CHEMICAL LABORATORY HAZARDOUS WASTE MANAGEMENT AT A DOE MULTIPROGRAM NATIONAL LABORATORY

Paul J. Turner
Pacific Northwest Laboratory
Richland, Washington

ABSTRACT

Pacific Northwest Laboratory (PNL), a United States Department of Energy (DOE) Multiprogram Energy Laboratory, is establishing a program for management of diverse small-quantity laboratory waste generated on site. Although the main emphasis of this program is "cradle-to-grave" tracking and treatment of hazardous chemical waste and mixed waste, low-level radioactive and transuranic (TRU) waste is also being included. With the program in operation, more than 95% of all regulated waste will be treated or destroyed on site. The cost savings will return the original investment in under six years and decrease the liability to PNL and DOE - a benefit with a potentially greater economic value.

Tracking of hazardous waste will be mediated by a computer-based inventory and tracking system. The system will track all hazardous materials from receipt through final disposition, whether the material is destroyed or treated for disposal. It will allow user access to handling and hazards information as well as provide an updated inventory by location, user, and hazard type.

Storage and treatment of waste will be performed by at least four facilities, made operational in three phases. Phase 1, which will be completed February 1990, calls for the establishment of a storage facility and an interim treatment facility. The storage facility (operational 5/89) provides longer than 90-day storage for materials awaiting final disposition. The interim Hazardous Waste Facility will treat, with limited scope, hazardous chemical, mixed, low-level radioactive, and TRU waste. It is an Environmental Protection Agency (EPA)/Washington Department of Ecology (WDOE) Part A permitted facility located in a pre-existing building. Phase 2, which is currently in progress, calls for the establishment of a "new" permanent facility, the Hazardous Waste Treatment Facility. This facility will be a Part B permitted facility incorporating state-of-the-art non-radioactive chemical waste treatment and destruction technology. Laboratories will be included for the demonstration of new and promising technologies that may be incorporated into routine treatments and transferred to other DOE laboratories or the private sector. When the permanent facility becomes operational, the interim facility will revert to a permanent role as a low-level radioactive, TRU, and mixed waste treatment facility. Phase 3 includes the establishment of a Testing and Evaluation facility. Also a fully permitted facility, it will provide laboratories for the development, testing on actual radioactive and non-radioactive waste streams, and performance evaluation of new and promising technologies for incorporation in both DOE and private programs.

INTRODUCTION

Pacific Northwest Laboratory is a US Department of Energy Multiprogram Energy Laboratory operated by Battelle Memorial Institute at the Hanford Site in the State of Washington. PNL has a multifaceted role as a primary center of nuclear and non-nuclear energy and materials research, a center for molecular sciences research, and a contract laboratory. Waste types generated from these activities are diverse and constantly changing with changes in ongoing research projects. The types of waste generated fall into all of the three main catagories of waste: radioactive, non-radioactive hazardous, and mixed. The radioactive waste of concern for our purposes is the transuranic waste (TRU) and low level radioactive (LLW) waste. High-level radioactive waste, which requires specialized handling, is outside the scope of this project.

Many of the laboratory operations resulting in LLW and TRU waste incorporate extremes of pH, organic solvents, or heavy metal salts. In combination with the TRU or low-level radioactive material they form a waste that is both hazardous and radioactive; i.e., mixed waste. Due to its hazardous component, it requires separate handling from the uncontaminated TRU and LLW. These mixed wastes represent the most difficult waste management problem.

Non-radioactive hazardous waste results from a wide range of laboratory operations including experimental studies, laboratory maintenance, and facilities operations. These wastes range from acidic and basic wastes, organic solutions, and heavy metal solutions to unused paints and cleaners. This is the largest of the waste problems at PNL.

