Executive Summary

This research effort represents a revision to the 1998 "Report on Treatment, Storage & Disposal Facilities (TSDF) for Hazardous, Toxic, and Radioactive Waste (HTRW)", prepared for the U.S. Army Corps of Engineers (USACE). The report focuses on costs associated with the treatment or disposal, or both, of hazardous wastes (excluding collection, packaging, and loading) as defined by the Resource Conservation and Recovery Act (RCRA) in Subtitle C, Section 3001 (see Figure ES.1). Also discussed are acceptability criteria regarding off-site disposal of listed wastes under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Low-Level Radioactive Waste Policy Act. Sections included in the 1998 submittal (landfills, incinerator facilities, deep well injection facilities, fuel blending and cement kilns, recycling, transportation, state taxes and fees, and regional interstate compacts) have been researched and updated, and expanded to include waste treatment facilities. New to this submittal are sections on Low-Activity Radioactive Waste from FUSRAP sites, disposal facilities in Canada that accept waste from the United States, Treatment Facilities, and HTRW packaging, and an analysis of cost changes relative to those reported in the 1998 submittal.

Each main category is divided into subsections, which delineate general discussion and overview of regulations. General discussions include definitions and background information. Regulatory issues are then referenced and briefly defined. The last section includes costing elements that are presented in abstract narrative form and also in detailed tables and figures. Discussed within the pricing narratives are statistical data such as average quotations, ranges, and cost drivers. Featured tables and figures represent the degree of cost variability associated with certain categories of hazardous waste disposal. Report organization is shown in Figure ES.2.

A summary of cost information in the 2005 TSDF Report are shown in Table ES.1. This information is general and is not intended to be representative of all facilities, and is further deliberated within the content of the Report.

This 2006 TSDF Report excluding pricing information can be accessed on the internet via the USACE HTRW Center of Expertise worldwide web home page, http://www.environmental.usace.army.mil/library/pubs/tsdf/tsdf.html .

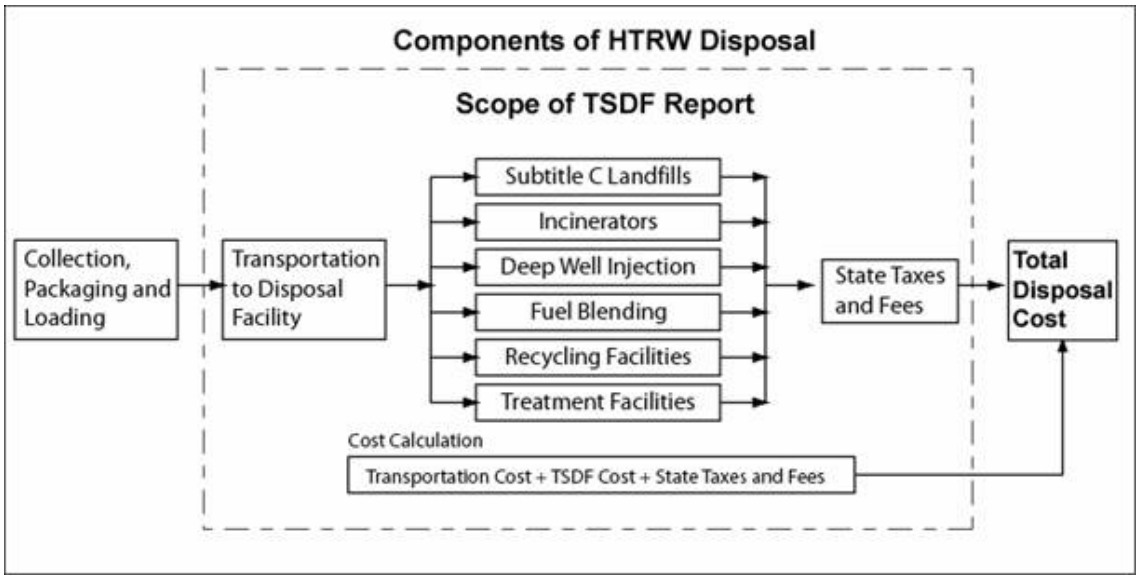
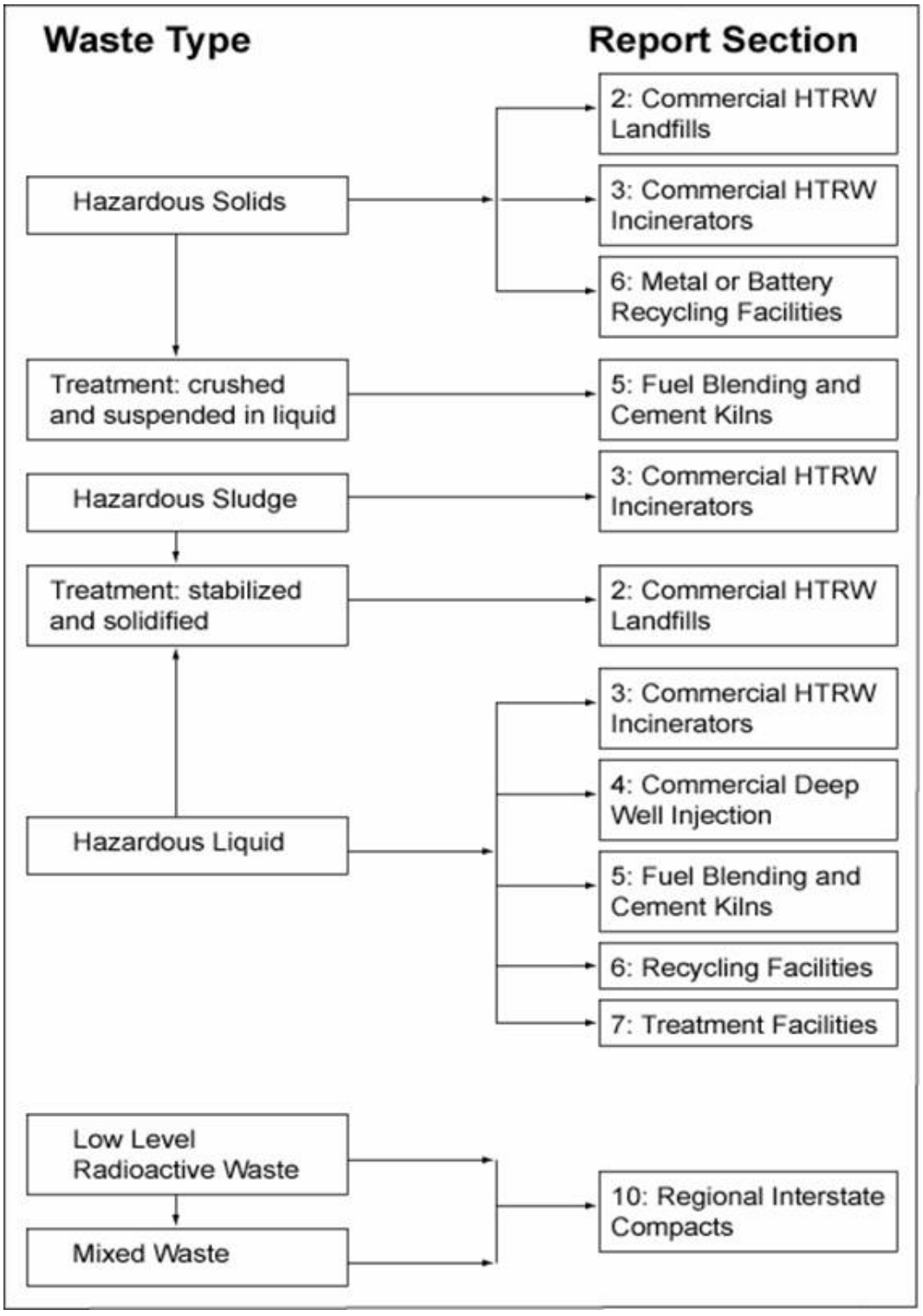


