

# MANAGING HANFORD SITE SOLID WASTE THROUGH STRICT ACCEPTANCE CRITERIA

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## ABSTRACT

Various types of waste have been generated during the 50-year history of the Hanford Site. Regulatory changes in the last 20 years have provided the emphasis for better management of these wastes. Interpretations of the *Atomic Energy Act of 1954 (AEA)*(1) and the *Resource Conservation and Recovery Act of 1976 (RCRA)*(2) have led to the definition of a group of wastes called radioactive mixed wastes (RMW). As a result of the radioactive and hazardous properties of these wastes, strict management programs have been implemented for the management of these wastes.

Solid waste management is accomplished through a systems performance approach to waste management that used best-demonstrated available technology (BDAT) and best management practices. The solid waste program at the Hanford Site strives to integrate all aspects of management relative to the treatment, storage and disposal (TSD) of solid waste. Often there are many competing and important needs. It is a difficult task to balance these needs in a manner that is both equitable and productive. Management science is used to help the process of making decisions. Tools used to support the decision making process include five-year planning, cost estimating, resource allocation, performance assessment, waste volume forecasts, input/output models, and waste acceptance criteria. The purpose of this document is to describe how one of these tools, waste acceptance criteria, has helped the Hanford Site manage solid wastes.

## NOMENCLATURE

Solid waste, as referred to in this paper, is any waste that exhibits the characteristics of a solid, that is, packaged solid wastes and lab-packaged liquid wastes. This definition of solid waste is different from the regulatory definition of a solid waste, which by law excludes certain wastes.

## INTRODUCTION

The Hanford Site is a large (1,450.29 km<sup>2</sup> [560 m<sup>2</sup>]) semiarid site located in the southeastern part of Washington State. Originally, the Hanford Site was chosen as the location for reactor and chemical separation facilities for the production and purification of plutonium. Document DOE/EIS-0113(3) provides a description of the Hanford Site. Currently, most activities are directed toward environmental remediation and restoration and waste management. Westinghouse Hanford Company performs the operations and engineering contract for the U.S. Department of Energy (DOE). In contrast to commercial facilities, the Hanford Site is owned by the U.S. Government.

## RADIOACTIVE WASTES

The DOE Order 5820.2A(4) defines the types of radioactive wastes. Regardless of source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g, at the time of assay, is considered transuranic (TRU). High-level waste is the highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid that contains a combination of TRU waste and fission products in concentrations requiring permanent isolation. As defined by DOE Order 5820.2A(4), waste that contains radioactivity and is not classified as high-level waste, TRU waste, or spent nuclear fuel or byproduct material is considered low-level

waste (LLW). Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as LLW, provided that the concentration of transuranic isotopes are less than 100 nCi/g. The Hanford Site also manages <sup>233</sup>U and <sup>226</sup>Ra as transuranic isotopes.

## HAZARDOUS WASTE

The DOE Order 5400.3(5) defines the hazardous and mixed waste program. Under RCRA, the term "hazardous waste" identifies a solid waste or a combination of solid wastes that because of its quantity; concentration; or physical, chemical, or infectious characteristics may (1) cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, disposed of, or otherwise managed. Under RCRA, hazardous wastes are either characteristic or listed. Characteristic wastes are wastes that exhibit the characteristics of ignitability, corrosivity, toxicity, or reactivity, whereas listed wastes are those that are specifically listed by RCRA as hazardous. The U.S. Environmental Protection Agency has delegated its authority (in the RCRA), thus allowing individual states to manage hazardous waste programs. Washington State hazardous waste regulations are codified in the *Washington Administrative Code (WAC)*, Section 173-303, "Dangerous Waste Regulations."(6) Washington State regulations are more restrictive than the federal RCRA regulations and cause many more wastes to be regulated hazardous wastes.

## RADIOACTIVE MIXED WASTE

The DOE Order 5400.3(5) defines the hazardous and mixed waste program. The RMW is waste that contains both radioactive and hazardous components regulated by the AEA and RCRA, respectively. The term "radioactive component"

refers only to the actual radionuclides dispersed or suspended in the waste substance. The radioactive and hazardous waste regulations provide an interesting dual regulatory climate that has necessitated a number of changes to waste management practices. The remainder of this paper describes the management of mixed wastes.

