VERIFICATION AND UPDATE OF BNL MIXED WASTE SURVEY*

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1. INTRODUCTION

NRC regulations in 10 CFR Part 61 require that low-level radioactive wastes (LLW) be treated to the extent practicable to minimize potential hazards associated with hazardous chemical, biological, pathogenic, or infectious materials included in the LLW. Under the Resource Conservation and Recovery Act and subsequent amendments, EPA requires that hazardous waste generation, transportation, storage, treatment, and disposal be conducted in accordance with regulations in 40 CFR Parts 260 to 270. Wastes are defined as hazardous wastes if they are listed in Subpart D of 40 CFR Part 261, or if they exhibit any of the characteristics described in Subpart C of Part 261. According to guidance published jointly by NRC and EPA,[1] mixed waste is defined as LLW that is also hazardous under 40 CFR Part 261.

In 1985, under contract to NRC, BNL executed a survey of LLW generators to identify the types and to quantify the volumes of mixed wastes shipped for disposal at licensed LLW disposal sites.[2] Later, in 1986, a telephone survey was conducted to verify the results of BNL's 1985 survey, to determine whether types of mixed wastes other than those identified in the 1985 survey may be present in LLW, and to verify whether the volumes of mixed waste have been accurately quantified. In addition, information was obtained on the management practices which generators are applying to LLW and to mixed wastes in particular.

2. SUMMARY OF TELEPHONE SURVEY RESULTS

About one-third (32) of the facilities which had responded to BNL's 1985 survey were contacted by telephone. Each contact consisted of:

- reviewing the data provided by the generator in the 1985 questionnaire response,
- ascertaining total LLW and mixed waste generated in 1985, and
- discussing current management practices for mixed waste.

With one exception, all generators contacted verified the data provided in the 1985 survey questionnaire. The one exception was a power plant which noted that the amount of chromate used had been overestimated, and that the amount reported was in storage until needed.

The results of the survey are summarized in Table 1. Quantitative information on volume of mixed waste shipped for treatment or disposal in 1985 was not obtained, because such data were not readily available from the generators.

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Most of the respondents indicated that LLW waste volumes shipped for disposal in 1985 were less than those shipped in 1984, in some cases as much as 50%. Several facilities generated and shipped approximately equal volumes for the two years, and one facility refused to provide numerical data on waste shipments over the telephone.

For most of the non-reactor generators, the decrease in total LLW shipments could be attributed to the fact that liquid scintillation (LS) vials and other wastes containing organic liquids are no longer accepted for disposal at the Richland, WA, site. The majority of facilities now ship de minimis LS wastes (i.e., those containing <0.05 μCi/g of H-3 or C-14) to processing facilities which separate the spent scintillation fluids from the vials and other containers. The fluids are then sent to industrial incinerators for reuse as fuel. These facilities also accept and process liquid scintillation media contaminated with other radionuclides, e.g., P-32. Several generators reported disposing of de minimis LS wastes as chemical wastes at local hazardous waste facilities. One generator is evaluating aqueous wastes more carefully in order to utilize the sewer disposal option to a greater extent than in the past. One generator has reduced waste volumes by using a high force compactor for all dry active wastes (DAW).

Some lead metal is still being shipped for disposal with other DAW. The exact amounts cannot be quantified, since the generators do not record the amounts shipped for disposal. In general, as a result of greater awareness of the mixed waste issue, generators are making efforts to prevent the disposal of non-contaminated lead containers (pigs) with DAW. Local lead salvage and recycling facilities are being utilized toward this end.

Various options have been utilized for the disposition of radioactively-contaminated oil wastes. Absorption or solidification and shipment for disposal at Richland was utilized in 1985. On-site incineration or burning as a fuel after obtaining permission from NRC under 10 CFR Section 20.302 has been practiced as well. One generator in the southeast reported that storage of oil wastes would be the normal practice for the near-term (during 1986) until the out-of-compact disposal allocation for the Richland site was known for certain.

