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APPLICATION OF EPA REGULATIONS TO LOW-LEVEL RADIOACTIVE WASTE

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INTRODUCTION

The disposal of low-level radioactive waste (LLW) is regulated by the U.S. Nuclear Regulatory Commission (NRC) under 10 CFR Part 61.(1) The U.S. Environmental Protection Agency (EPA) has promulgated regulations under authority of the Resource Conservation and Recovery Act (RCRA), governing the management and disposal of hazardous wastes. Recently, questions have been raised regarding the applicability of EPA standards to LLW containing hazardous chemical constituents, or radioactive mixed wastes.

As part of its technical assistance program for the NRC, Brookhaven National Laboratory has been conducting several studies in order to provide NRC with the information needed to determine the applicability of EPA standards to radioactive mixed wastes. The studies which have been completed focused on the following:

- a review of EPA regulations, and
- a review of the literature and commercial disposal site records for the known chemical characteristics of LLW.

EPA regulations concerning the management and disposal of hazardous wastes are contained in 40 CFR Parts 260 to 270. The regulation of particular concern for determining whether LLW would be considered hazardous is 40 CFR Part 261, "Identification and Listing of Hazardous Waste." In 40 CFR Part 261, wastes are defined as hazardous if they exhibit one of four characteristics:

- ignitability,
- corrosivity,
- reactivity, and
- extraction procedure (EP) toxicity.

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The characteristics are defined in Subpart C of 40 CFR Part 261. In addition to these characteristics, wastes are hazardous if they correspond to one of the wastes listed in Subpart D of 40 CFR Part 261. These lists are subdivided as follows:

- hazardous wastes from non-specific sources,

EP

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- hazardous wastes from specific sources,
- discarded commercial chemical products, off-specification species, container residues, and spill residues thereof.

The latter list of chemicals is subdivided into acutely hazardous and toxic lists.

The literature review and review of disposal site records identified two waste categories as potentially hazardous under the Subpart C characteristics. These were lead metal and organic solvents used in liquid scintillation media. No LLW types were identified which directly corresponded to the wastes listed in Subpart D. Lead was considered potentially hazardous because of EP toxicity. Organic solvents were identified as potentially hazardous due to ignitability and the presence of toxic constituents listed in Appendix VIII of 40 CFR Part 261.

Survey of LLW Generators

The results of the early studies by BNL were extended by conducting a survey of generators of LLW. The survey questionnaire was designed to address information gaps identified in the earlier studies, e.g. the presence and concentrations of various hazardous constituents such as phenols, hydrazine, cyanide, and chromates. The survey was sent to 239 reactor and non-reactor generators of LLW. Of these, 94 responses were received, representing approximately 29% by volume of all LLW sent to commercial disposal sites in 1983.[3] (A comparison with 1983 data was made since a breakdown with respect to generator type was not available for wastes disposed in 1984. The total volume of LLW decreased by ≈3% in 1984 compared to 1983. The survey data reported here are not final. Some responses were received late, and will be included at a later date.)

The distribution of waste volumes by generator type is shown in Table 1 and Figure 1. The response from each type of generator was reasonably consistent with the overall response, with the exception of medical facilities.

The analysis of the survey results revealed three broad categories of wastes which may be radioactive mixed wastes. These were as follows:

- wastes containing organic liquids, disposed of by all types of generators,
- wastes containing lead metal, i.e., discarded shielding and lead containers, and
- wastes containing chromium, e.g., process wastes from nuclear power plants which use chromates as corrosion inhibitors.

Certain wastes, specific to particular generators, were identified as potential mixed wastes as well.

TABLE 1. COMPARISON OF SURVEY RESPONSE WITH 1983 DATA
(cubic feet)

Generator Type	Totals for 1983[a]	Survey Response	Percent[b] Response
Reactor	1,734,000	512,000	29.5
Non-reactor			
academic	98,000	19,000	19.8
medical	100,000	7,500	7.5
industrial	777,000	242,000	31.2
Total	2,709,000	781,000	28.8

[a]Data from reference 3.
[b]Column 2 as a percentage of Column 1.