### WASTE TREATMENT, STORAGE, AND DISPOSAL

Certain wastes, such as LLW, continue to be shallow land disposed. The management of RMW is much more stringent. The purpose of RCRA is to reduce or eliminate the generation of hazardous waste and to TSD of hazardous waste so as to minimize the present and future threat to human health and the environment. The RCRA requires that cradle-to-grave management of wastes use a manifest system and that owners and/or operators of TSD facilities obtain permits for continued operation of facilities. Figures 1 and 2 provide a comparison of the current management practices and planned improvements to solid waste management. Figure 3 provides a schematic of the Solid Waste Operations Complex (SWOC). The SWOC provides a centralized location and infrastructure for all aspects of solid waste TSD.

### WASTE ACCEPTANCE CRITERIA

Solid waste receipts at the Hanford Site's solid waste TSD facilities are governed by WHC-EP-0063-3.(7) These waste acceptance criteria are a focal point around which the solid waste program gains stability and maintains control. These criteria are used along with the safety analysis documentation and operating documents to provide a safe operating envelope. This waste acceptance document procedurally implements criteria by which certain RMW and other wastes can be received. The main sections of this document include TRU waste, LLW, RMW storage, and RMW disposal.

The Hanford Site solid waste acceptance criteria have been a focal point for waste management for many years. The document has evolved over the past 20 years from being a small document to its present form, which includes or references all applicable aspects of DOE criteria as well as state,

federal, and local regulations. The document will continue to evolve as criteria change.

### WASTE SEGREGATION AND EXAMPLES

As a result of the regulatory requirements, solid wastes are segregated based on their constituents at the point of generation or as part of the process. Radioactive wastes are managed separate from nonradioactive wastes. Nonradioactive wastes may either be hazardous or nonhazardous. The solid waste program handles the following types of radioactive wastes:

- Low-level wastes
- Transuranic wastes
- Spent fuel.

Further, RMW is segregated by the waste generator based on waste compatibility. When placed in storage, these wastes are grouped into various storage categories. Figure 1 depicts solid waste segregation. Solid mixed wastes typically fall into one of the following storage categories:

- Corrosive (radioactive acid)
- Corrosive (radioactive caustic)
- Radioactive flammable
- Other mixed waste (other regulated material)
- Radioactive oxidizer
- Radioactive polychlorinated biphenyl
- Radioactive poison.

An example of a corrosive RMW might be contaminated sulfuric acid or sodium hydroxide from fuel reprocessing. Reactive RMW includes contaminated metals such as sodium and potassium from liquid metal-cooled reactors. Ignitable wastes include many organic wastes such as xylene and toluene from laboratory activities and acetone used as a paint stripper. Toxic RMW might include contaminated heavy metals such as chromium, cadmium, and silver. Solid lead or lead shielding when disposed of is considered a hazardous waste. Paint and paint solvents often contain organic solvents and heavy metal pigments, which cause the uncured and cured product to be regulated.

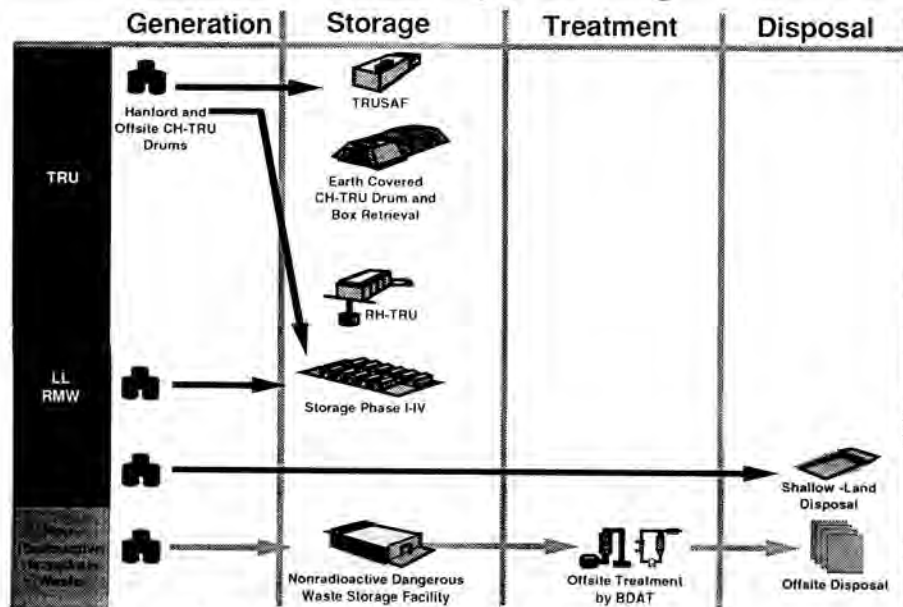


Fig. 1. Hanford site solid waste management 1993.