Table 1
Summary of Telephone Survey Results

Facility Type[a]	Total LLW (ft^3)		Number Who Generate:			
	1984	1985	LSW[b]	Lead	Chromates	Used Oil
Nuclear Power Plants	402,271	349,016	1	6	2	8
Industrial Facilities	131,954[c]	94,409[c]	3	4	0	3
Medical Institutions	14,883	7,337	7	2	0	1
Colleges, Universities	11,577[c]	9,863[c]	8	4	0	0

[a]Eight facilities of each type were contacted.
[b]LSW = Liquid Scintillation Wastes.
[c]Data provided by six generators only.

3. DISCUSSION

The original BNL survey identified three broad categories of potential mixed wastes: organic liquids, lead metal, and chromate-containing process wastes. EPA has proposed several changes to Part 261 which could have significant impacts on mixed waste identification and management. In particular, two proposed rules would expand the universe of hazardous wastes by extending the EP toxicity characteristic[3] and by listing used oils as hazardous wastes.[4]

3.1 Organic Liquids

LLW containing organic liquids included listed spent solvents and comprised the largest mixed waste category by volume. Currently, no LLW containing organic solvents are being accepted at LLW disposal sites. The treatment options currently being applied are summarized in Table 2. De minimis wastes and LS wastes which have decayed to background levels may be handled as hazardous waste. However, all LS wastes, including those containing radioisotopes with longer half-lives, would be considered mixed wastes in the strict regulatory sense.

The original BNL survey found that organic liquids used in laboratory preparations and solvents used for cleaning and degreasing were also present in LLW. These materials would also be classified as mixed wastes. Some generators which had reported such waste types in the original survey stated that they no longer generated these wastes. Two stated that they were storing these materials until the mixed waste issue is resolved.

Table 2

Treatment Options Utilized for Scintillation Wastes

Category	Option
de minimis (<0.05 μCi/g C-14 or H-3)	LSW processor or local TSDF[a]
short-lived isotopes (e.g., P-32)	storage for decay then TSDF, or LSW processor
longer-lived isotopes	LSW processor

[a]LSW = Liquid scintillation wastes; TSDF = EPA permitted treatment storage and disposal facility for hazardous waste.

3.2 Lead

At the time the telephone survey was conducted, lead metal wastes were still being shipped for disposal. No estimated volumes were available since detailed records for this waste type were not maintained by the generators contacted. Several power plants reported shipping contaminated lead to a

decontamination facility. The general practice for managing lead wastes involved checking for radioactive contamination, and, if the lead exhibited only background radiation levels, recycling on site or sending the waste to a local lead salvage company. One facility washed lead pigs with detergent to decontaminate them before disposing of them as nonradioactive waste. Several facilities also save lead containers and bricks for reuse within the facility.

Until early in 1987, wastes containing lead metal could be sent for disposal at either Barnwell or Richland, (Disposal at Barnwell was approved on a case-by-case basis.) The disposal of lead at Richland was halted with the issuance to the site operator of a revised license with explicit language prohibiting mixed waste disposal at the site. In a more recent development, EPA has taken the position that lead used as a container or for shielding purposes need not be considered a waste material.[5] Hence, contaminated lead is a mixed waste subject to RCRA regulations, while non-contaminated lead which is fulfilling its intended purpose as shielding is not. This policy has not been implemented at the disposal sites at this writing, in part because packaging or encapsulation requirements may be developed for non-radioactive lead.

3.3 Chromates

Of the power plants contacted, two use chromates as a corrosion inhibitor in component cooling systems. Small amounts (at the most 10 gallons) of chromate-contaminated liquids may enter the radwaste cleanup system through floor drains during maintenance activities. These are mixed with other liquids before being sent to evaporators for processing. Neither facility has tested the evaporator concentrates for chromate content. The personnel at one of the plants believe that any chromates present are converted to trivalent (and hence, non-hazardous) chromium oxides during processing.

