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OVERVIEW OF DOE LLWMP WASTE TREATMENT, PACKAGING, AND HANDLING ACTIVITIES*

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W. H. Pechin
DEPARTMENT OF ENERGY LOW-LEVEL WASTE MANAGEMENT PROGRAM
OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE 37830

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OVERVIEW OF DOE LLWMP WASTE TREATMENT, PACKAGING, AND HANDLING ACTIVITIES

W. H. Pechin
Department of Energy Low-Level Waste Management Program
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

This paper presents an overview of Department of Energy (DOE) Low-Level Waste Management Program funded activities on the treatment, packaging, and handling of low-level wastes. Other papers in the Group A sessions will present the details of this work.

The waste management system is summarized in Figure 1. The system approach is demanded here because what can be done at each step is heavily influenced by what has been done previously and will in turn affect what can be done in later steps. The choice of a waste treatment method must consider not only the nature of the waste to be treated, but also the effect of the treatment process on packaging requirements and the restrictions on waste form that may be imposed by transportation and disposal requirements. Throughout the system the choices are interlocked.

A major purpose of the program is to reduce the commitment of burial ground space while protecting the human health and safety in a cost effective manner. This cost effectiveness requires balanced decisions at each point in the waste management system. For instance volume reduction is an appealing way to reduce the cost of packaging transportation or burial, but the volume reduction process invariably produces secondary waste which must cycle back into the system. The cost of handling secondary waste could destroy the cost-effectiveness of an otherwise attractive treatment scheme. Only experience from actual operations or from engineering-scale demonstrations can tell us enough about the secondary waste problems to clearly indicate that a given treatment process is cost-effective.

The final product of the DOE Low-Level Waste Management Program will be documentation of the various options available for each step in the waste management system. This documentation will permit each responsible site whether government or commercial to tailor a waste management system that is safe and cost-effective for the waste mix unique to that particular site.

The efforts in the waste treatment, packaging, and handling technology include the selection and documentation of techniques for reducing the quantity of waste generated. The efforts also include the development and documentation of improved techniques for processing low-level waste to reduce its volume and increase the stability of the resulting waste form. This includes any techniques for reducing nonradioactive hazards associated with the waste form. The program is also involved in the investigation of waste packaging to improve transportation safety, increase disposal site stability and contribute to waste retention after disposal. The review and documentation of waste handling techniques is a part of the program since proper handling will reduce the potential for radiation exposure to both operating personnel and the public.

Three top-level objectives have been defined for technology development: (1) to develop and document the technology for waste generation reduction by September 1984; (2) to develop and document the technology for waste processing, packaging, and handling for shallow land burial by March 1984, and (3) to develop and document the technology for waste processing, packaging, and handling for greater confinement than shallow land burial by September 1985.

The technology development work is focused on development and demonstration applicable to the entire low-level waste stream from generation to disposal. The major components include waste generation reduction, waste processing, waste packaging, waste handling and waste form testing.

The waste generation reduction work has resulted in the preparation of a final draft of the Waste Generation Reduction Handbook by Pacific Northwest Laboratory (PNL) this year. No further activity is planned for this area until FY 1984 when the draft handbook will be reviewed and any necessary updating or revisions will be made.

The types of waste processing can be described as:

- mechanical processing which includes baling, shredding, compaction or any mechanical treatment which makes the waste easier to package or to further process,
- incineration which includes those processes which involve burning the waste, but as a more general term is sometimes used to include the digestion process,
- chemical processing which includes ion exchange and biological treatment,

- o metal volume reduction which includes sawing objects into pieces suitable for packaging and melting and casting metal waste into solid ingots,

- o waste form development which includes the preparation and characterization of candidate waste forms especially the various solidification techniques, and

- o general waste processing guidelines which document the various procedures sufficiently to provide guidance to the individual waste generator.

The waste packaging studies can be divided into general packaging guidelines, the transport package and the disposal package. The transport package is essentially completely devoted to the protection of the operating personnel and the public from any release of radioactive material during transportation. The design of the transport package addresses such off-normal situations as resistance to impact and fire and is not closely related to the properties of the waste. The disposal package is however in direct contact with both the final waste form and the disposal medium. In some cases such as in-drum mixing of solidification agents, the disposal package is directly involved in the waste processing. Thus the disposal package and the guidelines pertaining to it are of greater interest in LLW treatment technology.

Waste handling can be divided into general guidelines, generator site handling, transport handling, and disposal site handling. Here, as with the packaging, the interest for waste treatment technology is primarily the handling which takes place at the generator site and immediately precedes or follows or is part of waste processing.