Figure ES.1: Components of HTRW Disposal and Cost Calculation



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List of Acronyms

ASTM	American Society for Testing and Materials
BDAT	Best Demonstrated Available Technology
BIF	Boilers and Industrial Furnaces Rule
BLW	Bulk Liquid Waste
BSW	Bulk Solid Waste
Btu	British thermal unit
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
Dechl.	Dechlorinization
DLW	Drummed Liquid Waste
DOT	Department of Transportation
DRE	Destruction and Removal Efficiency
DSW	Drummed Solid Waste
ENR	Engineering News Record
FB	Fluidization Bed
HID	High Intensity Discharge
HMTA	Hazardous Materials Transportation Act
HSWA	Hazardous and Solid Waste Amendments
HTRW	Hazardous Toxic and Radioactive Waste
LI	Liquid Injection
LLRW	Low Level Radioactive Waste
LTT	Less Than Truckload
MEI	Maximum Exposed Individual
N/A	not Applicable
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NMI	Need More Information
NRC	Nuclear Regulatory Commission
NSPS	New Source Performance Standards
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PICs	Products of Incomplete Combustion
POHCs	Principal Organic Hazardous Constituents
ppmv	Parts per million by volume
RCRA	Resource Conservation and Recovery Act
RSPA	Research and Special Programs Administration
SW	Solid Waste
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbon
TSDF	Treatment Storage Disposal Facility
TSCA	Toxic Substances Control Act
UIC	Underground Injection Control
USEPA	United States Environmental Protection Agency

INTRODUCTION

1.1 BACKGROUND

In 1990, the U.S. Army Corps of Engineers recognized the need to develop a better understanding of off-site commercial hazardous waste Treatment, Storage and Disposal (TSD) facilities. The Corps of Engineers contracted with Project Time and Cost, Inc., to prepare a comprehensive report on these facilities. This report identified all known landfill, incinerator, and deep well injection TSD facilities in the United States at that time. Included in the narrative and its appendices were facility listings and locations, contact information, fee schedules (when obtainable), land disposal restriction notification forms, waste profile information, and facility brochures. In addition, information pertaining to state taxes and fees was presented. Low-level radioactive waste disposal interstate compacts were also discussed.

The December 1990 "Report on Treatment, Storage & Disposal Facilities" functioned as a reference for cost engineers regarding disposal charges associated with the Resource Conservation and Recovery Act (RCRA), Subtitle C hazardous wastes. Beneficial cost engineering information included average and tabular gate pricing data for primary categories of disposal, as well as facility contact information. The report also served as a basis for future development of off-site disposal cost line items for the Micro Computer Aided Cost Estimating System (MCACES) Unit Price Book (UPB). The disposal cost line items were subsequently developed and incorporated in Division 13 of the UPB.

The TSDF report was revised in October 1994. Previously listed disposal facility information was updated. Newly licensed landfill, incinerator, and deep well injection disposal facilities were identified. State taxes and fees and interstate compacts information were revised. Treatment capabilities and restrictions were also identified for each facility. Treatment of wastes prior to land disposal was discussed. These forms of treatment primarily include blending of solvents and soil washing prior to solidification and stabilization of wastes necessary to comply with land disposal restrictions. The narrative and appendices were comprised of similar detailed information representing all facilities that was included in the initial report. In addition, the 1994 revision was expanded to include dedicated sections on fuel blending and cement kilns as well as transportation of hazardous wastes. Both of the added sections consist of general discussions, details, and cost engineering aspects. All report sections encompassed regulatory aspects for their respective subjects.

Previously listed disposal facility information was further updated in a 1998 revision. The 1998 revision was also expanded to include a section on recycling facilities for five solid and liquid wastes (solvents, metals, fluorescent lights, lead-acid batteries, and used oil). The added section consisted of subsequent subsections that provide general regulatory information pertaining to generation, storage, and transportation of each of the materials. Also included were lists of recyclers that accept the materials, and cost information and acceptance criteria provided by participating recyclers.

This report is the 2005 update of the 1998 report. It includes the facility types listed in the 1998 report, but also includes a section on treatment facilities and reflects significant changes in the hazardous, toxic and radioactive waste (HTRW) transportation and disposal industry. Technological changes in incineration and treatment have allowed many new facilities to emerge, and many facilities have changed ownership as large corporations have built networks of

various facility types that treat and transfer waste for disposal. The business of waste fuels has also grown a great deal since 1998, with many more cement plants using high energy waste as kiln fuel. Recycling facilities have grown significantly in number, in some cases with associated industry, and in others with improved recycling technology. Many recyclers are also tied to in-network collection and transfer facilities.

Another apparent change in the HTRW industry is the decrease in the number of landfills. This is in part due to the increased number of facilities that are able to recycle, treat or de-list waste, the use of contaminated soil as raw materials in cement production after heating, and the use of waste fuels, each of which decreases the volume of waste that requires land disposal. Metals recovery has also decreased the volume of HTRW headed for landfills. Decreases in waste volume have also affected the number of deep well injection facilities and has contributed to a slight decrease in the number of incinerators.

Because of a substantial increase in the number of waste treatment facilities, and the improved technology that allows them to dispose of waste through de-listing or transfer to an in-network or affiliated incinerator or landfill, a new section was added to include them in the 2005 revision. This section includes the facility information as with other sections.

This 2005 revision can be accessed on the internet via the USACE HTRW Center of Expertise worldwide web homepage, http://www.environmental.usace.army.mil.

COMMERCIAL HAZARDOUS WASTE LANDFILLS

2.1 GENERAL DISCUSSION

A hazardous waste landfill is defined in 40 CFR 260.10 as

> a disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit.

Landfill disposal is extensively regulated under the Resource Conservation and Recovery Act (RCRA) because it presents serious environmental risks. The governing regulations for landfills are contained in 40 CFR Parts 260 to 268, with 40 CFR Part 268 identifying hazardous wastes that are restricted from land disposal. A responsible party can be exempted from these restrictions provided an approved petition shows that there will be no migration of the constituents from the disposal zone; an extension to an effective date was received; the waste meets relevant treatment standards; or that the waste is placed in a surface impoundment and the requirements of 40 CFR 268.4 are met.

Two basic types of environmental dangers exist in landfilling. The first is the potential mismanagement of reactive, ignitable, or incompatible wastes. Mismanagement of wastes could result in fires, explosions, or the release of toxic fumes. The second risk is that leachate, runoff, or wind erosion from a landfill can cause contamination of the subsoil, groundwater, and surface water.