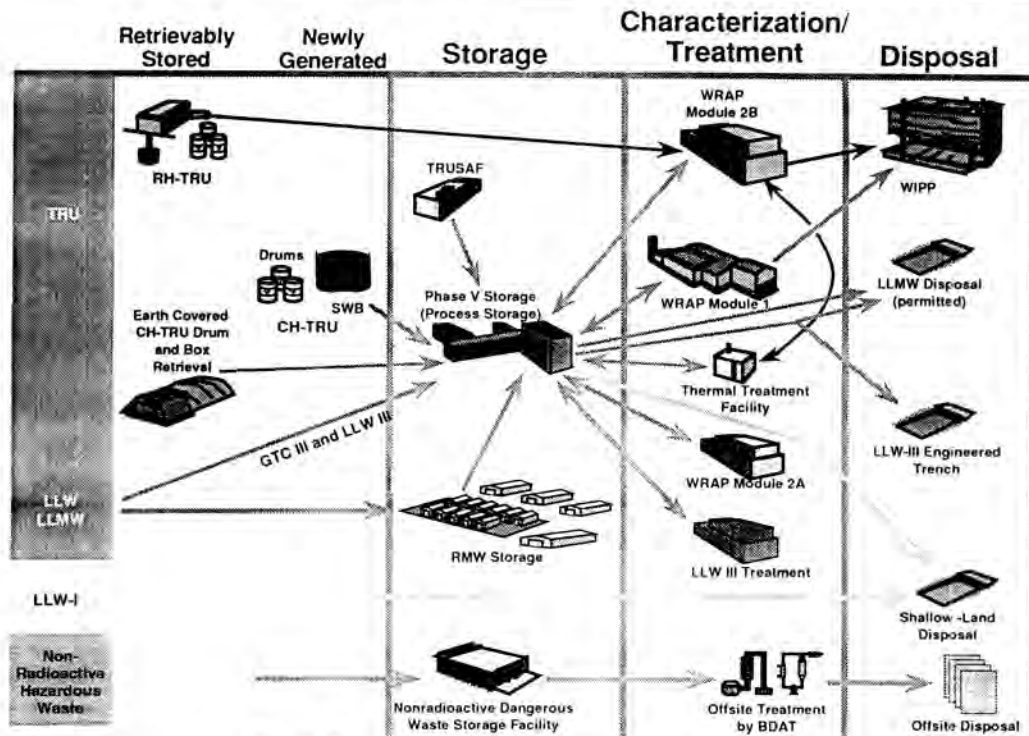


Fig. 2. Hanford site solid waste management 2000.

### RADIOACTIVE MIXED WASTE STORAGE

The regulatory climate emphasizes that best management practices be applied to the management of RMW. These management practices include the following activities in decreasing level of preference or acceptability:

1. Minimize the generation of RMW
2. Recycle wastes
3. Treat physically, chemically, or biologically
4. Treat thermally
5. Stabilize and solidify waste
6. Landfill.

Before landfilling or disposing of a waste, the waste must meet waste disposal criteria. In Washington State, the disposal criteria are very strict. Currently, few RMWs meet the disposal criteria; therefore, these wastes must be stored until treatment is available to condition these wastes for disposal. The Central Waste Complex (CWC), described in WHC-EP-0300(8), is designed to provide interim and long-term storage of RMW. When completed, the CWC will have the capacity to store more than seventy-five thousand 208.19-L (55-gal) drums of waste. These drums will remain in storage until treatment and disposal facilities are available.

### RADIOACTIVE WASTE TREATMENT

Wastes are treated by generators when feasible and when allowed by law (e.g., neutralization and/or absorption) before receipt at the CWC. Certain treatments may be prescribed to provide a stable waste form to ensure long-term stability. In many cases a waste generator may not be able to meet the treatment standards to allow waste disposal. Solid Waste Management will treat some of these wastes in the Waste Receiving and Processing Facility before disposal.

