STRATEGIC PLANNING FOR WASTE MANAGEMENT: CHARACTERIZATION OF CHEMICALLY AND RADIOACTIVELY HAZARDOUS WASTE AND TREATMENT, STORAGE, AND DISPOSAL CAPABILITIES FOR DIVERSE AND VARIED MULTISITE OPERATIONS*

Robert L. Jolley, Angel L. Rivera
Waste Management Technology Center
Oak Ridge National Laboratory
Oak Ridge, Tennesse 37831

Edward C. Fox
Engineering Technology Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831

George J. Hyfantis
Advanced Waste Management Systems, Inc.
Sevierville, Tennessee 37862

James F. McBrayer
Hazardous Waste Remedial Action Program
Support Contractor Office
Martin Marietta Energy Systems, Inc.
Oak Ridge, Tennessee 37830

ABSTRACT

Information about current and projected waste generation as well as available treatment, storage, and disposal (TSD) capabilities and needs is crucial for effective, efficient, and safe waste management. This is especially true for large corporations that are responsible for multisite operations involving diverse and complex industrial processes. Such information is necessary not only for day-to-day operations but also for strategic planning to ensure safe future performance. This paper reports on some methods developed and successfully applied to obtain requisite information and to assist waste management planning at the corporate level in a nationwide system of laboratories and industries. Waste generation and TSD capabilities at selected U.S. Department of Energy (DOE) sites were studied.

Collecting, analyzing, and maintaining the quality assurance (QA) of quantitative data concerning waste generation and TSD can be complex and arduous. This is particularly so if the industry or industries are multifaceted and produce a large variety of wastes. For example, the national industrial complex operated under the auspices of the DOE involves approximately 30 sites as well as widely varied industrial operations, including metal fabrication and processing, machining, chemical processes involving hazardous and radioactive components, solvent recycle and recovery, and explosives testing.

INFORMATION NEEDS

The efficient and environmentally safe management of chemically and/or radioactively hazardous waste requires extensive and reliable information about waste generation and characteristics and available TSD capabilities. Basic information needs include the chemical and physical characterization of the waste, the concentration of the hazardous constituents as well as of the nonhazardous materials that may govern the treatment methodology, the inventory of waste on hand, and the waste generation or accumulation rates. The chemical and physical nature of the waste constituents determines the degree of hazard and the TSD methods to be employed. Waste characteristics such as flammability and corrosivity are important in prioritization of treatment. For example, placing high priority on the treatment of flammable waste will focus available resources on reducing the potential for liability which could result from the event of accidental fires during storage.

Quantitative information concerning the relative amounts of hazardous and inert materials in waste is

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necessary for process and facility design. Large existing inventories of hazardous waste or high waste generation rates may also dictate treatment priority and the size and design of TSD units. Other factors affecting TSD strategies include waste generation site, health and environmental risks associated with waste types and treatment methods, environmental regulations pertaining to mixed and hazardous waste, availability and cost of TSD methods, and public perception.

WASTE STREAM CHARACTERIZATION

Several thousand varied and unique waste streams exist in the large industrial complex studied for this report. To facilitate the use of waste stream data and the integration of such information into collective generalizations useful from a system-wide waste management viewpoint, waste stream data collected by the DOE Waste Information Network1 were abstracted and organized into a form easily usable on a personal computer. Because of the relative ease of access and flexibility in data manipulation, commercially available spreadsheet software (Lotus 1-2-3 and dBASE III) was selected for use. Spreadsheets were prepared for each geographical site. The approximately 50-column spreadsheet categorized essential waste management data such as chemical/physical characteristics, concentrations, amounts or current inventories, and generation rates. Based on the chemical information, candidate U.S. Environmental Protection Agency (EPA) hazardous waste numbers were assigned to waste streams. Candidate EPA TSD numbers were also assigned for the current TSD methods. Other information included TSD locations, future projections, and problem areas.

In classifying the waste streams, several assumptions were made that reflect a generally conservative approach to the management of mixed waste. Any chemically hazardous waste streams also containing radioactivity were categorized as mixed wastes. Wastes containing several hazardous constituents were classified according to the components considered most hazardous.

Waste stream data in the spreadsheet format were submitted to each generation site for corroboration and evaluation. This QA step was of considerable importance for verification of data value.