To prevent sudden releases, ignitable or reactive wastes must be treated before placement in a landfill to render them no longer ignitable or reactive. Incompatible wastes must not be mixed in the same landfill cell without receiving proper treatment. For nonsudden release prevention (leaching), Subtitle C hazardous waste landfills or units must be constructed with a double liner and include a leachate collection system above and between the liners (40 CFR 264.301 and 265.301).

The placement of bulk or noncontainerized liquid hazardous waste in any landfill is prohibited because their constituents could potentially leach into groundwater over time. Additionally, USEPA regulations state that containers holding freestanding liquids may not be placed in landfills because the containers could corrode, allowing the contents to eventually leach into groundwater. Therefore, to avoid groundwater contamination, landfills may accept only containerized liquids in which the free liquids have been eliminated, removed, or mixed with adsorbents or solidified so that the freestanding liquid is no longer observed. The USEPA does, however, allow containers designed to hold liquids for a use other than storage, such as batteries or capacitors, to be landfilled. In addition, containers classified as “lab packs” and very small containers, such as ampules, may be disposed of in a landfill (40 CFR 262.314).

COMMERCIAL HAZARDOUS WASTE INCINERATORS

3.1 GENERAL DISCUSSION

Incineration is the controlled high-temperature oxidation of primarily organic compounds to produce carbon dioxide and water, with other inorganic wastes, such as acids, salts, and metallic compounds also being produced. This thermal destruction technology is specified as the treatment standard or "Best Demonstrated Available Technology" (BDAT) for treating a number of listed RCRA hazardous wastes. USEPA defines an incinerator as being an "enclosed device using controlled flame combustion that neither meets the criteria for classification as a boiler nor is listed as an industrial furnace." Rotary kiln, liquid injection, and fluidized bed are the three main types of commercial hazardous waste incinerators.

3.1.1 Rotary Kiln Incineration

Rotary kiln incineration is often used because of its versatility in processing solid, liquid and containerized wastes. Waste is incinerated in a refractory-lined rotary kiln, whose shell is mounted at a slight incline from horizontal to facilitate mixing the waste with the circulating air.

Typical rotary kiln systems include secondary combustion chambers or afterburners to ensure complete destruction of the hazardous waste. Solid wastes and drummed wastes are fed directly into the rotary kiln by a conveyor system or ram. Drums and cartons of waste can also be shredded prior to introduction to the incinerator. Liquids and pumpable sludges are injected through a nozzle into the kiln or the secondary combustion chamber. Noncombustible metal and other residues are discharged as ash at the end of the kiln. After leaving the kiln, the volatilized and combusted wastes enter the secondary chamber, where additional oxygen is available and high net heating value (NHV) liquid wastes or fuel may be introduced. In the secondary chamber, the wastes are destroyed at the desired destruction and removal efficiency (DRE).

3.1.2 Liquid Injection Incineration

In liquid injection incineration, liquid hazardous wastes are injected through a nozzle into the combustion chamber and atomized into fine droplets, converted to a gas prior to combustion, and then incinerated. By minimizing the unevaporated droplets and unreacted vapors, effective destruction of the liquid hazardous wastes is achieved. In addition, the temperature, residence time, and turbulence are optimized to maximize the destruction efficiency. Auxiliary fuels, such as natural gas or fuel oils, are typically used as supplemental combustion sources.

3.1.3 Fluidized Bed Incineration

The most recently developed incineration technology for hazardous wastes is fluidized bed. This technology offers a high degree of turbulence and a large heat-transfer area for mixing the hazardous waste, oxygen, and the hot fluid-bed medium. Fluidization is achieved by the balancing of the waste stream feed and an upward airflow. The extensive mixing in the bed and the large surface area available on the inert bed material produce a high degree of incineration with low excess-air levels and a minimal temperature gradient through the bed. Long residence times, usually from 5 to 8 seconds, ensure an effective DRE for the organic wastes and yield an inert ash. Certain hazardous waste chemical characteristics affect the ability of fluidized bed

incineration to effectively remediate hazardous wastes. The following table lists these chemical characteristics and their effects on the incineration process.

Waste Constituent or Characteristic	Effect
Sodium content	Destroys the bed fluidity by forming eutectic (a lowest possible constant melting temperature) structures
Corrosivity	Lowers the destruction efficiencies
High moisture content	Reduces the overall productivity of the fluidized bed process.
Fusible ash content	Binds the granular solids into large, non-fluid solid destroying the fluidity

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COMMERCIAL HAZARDOUS WASTE DEEP WELL INJECTION FACILITIES

4.1 GENERAL DISCUSSION

Injection wells are bored, drilled, or driven shafts or dug holes with a depth greater than the largest surface dimension into which fluids (any material or substance that flows or moves whether in a semisolid, liquid, sludge, gas, or any other form or state) are emplaced, as stated in 40 CFR 144.3. Deep well injection, also referred to as underground injection, involves the injection of aqueous wastes into well-confined geologic formations that are deep below the earth.s surface. Geologic formations with sufficient permeability and porosity surrounded by thick impermeable strata are chosen as deep well injection zones.

The main environmental concern regarding the underground disposal of hazardous wastes is the potential contamination of drinking water. For this reason, legislation was enacted under the Safe Drinking Water Act (SDWA) of 1974 to protect underground drinking water sources from the contamination that may be caused by the migration of hazardous liquids from injection wells.

COMMERCIAL HAZARDOUS WASTE INCINERATORS

5.1 GENERAL DISCUSSION

This section includes a description of the fuel blending and incineration process and its regulations. Included are map_5_1 maps of facilities and facility information listed by company in subsection 5.5, listed by state in subsection 5.6 with facility details.

1. In the past, the most common methods of managing flammable hazardous wastes were disposing of them in landfills or neutralizing their harmful constituents and properties by burning them in incinerators. Both of these waste management techniques have inherent disadvantages in terms of environmental and economic viability. A waste management alternative to these conventional methods should include a comprehensive approach in which the quantity of waste originally present is reduced, the waste products are recovered and used beneficially, and the harmful characteristics of the remaining waste are neutralized. Faced with these demands, many hazardous waste generators have begun to rely on a waste management technology called co-processing. Co-processing is defined as "using the cement manufacturing process to recycle, reuse, or treat waste while simultaneously manufacturing cement in a single combined operation." By employing co-processing an efficient and cost effective method of waste recycling, treatment, and destruction is realized, and cement, a vital product in the construction and maintenance of society's infrastructure, is produced.

Originally developed in Canada and Europe, the use of waste-derived fuels in cement kilns was perfected in the United States during the 1970's by Systech Environmental Corporation of Xenia, Ohio. This firm's involvement with co-processing was the subject of a USEPA funded study on waste-derived fuels. Conclusions reached by this study indicated that waste could be effectively eliminated when burned as a fuel and that waste fuels burn cleaner than traditional fossil fuels. In 1986 when Systech became a subsidiary of LaFarge Corporation, a cement and construction materials manufacturer, they were the innovators of the onsite co-processing facility concept. Basically, a co-processing facility combines a treatment storage disposal facility used to convert flammable hazardous waste into fuel, with a conventional cement production facility. As a consequence, effective generation and disposal of waste-derived fuels is achieved while the safe handling of flammable hazardous waste is not compromised.