New TSD facilities are planned for effective management of RMW. Figures 1 and 2 describe solid waste management

in 1993 and the year 2000. These figures depict construction of various facilities over the next decade. Figure 4 depicts the future SWOC, which will consist of various solid waste TSD facilities.

### RADIOACTIVE WASTE DISPOSAL

Shallow land disposal of RMW is the least-preferred option for the management of these wastes. Both federal (e.g., RCRA [2]) and state (e.g., WAC 173-303 [6]) regulations stringently control and regulate shallow land disposal of hazardous wastes. The RCRA prescribes waste form, packaging, and disposal facility requirements. The disposal facility requirements have been incorporated into an RMW RCRA-compliant disposal facility. This facility is scheduled to be constructed in 1994. This facility is also depicted in Figs. 2 and 3.

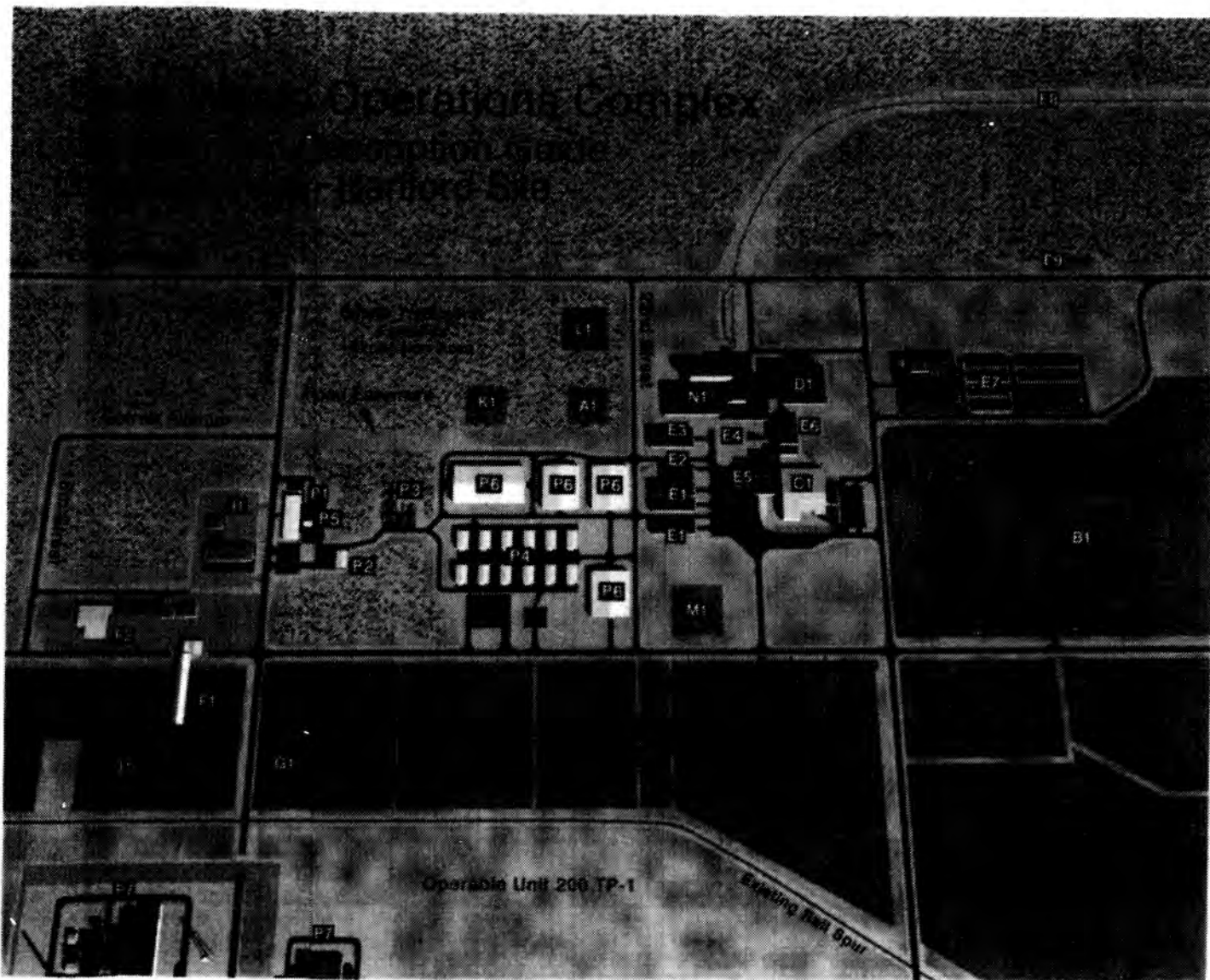
### SOLID WASTE INFORMATION TRACKING SYSTEM