GENERIC WASTE TREATMENT FLOWCHART

The treatment, storage, and disposal of hazardous and mixed wastes are dependent upon the nature and composition as well as the volume of the waste. Collectively, the waste streams were generalized into (1) wastes that are treated as wastewaters which produce sludges or residues requiring possible further treatment (e.g., detoxification or solidification); (2) wastes that may be burned and produce ash requiring possible further treatment (e.g., solidification); (3) solids or noncombustibles that require fixation, solidification, or packaging before disposal (e.g., asbestos); (4) chemicals requiring special detoxification or treatment (e.g., sodium, cyanides, etc.); and (5) historic wastes requiring remedial action. This categorization of wastes into treatment groups has been conceptualized into a flowchart (Fig. 1). The conceptualization incorporates a hierarchy of steps leading from generation to disposal. In general, it was assumed that all wastes were treated prior to disposal. Treatment residues may require fixation or solidification, and some wastes may be packaged before disposal.

TREATMENT FLOW SHEET QUESTIONNAIRE

Following QA by the individual sites, the waste stream data were sorted and grouped into the following treatment categories: incineration, neutralization, precipitation, physicochemical treat- ment, wastewater treatment, and fixation/solidification. During the course of the study, the unit operations neutralization, precipita- tion, and physicochemical treatment were determined to be subsets of general wastewater treatment.

A flow sheet questionnaire was prepared for each treatment category (e.g., Fig. 2). The questionnaires were designed to solicit: (1) comments and corrections by site representatives; (2) annual generation rate and waste inventories as corroboration of summaries prepared from waste stream data; (3) information concerning TSD capacities (current, required, and planned); (4) operating costs and planned expenses; (5) compliance issues; and (6) general comments and other issues. The data and information developed through use of the flow sheet questionnaire were subsequently used for development of various waste management options and for evaluation of the advantages and disadvantages that each option presented to the DOE

CONCLUSIONS

The methods discussed in this paper were successfully used to study waste management in a large, national multisite organization. The methods enabled the identification and characterization of individual waste streams with appropriate quality assurance, the at the national level through generic flowcharts. The data summaries and analysis permitted a comprehensive examination of corporate waste management practices.

REFERENCE

1. C. S. FORE et al., "DOE Waste Information Network InformationSystems: Data Management and Analysis," DOE/HWP-10, HazardousWaste Program Support Contractor Office, Martin Marietta EnergySystems, Inc., Oak Ridge, Tennessee (1985).