Before the actual co-processing is initialized, the flammable hazardous wastes that can be beneficially utilized in the cement kilns must be identified. These wastes are generally transported to the co-processing facility in fifty-five (55) gallon drums or in tanker trucks. Once at the treatment storage disposal facility lab, two distinct scenarios can occur. The waste is either a "candidate" waste or an "approved" waste. A "candidate" waste is one which has not yet been accepted in the waste fuel program, whereas an "approved" waste is one which has already been accepted in the program. A "candidate" waste will be analyzed for its ability to function with other wastes. Similarly, an "approved" waste will be analytically tested and compared with the results of the specimens originally submitted for approval. The analyses are conducted by adhering to strict state and federal procedures and those wastes not satisfying the regulations are rejected. By evaluating the physical, chemical, and thermodynamic properties of the wastes, specific requirements regarding the energy value and compatibility with the cement-making process can be met. The objective is to attain both optimum blending of the waste with other wastes and the most favorable matching of the resulting secondary fuel with its desired application.

Once this analysis and acceptance stage is completed, the wastes are classified and separated. The solid wastes are crushed into fine particles with a grinder and then suspended in organic liquid wastes. This mixture is then blended with other suitable liquid wastes to produce the secondary solvent-based fuel. Subsequently, samples of the secondary fuel are tested according to state and federal USEPA permit standards.

The secondary fuel is filtered and loaded in storage tanks at the treatment storage disposal facility after successfully passing USEPA testing. When production operations are ready to use the fuel, it is polish filtered and screened to remove any solid material that might adversely affect valves and nozzles or settle at the bottom of the tanks.

The cement-manufacturing process is not only the second stage of co-processing, but is an ideal method for recycling wastes by recovering their energy value. Many wastes that are burned as fuels and recycled in cement making contain a high energy content. These wastes are commonly generated in the manufacture or use of everyday goods and services. They include

- byproducts of pharmaceutical, cosmetic, and electronics manufacturers;
- solvents and inks used to print newspaper and other publications;
- solvents used to recycle paper;
- dry-cleaning solvents;
- paint thinners and paint residues;
- sludge from the petroleum industry;
- used motor oil;
- agricultural wastes; and
- scrap tires.

Generally, these wastes are organic compounds with composed primarily of carbon and hydrogen.

Prerequisites for hazardous wastes to be utilized as supplemental fuels include a certain degree of combustibility and energy content. Recent regulations mandate that hazardous waste fuels possess a minimum energy content of 5,000 Btu's per pound. The hazardous waste energy content generally exceeds 10,000 Btu's per pound. Acting as supplemental fuels, these wastes replace significant amounts of traditional fossil fuels such as coal, natural gas, oil, and petroleum coke.

Other restrictions govern the chlorine and metal content of the hazardous waste. When chlorinated wastes, such as those containing carbon tetrachloride or trichlorobenzene, are burned in a cement kiln, hydrogen chloride (HCl) is produced. Hydrogen chloride gas reacts with potassium and sodium oxide in the kiln to form alkali salts. These salts then volatilize in the burning zone and condense in the cooler regions of the kiln. Blockages can result in the kiln system, which ultimately hinder the cement making process if large amounts of alkali salt forms as a consequence of the waste's high chlorine content. In addition, the setting of the cement can be negatively impacted if the concentrations of certain metals surpass 0.1%. For the manufactured cement to comply with performance standards set by the American Society for Testing and Materials (ASTM), regulation of the metal concentrations is imperative. Metals that are generally present in the raw materials or fuel, and which must be monitored include arsenic, cadmium, chromium, lead, nickel, thallium, and zinc. Also, cement plants do not accept

polychlorinated biphenyl (PCBs) wastes and do not accept dioxins, pesticides, or radioactive wastes.

COMMERCIAL HAZARDOUS WASTE RECYCLING FACILITIES

6.1 GENERAL DISCUSSION

Historically, solid and liquid wastes were landfilled, incinerated or otherwise disposed of. These disposal options have obvious economic and environmental disadvantages. Since the mid-1960s recycling has become institutionalized and, as a result, is a widely utilized method of reducing the volume of solid and liquid wastes that were formerly either landfilled, incinerated or disposed of as a hazardous waste. Recycling of post-consumer materials involves

- the recovery materials from the waste stream,
- intermediate processing such as sorting or compaction,
- transportation, and
- final processing to provide a raw material for manufacturers or an end product.

The primary benefits of recycling include conservation of landfill space and natural resources (e.g., forest products, mineral deposits, and fossil fuels).

The requirements for successful recycling are that a strong demand exists for the recovered materials and that the market value of the recovered materials be sufficient to pay for the collection, processing, and transportation costs. Low market value and demand are the primary reasons that some materials are not currently recycled on a large scale.

This section will focus on five recyclable materials. Subsequent subsections will provide general regulatory information pertaining to generation, storage, and transportation of each of the materials. Included will also be a geographically distributed list of recyclers that accept these materials, and cost information and acceptance criteria provided by the recyclers.

COMMERCIAL HAZARDOUS WASTE TREATMENT FACILITIES
7.1 GENERAL DISCUSSION

Treatment is defined by the EPA as the process of changing the physical, chemical, or biological character of a waste so that its threat to the environment is reduced. According to the U.S. EPA, "*Treatment can neutralize the waste, recover energy or material resources from a waste, render the waste less hazardous, or make the waste safer to transport, store, or dispose of.*" There has been an emergence of new technologies and the many waste treatment facilities that can delist waste or transfer the treated waste to disposal facilities within a network or an affiliated company. Because these facilities are able to accept waste from the USACE as the final destination, this section was added in 1998.

The different technologies available for treatment are Biological treatment, Boiler, Carbon Adsorption, Chemical Oxidation, Chemical Reduction, Deactivation, Extraction, Incineration, Industrial Furnace, Macroencapsulation, Neutralization, Physical removal, Smelting, Stabilization, Steam stripping, Treatment in tanks, Vitrification, Wastewater treatment units, Waste to Energy Incineration, etc. The treatment method varies depending upon the type of waste stream. A few commonly used technologies are described below.

Extraction

Extraction is the process used to remove hazardous constituents from either gaseous or liquid waste streams by means of settling, filtration, adsorption, absorption, solvents, or other means. The extracted constituents must be further treated in order to classify them as less toxic or hazardous.

Chemical Oxidation

In this process the waste is treated with strong oxidizing agents such as persulfates, percholorates, hypochlorite, peroxides, or permanganates to oxidize and breakdown the harmful constituents in the waste and make them a less harmful or toxic components. Chemical oxidation is also referred to as alkaline chlorination.

Chemical Reduction

This process is very much similar to chemical oxidation, except that in this the agents used to breakdown the harmful constituents in the waste are strong reducing agents (e.g. sulfur dioxide, alkali salts, sulfides, iron salts, etc). This technique is commonly used to reduce hexavalent chromium to the trivalent state.

Neutralization

This process is commonly used for treating harmful corrosive waste streams. High pH corrosive waste stream are neutralized by adding acids, and low pH corrosive waste streams are neutralized by adding caustics or bases.

Metal Precipitation

Some hazardous waste streams have heavy metals present that are harmful for the environment. These heavy metals have to be removed from the waste stream before these streams can be further treated. The metals can be removed from these waste streams by using simple

precipitation method. Vibratory machines and tumblers using the Metals Precipitation System are the easiest way to remove metals.