Waste testing involves the development and documentation of general testing guidelines, the definition of treatment methods (i.e., the characterization of the waste form produced), the development of standardized test procedures and the determination of whether there is a need for testing center for quality assurance. This work is at an early stage, but it is obvious that one cannot compare candidate processes without information about the nature of the waste form produced. The proper operation of a waste treatment process will also almost surely require some minimal information about the product of that process. The requirement for testing centers for quality assurance has been suggested, but is not yet resolved.

Several state-of-the-art reports were prepared early in the program to provide baseline information and guidance to the development work. [1-3] These reports assisted in the identification of critical technology areas which most needed continued study or development work:

- o The reduction of the volume of waste generated which has already been mentioned.

- o The incineration of organic liquid wastes which essentially destroys a waste form that is difficult to handle in other ways.

- o The incineration of combustible solids which is applicable to a large fraction of the low-level waste and which provides a large volume reduction factor.

- o Metal waste volume reduction which applies to a waste type not amenable to other treatment methods.

- o Waste solidification which is needed for incinerator ash, aqueous concentrates and miscellaneous wastes.

- o Waste handling and segregation which is a necessary precursor to most other waste processing operations.

- o And finally, treatment of special solids prior to disposal which includes the removal of metallic sodium or the destruction of nitrate in salt wastes.

These critical technology areas have been the subject of studies or development tasks at the various participating sites around the country. The critical areas and participating sites are shown in *Figure 2.*

In the area of waste generation reduction, both Oak Ridge National Laboratory (ORNL) and Rockwell Hanford Operations (RHO) provided documentation of their on-site practices early in the program. PNL work has more recently provided comprehensive documentation of waste generation reduction practices in the Waste Generation Reduction Handbook.

RHO is developing a microwave plasma incinerator for the incineration of organic liquids . This task will complete hot bench-scale tests early in FY 1983 and will begin the assembly of a larger unit. Both EG&G Idaho and Savannah River Laboratory (SRL) are developing the incineration of organic liquids in multipurpose incinerators. The emphasis of the work under the purview of EG&G Idaho is on institutional incinerators which are being tested at the University of Maryland and at Purdue University to determine the practicality of such waste treatment on a small scale by individual institutions. The incinerator at SRL, known as the Solvent/Solids Incinerator Facility Test (SWIFT), is expected to handle both solids and liquids. The glass furnace at Mound incorporates the ash into a bed of molten glass thereby providing volume reduction, fixation and solidification simultaneously. The cold demonstration and product acceptability tests are expected to be completed in FY 1983.

For the concentration and treatment of liquids, Mound is investigating ultrafiltration and reverse osmosis. Ultrafiltration removes very fine particulate matter while the reverse osmosis removes material from solution. The biological treatment of liquids was investigated at ORNL both for the destruction of nitrates and the concentration of heavy metals.

Metal volume reduction at EG&G consists of melting stainless steel scrap and casting it into ingots. At ORNL, work was directed toward both decontamination of low-level metal waste and volume reduction by melting. At RHO the arc saw and vacuum furnace were tested for volume reduction of metal waste.

Waste form development work at Brookhaven National Laboratory (BNL) includes identifying and investigating potential solidification agents and processes and testing and evaluating the resulting waste forms.

BNL has also prepared a study of waste handling methods for low-level wastes. The Waste Treatment Handbook which has just been completed in draft form at ORNL contains chapters on both waste handling and waste packaging as well as waste treatment.

Argonne National Laboratory - West (ANL-W) is currently investigating the preparation of sodium contaminated waste for shallow land burial. The present rules do not allow the burial of waste with any degree of contamination by metallic sodium, so both removal methods and the amount of residual sodium are of interest. The Rocky Flats Plant is investigating the destruction of nitrate in low-level waste streams. Concerns relate to the prevention of the generation of oxides of nitrogen in the off-gas and the conversion of the waste to a soluble form.

In summary, the program objective is to develop the best available technology for waste treatment, packaging, and handling to meet the needs of shallow land burial disposal and for greater confinement than shallow land burial. The program has reviewed many of the hardware options for appropriate usage with low-level waste, but promising options remain to be evaluated. The testing of treatment technologies with actual radioactive process wastes has been initiated. The analysis of the interaction of treatment, solidification and disposal needs to be completed.

REFERENCES

1. Kibbey, A. H. and H. W. Godbee, 1980. A State-of-the-Art Report on Low-Level Radioactive Waste Treatment, ORNL/TM-7427.

2. Gilbert/Commonwealth, 1980. State-of-the-Art Review of Radioactive Waste Volume Reduction Techniques for Commercial Nuclear Power Plants, ORNL/SUB-79/13837/2.

3. Pitt, W. W. Jr., H. W. Godbee, C. H. Hancher, B. D. Patton, and S. E. Shumate II, 1980. Survey of Needs for Biological Treatment of Radioactive Low-Level Liquids in Nuclear Facilities, ORNL/NFW-79/76.