment to WIPP will not be possible within the time frame imposed by LDR. (LDR guidelines state that storage for more than one year generally indicates a violation of the intent to dispose of the material per regulations. After one year, the burden of proof switches to the generator to show that he is actively in the process of preparing the waste for disposal.)

The approach taken for this issue includes the recent request by the DOE, and the proposal by the EPA, to grant a two-year National Capacity Variance for all mixed wastes not listed under solvents, dioxins, or the "California List." The INEL is also actively working to develop treatment options for mixed waste, as discussed in an earlier section of this paper. The DOE continues to negotiate this issue with the EPA.

CONCLUSIONS

This paper has identified and discussed some issues encountered at the INEL in complying simultaneously with the RCRA regulations and the principles embodied in the AEA. The issues are especially difficult when RCRA regulations are applied to very large operations that have functioned for many years under the principle of ALARA.

Resolution of these and similar issues is being sought at the INEL and other DOE sites where mixed waste is managed. As discussed above, the process of resolution will involve a combination of performing technical evaluations, identifying alternative compliance routes that achieve the same purpose, and negotiating with regulators.

Few of the issues in the conflicting waste management methods under the RCRA and the AEA were fully anticipated at the time of the mixed waste rulings. However, many of those conflicts are apparent today. Dedicated efforts on the part of operators and regulators will be required to achieve timely resolutions.

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