

Low Level and Mixed Low Level Waste Treatment Technology Identification

U.S. Department of Energy Environmental Management Office of Waste Management

The mission of the U.S. Department of Energy (DOE) Office of Environmental Management (EM) is to complete the safe cleanup of the environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research.



To support DOE-EM in its mission, the Office of Waste Management (EM-30):

- Performs program management functions to identify and advance strategies to plan and optimize EM waste management projects and processes.
- Identifies and implements strategies and technical practices that improve the performance, costs and schedule and reduce the technical risk of EM projects.
- Supports implementation of EM waste and materials disposition activities and provides the complex-wide integration of operational disposition activities.
- Ensures safe and efficient packaging and transportation systems necessary to achieve waste and materials disposition EM-wide.

Objective

Develop concise information describing current and historical United States (U.S.) commercial low-level waste (LLW) and mixed low-level waste (MLLW) treatment capabilities to support exchanges on U.S. and international treatment capabilities, with a particular focus on technologies to address orphan (challenging) waste streams that lack a disposition path.

Historical Companies & Their Technologies

The 1996 report "Review of Private Sector and Department of Energy Treatment, Storage, and Disposal Capabilities for Low-Level and Mixed Low-Level Waste" summarized the current and near-term private sector vendor capability for the treatment, storage, and disposal of low-level and mixed low-level waste in 1996. The table shows the information currently available regarding each of those private sector vendors.

Table 1. Summary of Past Private Sector Vendors and Where They are Today

| Vendor | Current Website | Notes about Services and Past Technologies |
|---------------------------------|--|--|
| ADCO Services, Inc. | www.adcoservices.com | Radioactive waste disposal and hazardous waste disposal has been ADCO Services' line of business since 1965. One of the United States' oldest waste technology companies for radioactive and hazardous wastes such as self-immolating resin, radioactive and/or hazardous sludge, radioactive animal carcasses, biological, xenobiotic, viral, fluid, radioactive wastes, toxic solvents, dry active waste, mixed waste, and hazardous waste disposal for industrial settings, places of research, and medical fields. Additionally, ADCO Services developed specialized services in NRC manufacturing / paperwork preparation, preparation of hazardous waste manifests (manifests), decontamination and decontamination, emergency response assignments, health physics services, training programs, and sealed source (gauge and device) decontamination, removal, and disposal, as well as proper handling and treatment of naturally occurring radioactive items such as Thorium, Uranium (Uranium compounds), and Radium. ADCO will accept low-level radioactive waste in any type of U.S. DOT approved package from cardboard boxes, ("excepted packages"), up to and including 55-gallon drums. This includes fiber drums of any size, pails, metal drums ranging from 10-110 gallon, "super sacks", even polybags (with advance notification). |
| ADTECHS Corporation | - | - |
| Advanced Recovery Systems, Inc. | - | - |
| Afferox Ltd. | - | - |
| ALORON Corporation | http://www.aloron.com http://www.aloron.com/usa | Vendor's portfolio of services provided to the nuclear industry includes: • Asset Recovery - Decontamination services to allow for the reuse of assets • Contingency Planning - Nuclear Service Level 1 surface preparation and coating services • Low-Level Radioactive Waste - Dry active waste processing • Licensed Facility Access - Work under Vendor's Radioactive Materials License • Machine Shop - Nuclear licensed machining equipment • Metals & Large Components - Process and decontaminate over sized contaminated components • Motor & Pump Refurbishment - Repair and refurbishment services for small and large motors • Source Recovery - Sealed source recovery and recycling for radioactive applications • Contaminated Asset Storage - Interim and remote treatment and improved storage • Transportation - Transportation services for radioactive materials, including truck and rail access • Lead Blankets - A case study on the decontamination and recycling of lead blankets |

42 companies existed in 1996 to treat either LLW or MLLW

24 companies continue to exist today in 2013

11 companies have treatment capabilities on site

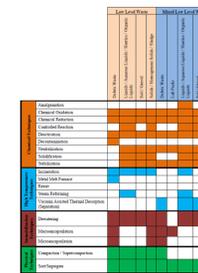
Waste Information Management System (WIMS) indicates DOE sites are forecasting to ship waste to **5**

Waste Information Management System (WIMS)

Results

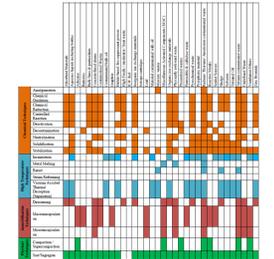
All the surveys were collected and the data was compiled onto two matrices.