With the advent of the EPA "landban" rules, all wastes must now be treated before disposal by burial. PNL along with other similar laboratories was faced with the option of paying to have its waste treated or treating the waste internally. PNL chose to treat its own waste and to use the implementation of treatments to satisfy the "landban" rules as an opportunity to develop, test, and demonstrate new and innovative treatment technologies. These treatments, if proven and cost effective, can be used by other DOE labo-

ratories and transferred to the private sector. The cost savings from treating wastes internally is projected to return the original investment for treatment facilities in under six years (Fig. 1) and decrease the liability to PNL and DOE - a benefit with a potentially greater economic value.

In order to accomplish the goal of managing and treating all laboratory wastes, a complex waste management program needed to be developed to track chemicals from "cradle to grave", ensure worker safety, and maintain compliance with all environmental regulations. A variety of options were examined. This paper will discuss the program that PNL chose and is now instituting to manage these wastes.

WASTE MANAGEMENT AT PNL

PNL's waste management program is composed of two parts:

- worker safety and environmental compliance, including chemical inventory and waste tracking
- waste treatment and treatment technology development.

These components, and the key personnel involved with them, are described below.

Worker Safety and Environmental Compliance

Environmental Compliance Manager and Hazardous Materials Custodian

PNL waste management programs are overseen by specially trained personnel. The research portion of PNL's laboratory operation is organized around eight Centers of Excellence. Two of the largest centers, for example, are the Materials and Chemical Sciences Center and the Earth and Environmental Sciences Center. Each center has an Environmental Compliance Manager (ECM) who is responsible for implementing and overseeing the waste management program within the center. An ECM may have responsibility for several buildings. Each building has a Hazardous Materials Custodian (HMC) who is responsible for ensuring that the waste management program is functioning within the building. The duties of the HMC include monitoring new chemical arrivals, collecting waste, ensuring that waste containers are properly labeled, and serving as a knowledgeable resource on waste handling issues.

Proper training of these individuals is paramount. PNL is currently working with Columbia Basin College (CBC), a local community college, to develop a two-year curriculum for hazardous material technicians that will satisfy the Hazardous Waste Operations and Emergency Response Rule (29 CFR 1910). Within this curriculum will be condensed courses designed to train HMCs (probably 40 hours) and general laboratory workers (probably 8 hours). Other community colleges in the tri-state area (Washington, Idaho, and Oregon) are participating in the curriculum development in conjunction with a non-profit institute based at Kirkwood Community College in Iowa, the Hazardous Material Training and Research Institute (HMTRI).

Computer-Based Inventory and Tracking System

Worker safety, environmental compliance, and inventory/tracking will be mediated by a computer-based system. The software is a combination of a commercially available software package (TINIA by ASI, Inc.) and internally written software. It will be run in Oracle on the PNL Vax in a UNIX environment.

Worker safety information, in the form of Material Safety Data Sheets (MSDS) and other handling information for specific materials, will be available to individual researchers through computer terminals. Most PNL laboratories and offices have personal computers that are in the process of being connected to a Local Area Network (LAN) line that will allow them to have a dual function as independent computers and terminals for direct access to all other computers at PNL. Via this system, soft and hard copies of worker safety information can be instantly obtained.

Tracking of waste and inventory of chemicals will be accomplished through the same system. When new chemicals arrive on site, each container will be assigned a unique number (the Chemical Abstract Service registry number (CAS number) or a similar number if not available) and labeled with a mark-sense label, similar to the Uniform Product Code (UPC) label, that can be read by a light-pen reader. Information stored in the file accessed by the unique number will include the identity (including commonly used names), quantity, location of delivery, users, and all hazard and fire safety information. The management system will keep a dynamic inventory of all chemicals on site. This datafile can be used to retreive instantaneous information such as quantities grouped by type, fire hazard, hazard class, location, or any other of a number of catagories. When the contents of an individual container are used up, the container number will be eliminated from the inventory and the container properly discarded.