The Solid Waste Information Tracking System provides data management of all solid waste in solid waste management facilities. This data system provides online tracking of all pertinent data on a per-container basis. The data system is an interactive system networking the waste generator with the TSD facilities. The system tracks waste container location through the various facilities to final disposal. The system is also used to generate all required regulatory and DOE reports on waste volumes and waste types.

### PERFORMANCE ASSESSMENT

After issuance of DOE Order 5820.2A(4) in 1988, the Hanford Site started work on the performance assessment for a portion of the Low-Level Burial Grounds. It is expected that the performance assessment will be completed by the end of 1993. Based on the studies performed to date, waste will be required to be categorized based on the radioactivity level and type. Various different categories of waste equate to certain concentrations to allow for continued shallow land disposal of





- Project W-272 (Capital Work Order)**
- A1** Special Case Waste Storage Facility
- Project W-025 (Expense Funded)**
- B1** Radioactive Mixed Waste Disposal Facility (218-W-5/T31)
- Project W-026 (91 LI)**
- C1** Waste Receiving and Processing (WRAP) Module 1
- Project W-100 (94 LI)**
- D1** WRAP Module 2A
- Project W-112 (94 LI)**
- E1** Long-Term Drum Storage
- E2** Ignitable Drum Storage
- E3** Box Storage
- E4** Transfer Corridor
- E5** Shipping and Receiving
- E6** Automated Stacker Retriever System (AS-RS)
- E7** Hanford Central Waste Support Complex
- E8** Railroad Extension
- E9** North Perimeter Gate, Guard Station, and Road to Route 11A (not depicted)
- E10** Infrastructure (not depicted)
- Project W-113 (94 LI)**
- F1** Solid Waste Retrieval Facility (218-W-4C/T04)
- F2** NDE/NDA Building
- Project W-156 (97 LI)**
- G1** Alpha Casson Retrieval
- Project W-174 (TBD)**
- H1** Enhanced Solid Low-Level Radioactive and Mixed Waste Disposal (not sited)
- Project W-219 (Expense Funded)**
- I1** Temporary Office and Change Rooms
- Project W-221 (97 LI)**
- J1** Solid Waste Retrieval Phase II
- Project W-300 (94 GPP)**
- K1** Alkaline Metal Storage
- Project W-242 (97 LI)**
- L1** Thermal Treatment Facility
- Project W-247 (97 LI)**
- M1** Waste Reduction and Reclamation Facility
- Project W-255 (97 LI)**
- N1** WRAP Module 2B
- Existing Facilities**
- P1** 272 WA
- P2** 2401-W PCB and Mixed Waste Storage
- P3** Low Flash Point Mixed Waste Storage Units
- P4** Radioactive Mixed Waste (RMW) Storage Buildings (2402-W series)
- P5** 213-W Compactor Building
- P6** Mixed Waste Storage Phase I-IV (2403-W series)
- P7** Z Plant Operations (Non solid Waste Facilities)
- U** = Line Item
- GPP** = General Plant Project
- TBD** = To Be Determined
- LLBG** = Low Level Burial Ground
- CWC** = Central Waste Complex
- SWDC** = Solid Waste Operations Complex Phase I MSA

Fig. 3. Solid waste operations complex.