U.S. Treatment Technologies vs. U.S. Waste Categories



The 1st matrix correlates U.S. treatment technologies to U.S. waste streams.

U.S. Treatment Technologies vs. Nation X Waste Categories



The 2nd matrix is for the purpose of collaboration with international nations. Nations would be able to provide their waste streams and the treatment facilities can indicate what treatment technology capabilities they have. This particular matrix was completed for a specific nation.

Summary of Treatment Technologies

| Technology | Summary Description | Advantages | Disadvantages | Stage of Development |
|------------------------|---------------------|------------|---------------|----------------------|
| 1. Solidification | ... | ... | ... | ... |
| 2. Incineration | ... | ... | ... | ... |
| 3. Slurry Wall | ... | ... | ... | ... |
| 4. Deep Well Injection | ... | ... | ... | ... |
| 5. Landfill | ... | ... | ... | ... |
| 6. Storage | ... | ... | ... | ... |
| 7. Recycling | ... | ... | ... | ... |
| 8. Other | ... | ... | ... | ... |

Details of each available technology was collected

- Summary description
- Advantages
- Applicability
- Disadvantages
- Specific example of applicability
- Stage of development

U.S. Vendors and their Treatment Technologies

| Vendor | Technology 1 | Technology 2 | Technology 3 | Technology 4 |
|---------------------------------|--------------|--------------|--------------|--------------|
| ADCO Services, Inc. | ✓ | ✓ | ✓ | ✓ |
| ADTECHS Corporation | ✓ | ✓ | ✓ | ✓ |
| Advanced Recovery Systems, Inc. | ✓ | ✓ | ✓ | ✓ |
| Afferox Ltd. | ✓ | ✓ | ✓ | ✓ |
| ALORON Corporation | ✓ | ✓ | ✓ | ✓ |
| ... | ... | ... | ... | ... |

A table identified supplier information; it indicated which technologies were available from each vendor.

Present Technologies

Surveys were sent out to the 5 private sector vendors to gather specific details on available technologies.

1. Perma-Fix Environmental Services, Inc.
2. EnergySolutions
3. Studsvik, Inc.
4. Waste Control Specialists LLC
5. Philotechnics

A list of the U.S. waste categories and international waste categories were provided. The vendor marked off which waste categories they would have the means to treat on site.

Waste Categories

Using the DOE Waste Treatability Group Guidance report, six waste categories were identified.

1. Liquids / Slurries
2. Solids
3. Soil / Gravel
4. Debris Waste
5. Lab Packs
6. Special Waste Forms

| Waste Category | Description | International Waste Stream within U.S. Category |
|--|--|--|
| Liquids / Aqueous Liquids / Slurries / Organic Liquids | Wastes that are liquids, including slurries. Slurries are defined as liquids with a total suspended solids (TSS) content of 21% and $100\mu\text{m}$. Only liquids and slurries packaged in bulk, free form (e.g., drums, tanks) are included in this category. Liquids and slurries packaged in 55-gallon drums are assigned to other WSCs. Includes liquids and slurries containing less than 1% total organic carbon (TOC). This waste is further evaluated per the criteria of Water-soluble (Acidic, Basic, Neutral, Cyanide) and Aqueous Slurries (Acidic, Basic, Neutral, Cyanide). This category includes liquids and slurries containing 21% TOC. This waste is further evaluated per the criteria of Aqueous Organic Liquids (Aqueous Halogenated, Aqueous Non-halogenated) and Pure Organic Liquids (Halogenated/Non-halogenated). | Aqueous liquids including slurries. • Contaminated bulk oil • Material contaminated with Trisodium OSA |

The descriptions go into further detail of what specific waste would be included in each category. Based on the descriptions provided by the international nation for their waste categories, the table also lists the international category titles that would fall into the U.S. categories.

Conclusion

- This information will be useful for future collaborations with international partners to determine common challenging untreatable waste streams and to work together to develop technologies to treat and continue disposal.
- The U.S. has been able to learn from past challenges and improve the development of new technologies. Many countries can benefit from our lessons learned.
- The five companies surveyed provide the main treatment options for the U.S. DOE waste streams. It is vital that as disposal of LLW and MLLW continues, these companies take part in the collaboration of technology development to meet U.S. DOE waste treatment and disposal demands.