As material from containers is used, the software is designed with the option to maintain a log of usage (a requirement for biohazardous materials). Also, when the storage location of a container changes, the datafile will be modified. Periodic manual inventories will be performed to ensure the accuracy of the inventory. Using the light-pen reader, these inventories will be quick and accurate. The computer software is designed to check current inventories against previous inventories to eliminate the possibility of human error in overlooking containers. It is not PNL's intent at this time to track solutions made in the laboratory, although this capacity has been built into the software. The container-based tracking system will also will extend to

wastes. As waste containers are filled, they will also be assigned a unique number and labeled with a mark-sense label. The information contained in their datafiles will be similar to that in the inventory files - type of material, quantity, hazard class, fire class, location, etc. Tracking of the waste containers will continue until they are treated or reach final disposal.

Additional features of the system will be checks on chemical type and users vs. individual training records to verify that users have been properly trained, and to monitor individual laboratory loading vs. Uniform Building Code (UBC) and Uniform Fire Code (UFC) restrictions.

The information contained in the datafiles on type and quantity of chemicals and waste will be used to compile the necessary for SARA Title III and OSHA reports. Forms for the various types of reporting will be generated by the computer and sent directly to the responsible agencies.

Waste Treatment and Treatment Technology Development

Treatment and Storage Facilities

The development of waste treatment facilities has been a major initiative at PNL during the last year. Current plans call for a three phase development of facilities for the treatment of all laboratory hazardous and mixed waste and the establishment of a testing and evaluation facility.

Phase 1 of the initiative is to modify several rooms in an existing building for use as a permitted interim waste treatment facility (325-WTF) (Fig. 2). This 1700 square foot facility, which is scheduled to begin operation in February 1990, will treat a limited amount of radioactive, mixed, and non-radioactive hazardous waste. It will consist of two laboratories, one for radioactive and the other for non-radioactive hazardous waste. The 325-WTF will also provide less than 90 day storage for hazardous materials in line for treatment - working in conjunction with a permitted storage facility that began operation in 1989 (305-B Storage Facility)(Fig. 3).

The 325-WTF, because of size and building classification limits, will begin operation only routinely treating wastes that can be encapsulated, neutralized, or separated into hazardous and non-hazardous components. It will, however, provide space for the demonstration and laboratory-scale testing of new and innovative technologies on actual waste streams. Some of the first candidates are electrochemical destruction of organics and precipitation technologies. It will also be a center for the development of artificial intelligence for the determination of best waste treatment option.

Secondary waste streams from 325-WTF treatments, encapsulated deregulated waste, and untreatable wastes will either be shipped to the 305-B Storage Facility for offsite disposal, in the case of non-radioactive waste, or sent to the Hanford Site operations contractor for interment in waste tanks or burial.

Phase 2 of the waste treatment facilities initiative is the building and permitting of a 10,000-square-foot permanent Hazardous Waste Treatment Facility (HWTF)(Fig. 4) for the treatment of small-quantity diverse laboratory wastes (large-volume process waste will still be the responsibility of the onsite operations contractor). This facility is a FY-1991 line item and is currently included in the budget. It is scheduled to begin operations in late 1992 or early 1993. Currently, design is complete and the permitting and environmental documentation under way. When the HWTF is fully operational, the 325-WTF will become a permanent facility for the treatment of radioactive and mixed waste. Only non-radioactive hazardous waste will be treated in the HWTF. It is projected that during full operation of both facilities, over 95% of all PNL laboratory wastes will be treated and deregulated or destroyed.

Included in the operation portion of the HWTF design are three temporary storage rooms for waste awaiting treatment, a small characterization laboratory, a neutralization facility with the capacity for continuous-feed operation, a grouting facility, and a small incinerator with throughput of about 100-200 kg per day. Also included in the design are two laboratories dedicated to the demonstration and testing of new and innovative technologies. The non-operational portion of the facility, separated from the operations side by an airlock, will be offices, a conference room, a lunch room, and a computer room.