Flocculation

Flocculation is used to remove heavy metals, ink, paints, and oil from a hazardous waste water stream. Depending upon the amount and type of contaminants present in the waste water stream different type of flocculation systems is used.

Carbon Adsorption

In this the hazardous waste stream is passed over a bed of activated carbon. The hazardous waste particles get adsorbed on the activated carbon making the stream less harmful or toxic. Carbon adsorption can used be used on both gaseous and aqueous waste streams.

Stabilization

The method of reducing the mobility of the hazardous constituents of a waste which makes it easier to handle is called stabilization. Portland cement, lime, fly ash, and cement kiln dust are the most common stabilization agents added to waste streams.

Macroencapsulation

This a process in which the harmful constituents present in the waste are coated with a thin layer of plastic or resin in order to avoid the leaching of harmful substances. Macroencapsulation specifically does not include any material that would be classified as a tank or container according to 40 CFR 260.10.

Biological Treatment

This is a process of treating the harmful constituents present in the waste with biological agents like bacteria, fungi, or algae. The harmful constituents are converted into CO_2, H_2O and biological cell mass. This process is usually performed in a bio-plant. The bio-plant has suitable conditions inside it to accelerate the process of biodegradation.

COMMERCIAL HAZARDOUS WASTE TRANSPORTATION

8.1 GENERAL DISCUSSION

Transporting hazardous wastes safely and efficiently from generators to permitted treatment storage disposal (TSD) facilities is of vital importance to the fundamental concept of "cradle-to-grave" management of hazardous wastes. The USEPA defines "transportation" as "the movement of hazardous waste by air, rail, highway, or water" and a "transporter" as "a person engaged in the offsite transportation of hazardous waste by air, rail, highway, or water." In other words, anyone who moves hazardous wastes which are requiring a manifest off the site where they have been produced or away from the site where they are being treated, stored, and disposed of is subject to the standards applicable to a transporter. Entities that are not governed by these regulations include: generators, owners, or operators of permitted waste management facilities who engage in on-site transportation of their hazardous wastes.

The federal regulatory system governing the transportation of hazardous materials was developed with substantial industry involvement. The existing regulations developed by the Department of Transportation (DOT), USEPA, and other federal agencies are extensive. They cover the following aspects of hazardous waste transportation: classification of the waste, specifications for containers, communication requirements such as container and vehicle labeling, handling and operating standards for each mode of transportation, safety requirements for shippers and handlers, worker safety, and environmental protection.

COMMERCIAL HAZARDOUS WASTE FACILITIES IN CANADA

9.1 GENERAL DISCUSSION

This section is a review of a collection of facilities in Canada that accept offsite HTRW from the United States. This section has been included in awareness of the volume of waste that is transported from the United States into Canada every year. Current differences in US EPA and Environment Canada guidelines may allow for easier or more economic treatment, storage or disposal of HTRW than similar US facilities. However, the regulatory gap between US EPA and Environment Canada documents is quickly closing.

LOW-ACTIVITY RADIOACTIVE WASTE

10.1 HISTORICAL BACKGROUND & LEGISLATION

With the passage of the Energy and Water Resources Appropriation Act of 1998, the United States Army Corps of Engineers (USACE) was designated by Congress with responsibility to manage and execute the Formerly Utilized Sites Remedial Action Program (FUSRAP) previously managed by the United States Department of Energy (DOE). Many of the sites currently in FUSRAP are on the verge of undergoing the final remedial action stage and will likely require off site disposal of primarily radioactive material with varying levels of radioactivity, in some cases including other hazardous substances.

Prior to 1978, the Atomic Energy Act (AEA) regulated only 11e.(1) byproduct material, which is material made radioactive in the processing of special nuclear material. In 1978, the Uranium Mill Tailings Radiation Control Act (UMTRCA) was established. Congress expanded jurisdiction of the AEA to include all the wastes generated in the course of processing ores for uranium or thorium if they were processed for their source content (11e.(2) byproduct material). This definition excludes the wastes of processing ores for other mineral content even if the wastes are radioactive. The Nuclear Regulatory Commission (NRC) has ruled that pre-1978 11e.(2)FUSRAP waste material may be disposed of at Resource Conservation and Recovery Act (RCRA) Subtitle C hazardous waste management facilities, if such disposal is in compliance with applicable laws.

Provisions to the AEA were enacted in 1980 through the Low-Level Radioactive Waste Policy Act, which encouraged the states to develop low-level radioactive waste (LLRW) disposal facilities or to enter interstate compacts to develop facilities to serve the compact member states. These provisions were significantly amended in 1985 through the Low-Level Radioactive Waste Policy Amendments Act. Exportation of waste from regional compacts within which the FUSRAP sites are located will not require compact notification or coordination. Compacts may prohibit the disposal of low-level radioactive waste from outside the member states in certain circumstances, or charge increasing surcharges for states which have neither developed their own disposal facility nor entered into a compact that develops a facility if necessary to eliminate an immediate and serious threat to the public health and safety or the common defense and security. The statute specifically allows a compact facility to refuse to accept for disposal material identified under the FUSRAP, although a compact facility is not prohibited from accepting FUSRAP waste for disposal.

The USACE came into FUSRAP with no established agency policy specifically regarding disposal of such low specific activity waste, other than to comply with all applicable laws and regulations, and to ensure the protection of public health and the environment, the same as the agency policy regarding disposal of all hazardous, toxic and radioactive waste. USACE has, however, had experience disposing of low specific activity waste from Department of Defense facilities, the United States Environmental Protection Agency (EPA) National Priority List sites, and for other federal agency customers. Recognizing the negative impact of confining disposal options to a single, remotely located facility, USACE has determined to evaluate the types of waste materials at FUSRAP sites, the legal authorities which govern the materials, and the range of potential disposal sites which are approved to accept the types of materials. This approach is intended to ascertain if competition can be secured for the disposal for FUSRAP waste, while

remaining fully in compliance with all laws and protecting the public interest, both from health and fiscal perspectives.

10.2 INTERNATIONAL REGULATIONS

There are a number of international bodies and organizations which deal with the transportation of radioactive material. The majority of these international bodies are sanctioned by or affiliated with the United Nations (UN). These agencies write regulations and recommend their adoption by member states as a basis for national regulations. The International Atomic Energy Association (IAEA), located in Vienna, Austria, has been the primary body for the establishment of radioactive material regulations which have served as the basis of all other international regulations and requirements. The International Civil Aviation Organization (ICAO) is active in regulating the transport by air of dangerous materials, including radioactive material. The ICAO requirements have been adopted by nearly all countries. The International Air Transport Association (IATA), a body of member air carriers, also publishes regulations or air transport of restricted articles, including radioactive materials. Although IATA is not recognized in the DOT regulations, the ICAO requirements are essentially restated in the IATA regulations. For ocean vessel transportation, the International Maritime Organization (IMO) issues safety regulations for all types of hazardous materials, including radioactive material. The ICAO and IMO regulations reflect the United Nation's recommendations for all hazardous materials, which include the IAEA standards for radioactive material. The ICAO and IMO regulations tend to provide more explicit requirements to shippers and carriers than the basic UN and IAEA standards. Over the past decade, DOT has revised their regulations towards full consistency with the international standards, especially in the area of radioactive material transportation.