3.4 Oil Wastes

The proposed EPA rule[4] listing all used oil as hazardous wastes would result in a significant increase in the volume of mixed wastes, according to data from BNL's original survey. Radioactively-contaminated oil wastes are generated primarily by reactor facilities. This telephone survey has confirmed reactors as the source of most oil wastes, and, in addition, that alternative methods for disposal are being sought by reactor facilities for waste oils. These include on-site "incineration" in auxiliary boilers when the radioactivity in the oil is at levels below regulatory concern, and separation of water from the oils to reduce waste volumes.

3.5 Impacts of New Hazardous Waste Regulations

Some of the confusion and uncertainty regarding mixed waste management results from the continuing development of EPA's hazardous waste management system. Regulations have been proposed to revise the EP toxicity characteristic,[3] and to regulate boilers and industrial furnaces which burn hazardous wastes as fuel.[6] In addition, a final rule was published[7] which restricts the land disposal of "California list" wastes. The revised EP toxicity test[3] will be called the toxicity characteristic leaching procedure (TCLP). The list of hazardous constituents which cause wastes to be

classified as hazardous was expanded to include many solvents already listed under the spent solvent categories. The TCLP could have the effect of increasing the types of waste which may be potential mixed wastes. For instance, if certain water-miscible solvents (phenol or isobutanol) were disposed of with other aqueous wastes, as "absorbed liquids," the resulting waste might exhibit the toxicity characteristic. There is no evidence to determine whether LLW in the absorbed aqueous liquids category would be mixed waste under the TCLP, because generators as a rule do not keep records of the chemical composition of wastes shipped under this category.

Regulation of boilers and industrial furnaces could affect the current management of spent scintillation fluids. The proposed regulation prescribes emission standards and operating requirements under 40 CFR Part 266, Subpart D. Limitations on the amount of hazardous waste to be burned are specified according to boiler or furnace size. Included in the category of industrial furnaces are lime kilns and cement kilns. Two scintillation fluid waste processors send the bulk fluids for incineration at cement kilns at present; thus this outlet for mixed waste will be affected by the proposed regulation.

The restrictions on "California list" wastes represent a continuation of the policy mandated by Congress to eventually ban the land disposal of untreated hazardous wastes. The California list consists of liquid hazardous wastes containing certain metals, free cyanides, PCBs, corrosives with pH less than 2.0, and liquid and non-liquid wastes containing halogenated organic compounds (HOC). HOCs are one type of mixed waste identified in BNL's survey; they are used for degreasing equipment and for dry cleaning. The exact amounts of HOC waste generated could not be determined from BNL's survey, but the total volume of cleaning and degreasing solvents shipped for disposal in 1984 was much less than the volume of scintillation fluid wastes.

4. CONCLUSION

The telephone survey indicated that LLW generators are more cognizant of EPA regulations than before, are aware of mixed waste issues, and are attempting to minimize the generation of mixed wastes. In addition to confusion and uncertainty, there is also some frustration among LLW generators, brokers and processors because the EPA regulations are complex and changing. While some mixed wastes (e.g., scintillation fluids) are amenable to treatment, some of the treatment options are in danger of being regulated out of existence. Furthermore, proposed and finalized increases in EPA's hazardous waste "universe" may result in corresponding increases in the universe of potential mixed wastes. There is no obvious resolution of the mixed waste problem in sight in the near future.

5. REFERENCES

1. Federal Register, 52 FR 11147, April 7, 1987.

2. B. S. Bowerman et al., "An Analysis of Low-Level Wastes: Review of Hazardous Waste Regulations and Identification of Radioactive Mixed Wastes," NUREG/CR-4406, BNL-NUREG-51933, December 1985.

3. Federal Register, 51 FR 21648-21693, June 13, 1986.

4. Federal Register, 50 FR 49258-49270, November 29, 1985.

5. Letter from Marcia Williams, EPA, to Terry Husseman, Washington Dept. of Ecology, June 26, 1987.

6. Federal Register, 52 FR 16982-17050, May 6, 1987.

7. Federal Register, 52 FR 25760-25792, July 8, 1987.