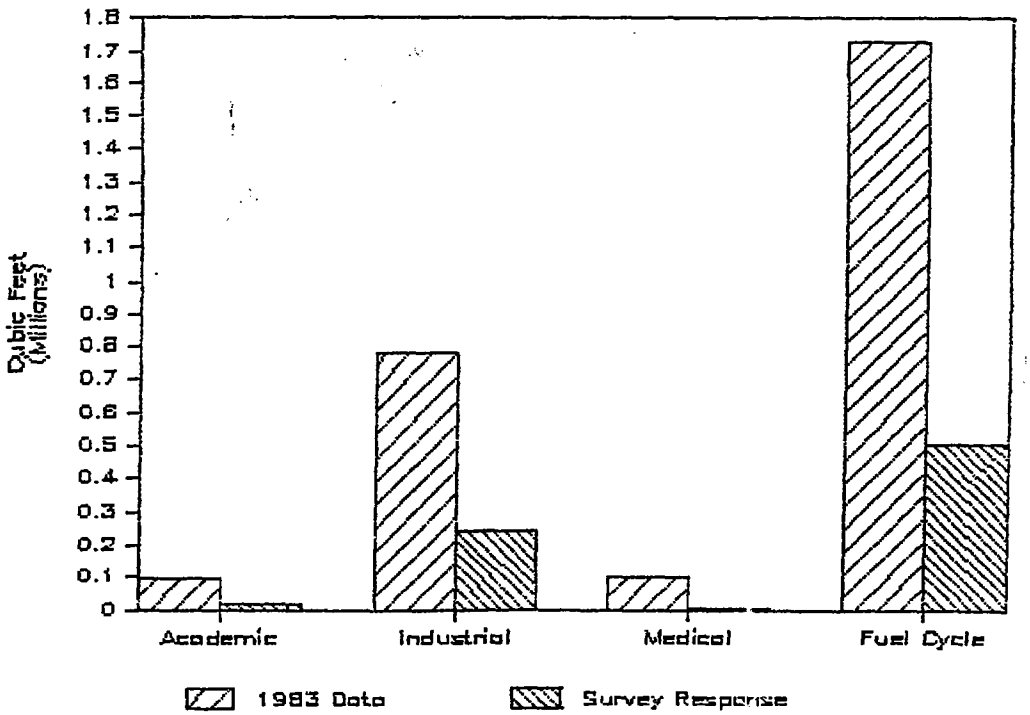

Figure 1. Comparison of survey response with 1983 data.

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Two of the three categories of wastes listed above are generated in significant quantities by academic facilities: wastes containing organic liquids and wastes containing lead metal. A total of 16,647 ft^3 of wastes containing organic liquids were shipped for disposal. The figure represents 2.1% of all wastes reported in the survey. The volume includes absorbents or solidification agents, and hence is not the volume of organic liquids shipped to commercial disposal sites.

The sources of wastes containing organic liquids with respect to generator type and according to waste type are shown in Tables 2 and 3, respectively. These indicate that the largest amounts of waste in terms of disposal volume consist of scintillation vials, and that academic and industrial generators are the two largest sources of wastes containing organic liquids.

TABLE 2. SOURCES OF WASTES CONTAINING ORGANIC LIQUIDS

Generator Type	Volume (ft^3)	Percent of Total
Reactor	2,451	14.7
Non-reactor		
academic	6,071	36.5
medical	2,499	15.0
industrial	5,626	33.8
Total	16,647	100.0

TABLE 3. WASTE TYPES CONTAINING ORGANIC LIQUIDS

Waste Type	Volume (ft^3)	Percent of Total
Scintillation liquids	3,236	19.4
Scintillation vials	8,519	51.2
Organic lab liquids	3,281	19.7
Miscellaneous solvents	1,611	9.7
Total	16,647	100.0

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A comparison of the results listed in Tables 1 and 2 shows that, as a percentage of the total wastes reported for each generator type, wastes containing organic liquids represented 0.5% of all reactor wastes, 31.5% of academic totals, 33.1% of medical wastes, and 2.3% of industrial wastes. Because organic-containing wastes form a larger percentage of medical facility wastes, and medical facilities are under-represented in terms of volume compared to other generator types, the value of 2.1% mentioned earlier as the overall percentage of organic-containing wastes may underestimate the national figure. However, it was found during follow-up contacts that some respondents had included volume data for scintillation vials which were de minimis (de-regulated) and were sent to facilities other than commercial LLW disposal sites.

Wastes containing lead metal are present in less than one percent by volume of all LLW, according to the survey. These wastes are primarily in the form of discarded, contaminated shielding, e.g., lead bricks or blankets, and containers such as lead pigs for sealed sources. Academic facilities disposed of the latter form, and accounted for <0.5% of the lead-containing wastes in the survey. The lead metal wastes were generally mixed with non-compactible trash, and the quantities reported reflect the amounts as-shipped.

The amounts of lead-containing wastes reported in the survey are summarized in Table 4 according to generator type. These are reported as weight (lbs) since more than half the respondents for this category of wastes provided weight rather than volume data.

TABLE 4. SOURCES OF LEAD-CONTAINING WASTES

Generator Type	Weight (lbs)	Percent of Total
Reactor	77,400	63.3
Non-reactor		
academic	490	0.4
medical	2,800	2.3
industrial	41,660	34.0
Total	122,350	100.0

Conclusions and Discussion

The survey reported here was conducted with the intent of identifying categories of LLW which would be classified under EPA regulation 40 CFR Part 261 as hazardous due to the chemical properties of the waste. Three waste

types are identified under these criteria as potential radioactive mixed wastes:

- wastes containing organic liquids,
- wastes containing lead metal, and
- wastes containing chromium.

The survey also indicated that certain wastes, specific to particular generators, may also be radioactive mixed wastes.

Ultimately, the responsibility for determining whether a facility's wastes are mixed wastes rest with the generator. However, the uncertainties as to which regulations are applicable, and the fact that no legal definition of mixed wastes exists, make such a determination difficult.

In addition to identifying mixed wastes, appropriate methods for the management of mixed wastes must be defined. In an ongoing study, BNL is evaluating options for the management of mixed wastes. These options will include segregation, substitution, and treatments to reduce or eliminate chemical hazards associated with the wastes listed above.

The impacts of the EPA regulations governing hazardous wastes on radioactive mixed waste can not be assessed in detail until the applicability of these regulations is agreed upon. This issue is still being discussed by EPA and NRC and should be resolved in the near future. Areas of waste management which may affect generators of mixed wastes include:

- monitoring/tracking of wastes before shipment,
- chemical testing of wastes,
- permits for treatment or storage of wastes, and
- additional packaging requirements.

REFERENCES

1. Code of Federal Regulations, Title 10, Energy, Parts 0 to 99 revised as of January 1, 1985.

2. Code of Federal Regulations, Title 40, Protection of Environment, Parts 190 to 399, revised as of July 1, 1984.

3. Conference of Radiation Control Program Directors, Inc., "The 1983 State-by-State Assessment of Low-Level Radioactive Wastes Shipped to Commercial Disposal Sites," DOE/LLW-39T, December, 1984.