10.3 FEDERAL REGULATIONS

The requirements imposed on the transportation of hazardous materials, including radioactive materials and wastes are found in 49 CFR Subchapter C, Part 171 through 178. More specifically, 49 CFR 173, Subpart I addresses the transport requirements for Class 7 radioactive materials/wastes.

In addition, the transportation requirements of the NRC which apply to the transport of NRC-licensed radioactive material are located in 10 CFR Part 71. Since 10 CFR 71 is a matter of "compatibility" for regulatory programs of the NRC "Agreement States", effectively it is also applicable to activities of Agreements States licenses. In accordance with 10 CFR 71.5, each NRC licensee who transports licensed radioactive material outside the site of usage, as specified in the NRC license, or where transport is on a public highway, or who delivers licensed material to a carrier for transport, must comply with the applicable requirements of the DOT hazardous materials regulations. NRC inspects the shipping practices of the licensees, and enforces the licensee compliance with the DOT regulations. In addition, with the exception of DOT specification packages and packages approved by the U.S. Department of Energy (DOE), all packages used for domestic shipments of non-LSA/SCO Type B quantities, LSA/SCO Type B quantities for which the unshielded radiation level at 3 meters is greater than 10 mSv/hour (1 rem/hour), and fissile material which exceeds a "fissile exempt" quantity, must be certified for use by the NRC. The user must register with the NRC and make all shipments in compliance with the terms of the package approval. The package approval standards and performance requirements are set out in 10 CFR 71.

Several other transport-related requirements for NRC licensees are also in 10 CFR Parts 20 and 61. 10 CFR Part 20 has several transportation-related requirements that are provided in 10 CFR 20.1906, 10 CFR 20.1601(e), 10 CFR 20.2006, and Appendix G. NRC and Agreement States regulate licensed shippers and receivers. DOT's authority applies to shippers and carriers, not receivers. 10 CFR 20.1906 requires that an NRC licensee who receives a radioactive package perform certain monitoring of the package. 10 CFR 20.1601(e) requires control of access to High Radiation Areas containing radioactive material packages. 10 CFR 20.2006 and Appendix G are designed to control the transfer of low-level radioactive waste by any waste generator, waste collector, or waste processor who ship low-level waste. Appendix G provides the specific requirements that must be met while completing the Uniform Low-Level Radioactive Waste Manifest.

10 CFR Part 61 contains regulations for the siting and operation of near surface low-level waste disposal sites, as well as the requirements for the classification and form of material which may be transferred (including transport) for disposal at such a facility. The requirements for waste classification and waste form are not technically equivalent to DOT requirements for radioactive material classification and packaging purposes of transportation. However, shippers inevitably must keep these Part 61 requirements in mind when preparing such low-level waste (usually LSA and SCO materials) for shipment to a shallow land burial facility. Part 61 also contains specific requirements for radioactive waste manifest information and format which are more rigorous and detailed than the DOT requirements for shipping papers in 49 CFR 172.

In summary, the transportation requirements for radioactive materials and wastes are substantially different from transportation of other types of DOT hazardous materials. On USACE projects, a project Health Physicist (HP) will be familiar with the associated transportation requirements and can assist in the waste classification, transportation and disposal aspects of the material/waste.

10.4 RADIOACTIVE MATERIAL/WASTE CHARACTERIZATION

The licensing and regulation of radioisotopes in the United States are shared by the NRC, EPA and many state governments for non-defense radioactive materials. The NRC is the Federal agency given the task of protecting the public health and safety and the environment with regard to the safe use of nuclear materials. The NRC or an "Agreement State" regulates medical, academic, and industrial uses of nuclear materials generated by or from a nuclear reactor. The EPA is responsible for setting air emission and drinking water standards for radionuclides in addition to regulating hazardous waste and mixed waste.

The Atomic Energy Act (AEA) establishes authority over certain activities (mining, storage, processing, extraction, disposal) involving a number of types of radioactive materials. The NRC has regulatory authority under the AEA for the following radioactive materials:

1. *Special nuclear material*: plutonium, uranium-233 and enriched uranium-233 & 235;

2. *Source material*: uranium, thorium or ores containing 0.05% by weight or more of either or both);

3. *Byproduct material*: radioactive material from nuclear reactors tailings, discrete sources of Ra-226 and NORM, and NARM;

4. *Low-level radioactive waste (LLRW)*: radioactive material that is not high-level waste, spent nuclear, or 11.e.(2) byproduct. Radioactive material from nuclear power plants, hospitals, research institutes etc. Broad concentration from slightly above natural background to high specific activity;

5. *High Level Waste*: spent fuel from nuclear power plants containing fission byproducts from reprocessing.

An Agreement State may regulate source material, byproduct material, LLRW, and special nuclear material in quantities not sufficient to form a critical mass.

Radioactive material that is regulated under the AEA will need to be disposed of at an NRC (10 CFR 61) or Agreement State licensed facility. It should be noted that in the late 1990's, USACE prepared a letter to NRC requesting clarification on the characterization of some of our wastes for purposes of disposal. In response to questions from USACE, the NRC stated in writing that no NRC license is required for USACE or its contractors to handle certain historic radioactive materials on FUSRAP sites, and further that no NRC license is required for off site disposal of these materials. This determination is based on the fact that the AEA 11.e.(2) definition of byproduct materials subject to AEA regulation was not enacted until 1978 as part of the Uranium Mill Tailings Radiation Control Act (UMTRCA), Public Law 95-604. The regulatory jurisdiction over 11.e.(2) materials now exercised by the NRC is not deemed to be retroactive to materials processed prior to the November 1978 date of the law creating this jurisdiction. The NRC advises that neither an NRC license nor an Agreement State license (issued pursuant to authority delegated under the AEA) is required for handling the materials from the specified sites, and therefore no NRC or Agreement State license is required for disposal of the materials from the sites. The NRC also stated that it would not object to the disposal of FUSRAP waste materials which are pre-1978 11.e.(2) byproduct materials at RCRA Subtitle C hazardous waste management facilities, if such disposal is in compliance with applicable state law. In further clarifications with the NRC, this jurisdictional limitation applies to all pre-1978 MED or AEC uranium or thorium milling sites, or sites with materials, which are byproducts of processing from those sites. Thus, gathering all available historical documents regarding activities at the site to determine the origin of the radioactive materials which are present is critical to correct characterization of the materials for disposal purposes. In addition, the NRC has clarified in discussions that the determination of lack of regulatory jurisdiction due to the prospective application of UMTRCA does not change the proper characterization of the materials as 11.e.(2) type byproduct materials. However, it is important to note that Congress would need to take legislative action and expand NRC's authority to regulate the pre-1978 11.e.(2) type materials that the NRC refers to as "residual radioactive material resulting from the processing of ores before the enactment of UMTRCA."

Another general category of radioactive material that is regulated is mixed waste. If hazardous wastes are present in waste materials, which also contain AEA regulated radioactive materials, they are known as "mixed wastes" and may potentially be regulated by EPA and NRC. If materials are byproduct materials under the AEA, and are potentially characteristic hazardous waste due to the presence of constituents which are natural to the original ore or were added in the processing for special nuclear materials or uranium or thorium, then this characteristic is part of the AEA regulated byproduct materials and exempt from RCRA due to the definition of solid waste. If other characteristic hazardous waste or listed hazardous waste has been added to byproduct materials, then the resulting materials are mixed wastes. Another important distinction to note is that pre-1978 byproduct material, that exhibits a RCRA characteristic or is

RCRA listed and it is unrelated to the processing or natural ore, the material would not be a "mixed waste" since the radioactive contamination is not AEA regulated.