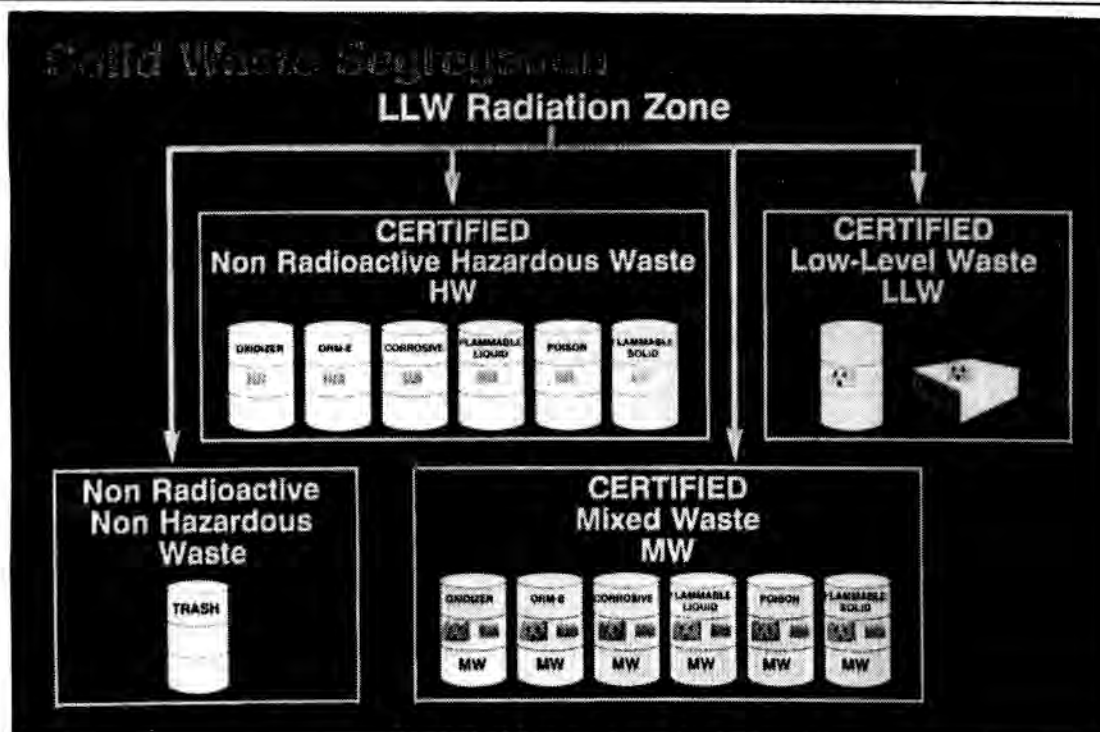


Fig. 4. Solid waste segregation.

LLW. These criteria are necessary to ensure safety of the population and the environment.

The Hanford Site waste categories are similar to the U.S. Nuclear Regulatory Commission categories. One difference is that the Hanford Site has adopted two waste categories instead of three. These waste categories have been included in the solid waste acceptance criteria. These criteria deal with the short- and long-term management of the waste categories.

#### SYSTEMS APPROACH TO WASTE MANAGEMENT

The goal of solid waste management is to provide a systems performance approach to waste management that uses BDAT and best management practices. This approach stresses cradle-to-grave management of wastes. The intent is to "know your waste" before and as it is generated and, to the extent practical, minimize the generation of wastes. For existing wastes and future generated wastes, technology will be applied to safely store and treat the wastes. The final outcome is a system that safely manages wastes in a manner that is protective of human health and the environment.

#### REFERENCES

1. *Atomic Energy Act of 1954*, 42 USC 2011 et seq.
2. *Resource Conservation and Recovery Act of 1976*, 42 USC 6901 et seq.
3. DOE/EIS-0113, *Final Environmental Impact Statement - Disposal of Hanford Defense High-Level, Transuranic and Tank Waste, Hanford Site*, Richland Washington, 5 vols, U.S. Department of Energy, Washington, D.C. (1987).
4. DOE Order 5820.2A, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C. (1988).
5. DOE Order 5400.3, *Hazardous and Radioactive Mixed Waste Program*, U.S. Department of Energy, Washington, D.C. (1989).
6. WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.
7. WHC-EP-0063-3, *Hanford Site Radioactive Solid Waste Acceptance Criteria*, Westinghouse Hanford Company, Richland, Washington (1991).
8. WHC-EP-0300, *Alternatives to Land Disposal of Solid Radioactive Mixed Wastes on the Hanford Site*, Westinghouse Hanford Company, Richland, Washington (1990).