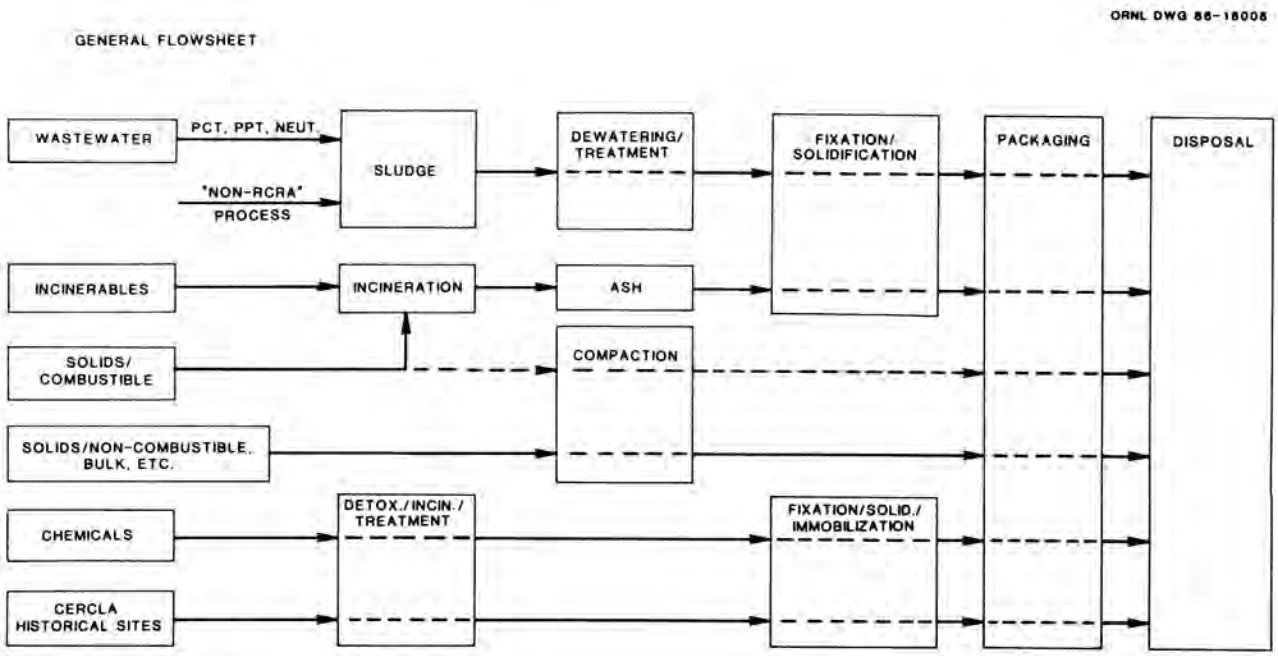

Fig. 1. Generalized Flowchart for Waste Treatment Categories (the dashed lines indicate that the Treatment Represented by the Box is Optional.

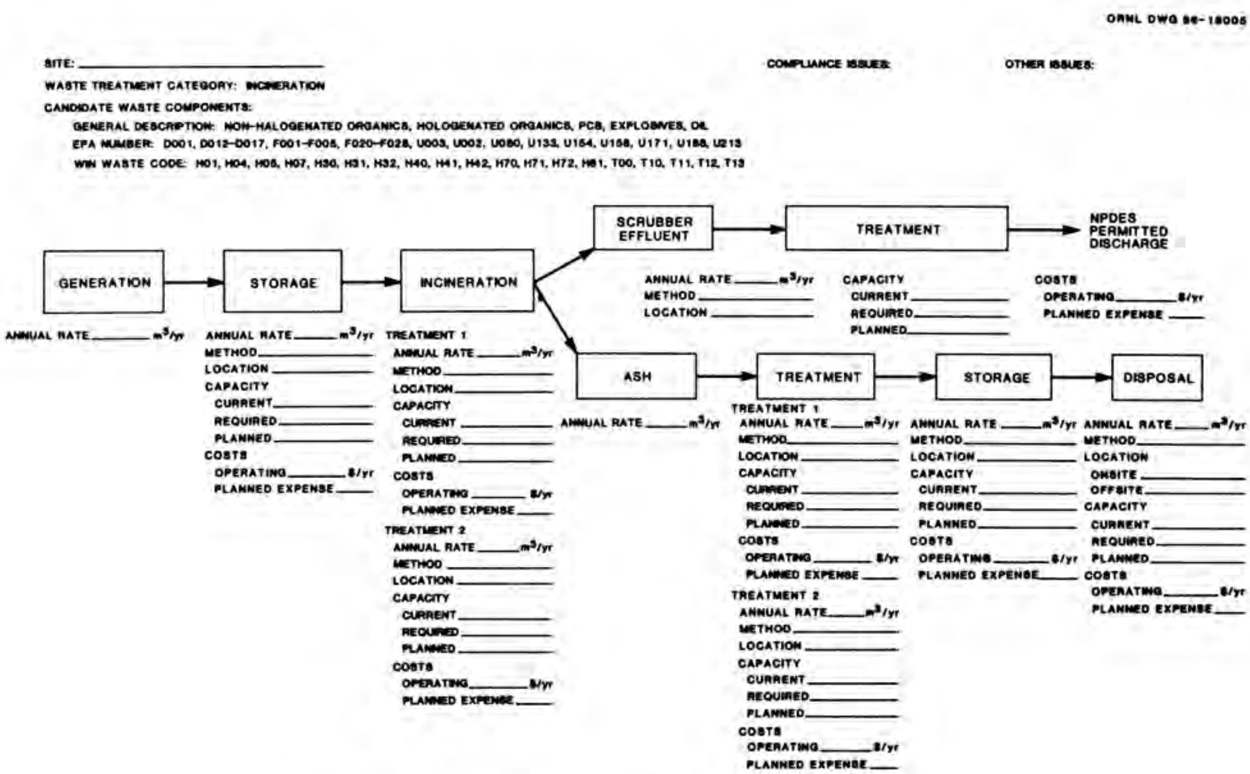

Fig. 2. Example of Treatment Flowsheet Questionnaire.