As new technologies are tested, it is expected that several will prove useful. Eventually, new space will be needed to incorporate these into routine treatment. Phase 3 of the facilities initiative is to build a Testing and Evaluation facility dedicated to the demonstration, testing, and evaluation of both PNL-developed technologies and ones developed by other DOE laboratories and the private sector. This facility would satisfy the need within the DOE system for a dedicated and permitted facility for this purpose.

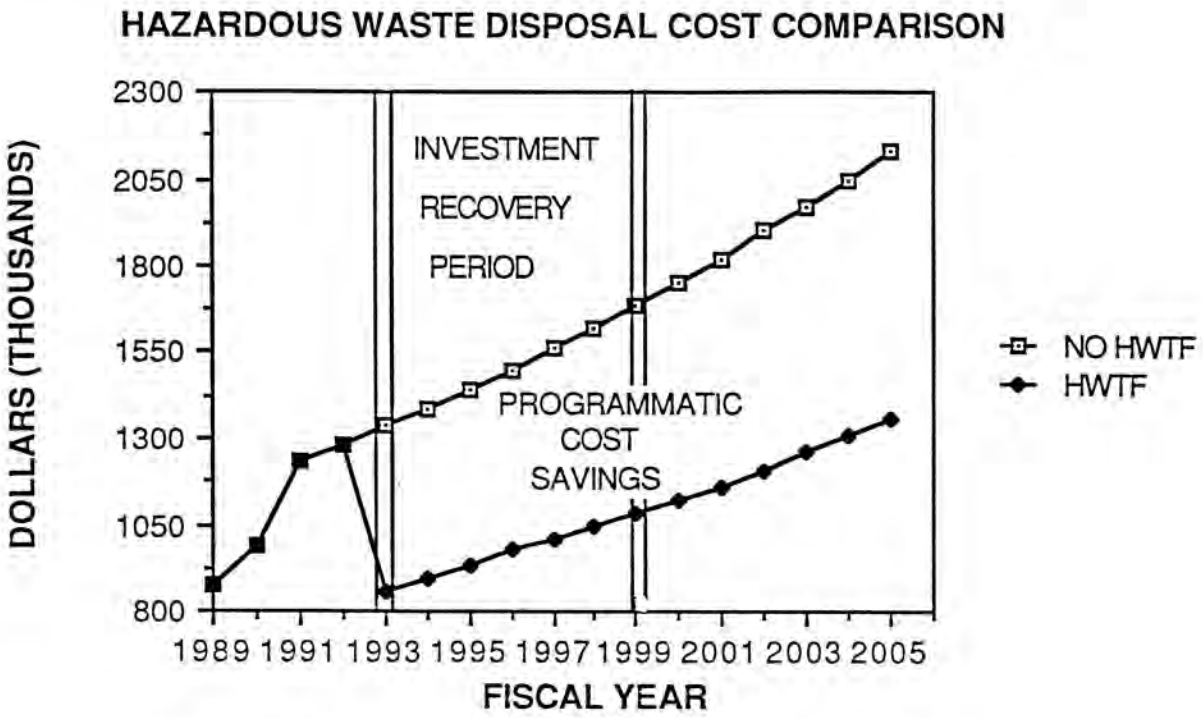

Fig. 1. Cost Savings from Hazardous Waste Treatment Facility.