States are authorized by the AEA to regulate radiological hazards for low-level radioactive wastes that have been exempted by regulation by the NRC. An example of material not regulated under the Atomic Energy Act (AEA) is diffuse sources of naturally occurring radioactive material (NORM) that has been processed or underwent mineral extraction. Even though NORM is not regulated under the AEA, it still may have a potential radiological risk because the radionuclide concentration may have been increased or redistributed. Until recently, the radioactive material subset identified as NORM, included a category of radioactive material that has now been identified as technologically enhanced naturally occurring radioactive materials (TENORM). The words "technologically enhanced" were added to distinguish clearly between radionuclides as they occur naturally and radionuclides that human activity has concentrated or exposed to the environment. TENORM is produced when radionuclides that occur naturally in ores, soils, water, or other natural materials are concentrated or exposed to the environment by activities, such as uranium mining, sewage treatment or water treatment sludges. EPA has used its authority under a number of existing environmental laws (Clean Air Act, Clean Water Act, Safe Drinking Water Act) to regulate some sources of TENORM.

Waste that is known to be present or likely to be found at FUSRAP sites falls within a variety of definitions established in federal statues and regulations. Whenever any materials are to be sent off-site, there are laws and regulations which apply to transportation, processing, treatment, storage or disposal of the materials as part of the responsibility for execution of cleanup of hazardous substances under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). USACE must characterize the materials to determine which laws and regulations apply to the types of materials present, and to ensure that they are managed, treated, recycled, or disposed of in compliance with those laws and regulations.

An essential part of the characterization process is to gather, review, and evaluate historical process information. Waste is characterized based on contaminant concentrations, origin of the waste, and the process in which the waste was generated. The definitions of AEA regulated materials depend not only on a laboratory analysis of the materials, but on whether the materials were processed, when processing occurred, and the primary purpose of processing. For both RCRA listed waste and 11e.(2) byproduct material subject to NRC licensing (after 1978 UMTRCA), the date of the processing and disposal activities can be a major factor in determining regulatory jurisdiction. For Manhattan Engineer District (MED) or Atomic Energy Commission (AEC) atomic weapons programs, and later commercial process activities, both government historic records and available industry records must be collected and reviewed to obtain the necessary process information.

10.4.1 Byproduct Material

There are two main types of byproduct materials:

1. those produced by nuclear reactors; and
2. those produced by uranium and thorium mining processes.

By definition, byproduct material is

1. any radioactive material yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material; and
2. the tailings and wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including waste from uranium solution extraction processes.

Byproduct material does not include source material or underground ore bodies depleted by solution extraction. Byproduct material is subject to NRC regulation.

10.4.2 Hazardous Waste (HW)

Hazardous wastes are wastes regulated by the EPA under RCRA, or by an authorized state authority. In simple terms, it includes characteristic wastes that are ignitable, corrosive, reactive, or toxic by definition, and listed wastes the EPA or state has predetermined to regulate as hazardous waste.

10.4.3 High-Level Radioactive Waste (HLRW)

This is highly radioactive material resulting from the reprocessing of spent nuclear fuel. It includes liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains materials in concentrations requiring isolation.

10.4.4 Low Activity Radioactive Waste (LARW)

This type of radioactive waste contains very small concentrations of radionuclides (average specific activity less than 2000 picocuries per gram [pCi/g]), but can present a significant chronic public health hazard. Although LARW generally contain lower levels of radioactive material and present less of a health hazard than either spent nuclear fuel or high-level waste fission products from chemical processing of spent fuel, it may contain naturally occurring or other long half-life radionuclides at well above background levels. LARW includes a broad spectrum of materials declared as wastes from a variety of national defense and private sector activities. This type of waste may have been produced from a variety of activities including national defense, nuclear power, industry, medicine, research, and mineral recovery.

10.4.5 Low-Level Mixed Waste (LLMW)

This is waste containing low-level radioactive waste and RCRA designated hazardous waste. This means that the waste is regulated by the EPA and possibly state authorities, and is subject to NRC regulations as well.

10.4.6 Low Level Radioactive Waste (LLRW)

Radioactive material that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, or byproduct material produced by the extraction or processing of uranium or thorium ore, is classified as low-level radioactive waste by the NRC. Because this type of waste is defined by what it is not rather than by what it is, the term applies to a broad range of wastes and does not necessarily identify whether or not it is low hazard. This type of waste is not regulated by EPA as hazardous waste. However, it is regulated by the NRC, by state law or interstate compact agreements. This type of waste does not include naturally occurring material or accelerator-produced radioactive material (spent fuel).

10.4.7 Mixed Waste (MW)

Materials regulated as hazardous waste under the RCRA; and source, special nuclear, or byproduct material subject to the Atomic Energy Act. If the hazardous portion of the mixed waste is a natural component of the ore or normally results from processing ore (and thus not subject to RCRA), then the material is not a mixed waste. It is only regulated for its radioactive component.

10.4.8 Naturally-Occurring and Accelerator-Produced Radioactive Materials (NARM)

These are radioactive materials not regulated by the NRC. Radioactive ores and technologically enhanced natural radioactive materials (TENORM) are not regulated by the NRC. Materials are made radioactive by exposure to a particle accelerator are also not regulated by the NRC. NARM refers to either type of materials. NARM is regulated by some states.

10.4.9 Naturally Occurring Radioactive Material (NORM)

These radioactive materials are not governed by the AEA. The material's radioactivity has been enhanced, usually by mineral exploration or processing activities. It does not include the natural radioactivity of rocks, soils, or background radiation. This type of material is a subset of NARM.

10.4.10 Source Material

Licensable source material is defined as: (1) uranium or thorium in any physical or chemical form, or (2) ores containing one twentieth of one percent (0.05%) by weight uranium or thorium or any combination thereof. Source material in any chemical mixture, compound, solution or alloy in which the source material is less than one twentieth of one percent (0.05%) by weight is considered an unimportant quantity of source material. Source material does not include special nuclear material, and is subject to regulation by the NRC.

10.4.11 Special Nuclear Material (SNM)

SNM includes weapons grade material or material used for special power generating reactors that can consist of plutonium, uranium-233, uranium enriched in the isotope 233 or isotope 235 or any material artificially enriched by these, but not including source material. Special nuclear materials also are not considered to be source material. There are very strict licensing and handling controls for special nuclear material due to its importance in the fabrication of weapons grade materials. Special nuclear material is regulated by the NRC.

10.5 NRC WASTE CLASSIFICATION

Characterizing the waste as described above is essential in determining the proper disposal requirements for the material or waste. In addition, proper classification is also essential for the land disposal of radioactive wastes containing byproduct, source and special nuclear material to determine the laws and regulations that apply to that material.