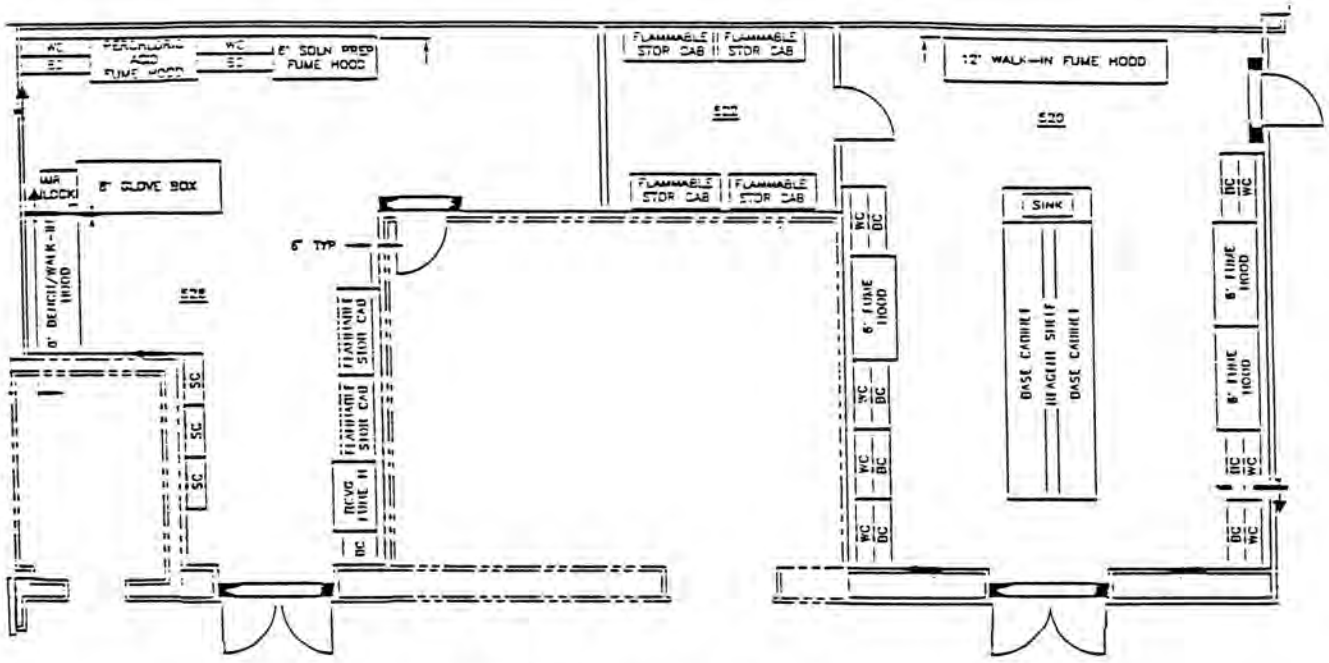

Fig. 2. 325 Building Waste Treatment Facility.

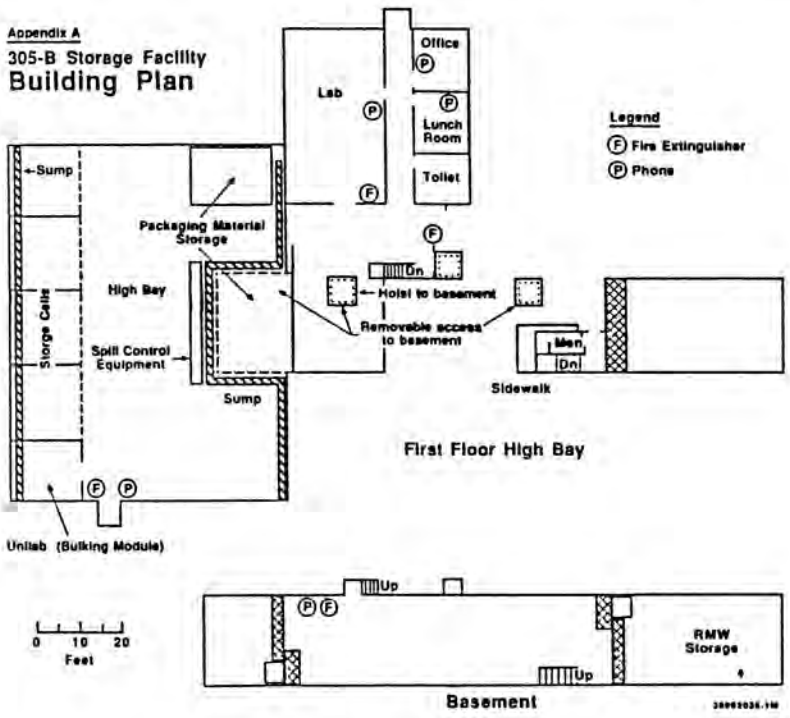

Fig. 3. 305-B Waste Storage Facility.

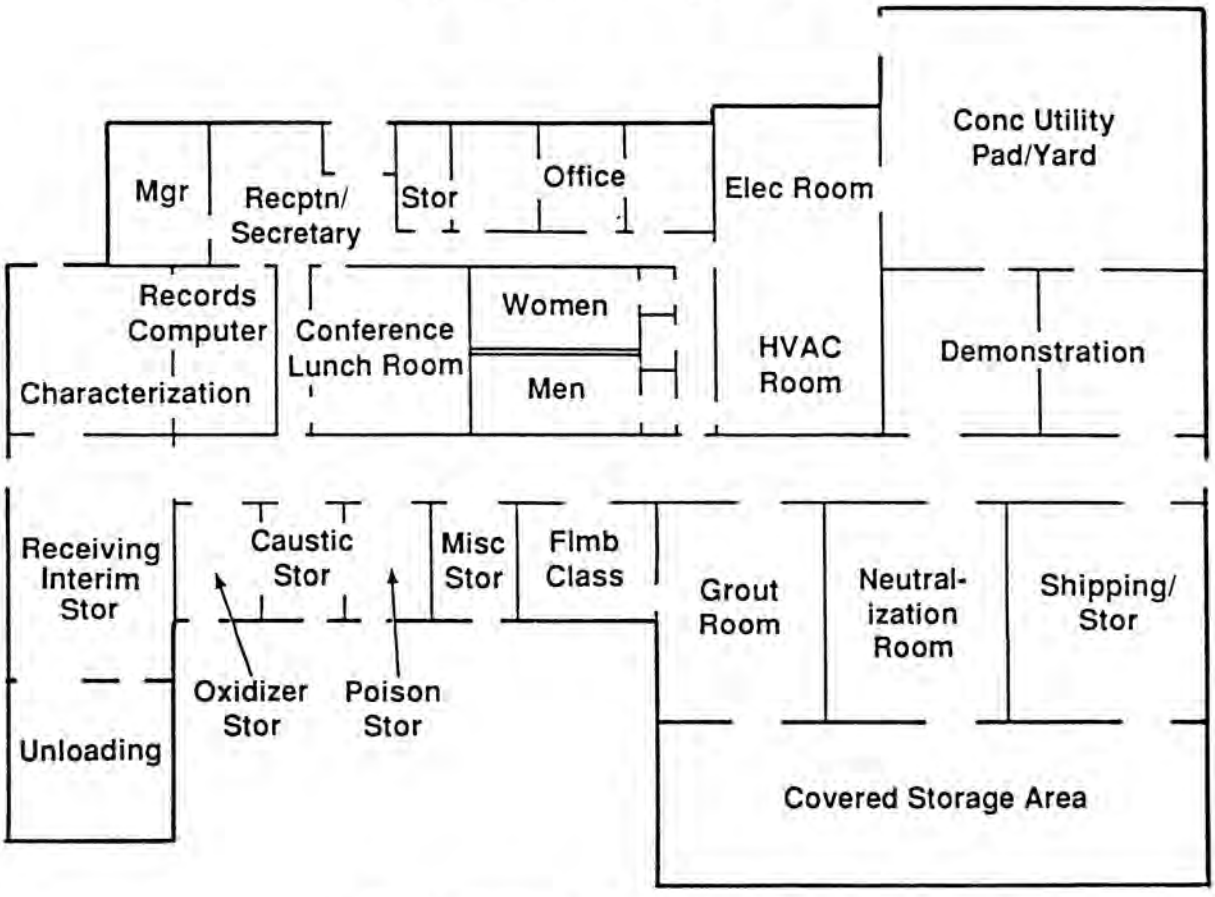

Fig. 4. Hazardous Waste Treatment Facility.