The regulations in Part 61 of 10 CFR establish the procedures, criteria and terms and conditions upon which the NRC issues licenses for land disposal of radioactive wastes containing byproduct, source and special nuclear material received from other persons. Part 61 defines the three classes of low-level radioactive waste (Class A, Class B, and Class C) that may be placed

in a low-level radioactive waste disposal facility. The definitions of these classes are based on the specific radioactive isotopes present, their concentrations, and their half-lives. Any low-level waste with a concentration of radioactive material greater than that specified for these three classes is termed “greater than Class C”, is a federal responsibility, and must be disposed of in a "deep geologic repository" like the one designed for high-level waste at Yucca Mountain. Part 61 does not apply to disposal of high-level waste as provided for in Part 60 or 63, uranium or thorium tailings or wastes as provided for in Part 40, or disposal of licensed material as provided for in Part 20 (e.g. Subpart K-Waste Disposal).

10.5.1 Classification of waste for near surface disposal in accordance with 10 CFR 61.55

Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.

10.5.1.1 Classes of waste

Class A Waste

Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in §61.56(a). If Class A waste also meets the stability requirements set forth in §61.56(b), it is not necessary to segregate the waste for disposal. Class A, which has the lowest concentration of radioactive material and poses the least potential hazard, must meet minimum regulatory requirements specified in Part 61. Class A waste must decay within 100 years to an acceptable level to not present a hazard to an intruder after institutional control of disposal site access is no longer required.

Class B Waste

Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in §61.56. Class B contains a higher concentration of radioactive material than Class A. It must meet additional standards and be packaged in a stable container. Class B waste must also decay within 100 years to an acceptable level to not present a hazard to an intruder after institutional control of access to the disposal site is no longer required by the regulations.

Class C Waste

Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in §61.56. Class C has the highest concentration

of radioactive material allowed in a low-level radioactive waste disposal facility. Class C waste must meet the same standards as Class B, and in addition, it must be packaged so that inadvertent intruders are protected from exposure to the waste both during the time the disposal facility is open and for 500 years after it has been permanently closed.

Other Waste

Waste that is not generally acceptable for near-surface disposal is waste for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. In the absence of specific requirements in this part, such waste must be disposed of in a geologic repository as defined in part 60 or 63 of 10 CFR unless proposals for disposal of such waste in a disposal site licensed pursuant to this part are approved by the Commission.

10.6 Overview of regulations

10.6.1 General Information

USACE assumes the role of lead federal agency with responsibility for necessary response actions for releases of hazardous substances authorized to be addressed under FUSRAP, i.e. those hazardous substances resulting from past MED or AEC site activities in support of the nation's early atomic weapons and energy program, and those hazardous substances present at the FUSRAP sites directed to be included in the program by Congress. Facilities that receive the waste materials for treatment, storage or disposal off site are required to have all applicable permits.

Low-level radioactive waste disposal is governed by the AEA, which provides that it is radioactive material that is neither high-level radioactive waste, spent nuclear fuel, or 11e.(2) byproduct material, and is classified as such by the NRC. The NRC has developed criteria for low-level radioactive waste, designated as Class A, B, or C, for purposes of disposal facility acceptance criteria. The regulatory authority created in the AEA is exercised by the NRC.

The NRC is authorized to enter into agreements with States to allow states to license the handling of special nuclear materials in quantities not sufficient to form a critical mass, source materials and byproduct materials, both 11e.(1) and 11e.(2). States may also be authorized by the NRC to regulate the disposal of low-level radioactive waste under agreement with the NRC. The NRC retains its regulatory jurisdiction for radioactive materials not transferred to the state pursuant to the agreement. Thus, materials or entities not regulated by the States are still subject to NRC regulation. Finally, States are authorized by the AEA to regulate radiological hazards for low-level waste, which as been exempted from regulation by the NRC. Some states regulate such material as NORM or as NARM.

The other general category of waste materials from FUSRAP sites that are subject to regulation includes solid and hazardous wastes. The EPA regulates the management of hazardous waste including both listed wastes and characteristic hazardous wastes. Source, special nuclear, and byproduct material are exempt from regulation under RCRA. The EPA can authorize a state to regulate hazardous waste management in lieu of the federal RCRA program if the state program is approved by the EPA. Mixed wastes are potentially regulated by both the EPA, or an authorized state, and the NRC. If materials are byproduct materials under the AEA, and are potentially characteristic hazardous waste due to the presence of constituents natural to thorium,

then this characteristic is part of the AEA regulated byproduct materials and exempt from RCRA due to the definition of solid waste.

State RCRA authorization must specifically include mixed wastes for this regulatory jurisdiction to be held by a state. There are a few states that are authorized to regulate hazardous wastes but not mixed wastes. In some of these RCRA authorized states, the state will regulate hazardous wastes and may also regulate NORM or NARM, and the RCRA hazardous waste management facility permit may include authorized low levels of radioactivity to be present in hazardous wastes accepted at the facility, even if the state is not regulating mixed waste or the facility is not permitted to treat, store, or dispose of mixed waste. Solid wastes are authorized by RCRA to be regulated by the states, with certain minimum standards for regulation. Solid waste disposal facilities are known as Subtitle D facilities, for the chapter of the 1976 law which recognized the states' authority to regulate non-hazardous solid waste management facilities, as distinct from Subtitle C facilities, which are RCRA regulated hazardous waste management facilities.

10.6.2 Disposal Options

Disposal options for radioactive materials will vary from readily disposable locally, to no immediate disposal options at all, depending on the type, quantity, concentration, and pedigree of the radioactive materials. Very early in the planning process and well before any execution, a disposal plan must be prepared. Kansas City District has a number of pre-placed contracts for disposal of radioactive waste that may be accessed by all of USACE. The project Health Physicist (HP) should be contacted to assist with initial estimates of potential disposal sites.

Shipments of LARW, including NORM, are controlled by the Department of Transportation. Transportation hazards are not as well recognized as chemical hazards for LARW. Present requirements placed on waste generators along with the limited number of disposal sites result in transporting large amounts of LARW over long distances. For more information on transportation refer EM-1110-35-1.

If the materials are LLRW, then they must be sent to either a LLRW compact facility, or to another licensed facility, with the approval of either the regional compact commission or the licensing regulator for the facility. If the materials are NORM, then they are governed for disposal only by the law of the receiving state, and some states have licensed facilities for disposal of NORM waste with specified limits of radioactivity.

If the materials contain hazardous waste, then it must be ascertained if it is mixed waste. If the materials are byproduct type materials, and there is a hazardous characteristic present either as a result of the natural conditions of the ore or as a result of chemicals used in the radioactive materials processing, then they are byproduct materials only and not RCRA regulated. Disposal of mixed waste requires both an NRC or Agreement State license, and a RCRA hazardous waste management facility permit which specifically authorizes receipt of mixed waste.

Finally, there is some higher activity radioactive material at one FUSRAP site, for which a commercial disposal facility may not be available. If the material is suitable for alternate feed material for reprocessing, then it may be necessary to arrange with the Department of Energy for disposal of these materials at one of the DOE sites that can accept materials with such high activity. Since the materials appear to be pre-1978 11e.(2) byproduct materials that were the result of processing in support of the nation's early atomic weapons program, one or more of the

DOE disposal sites may be appropriate for disposal of such waste. Such an arrangement would require negotiations with and approval of the DOE.

Other factors should be considered in deciding upon the best disposal option, including the specific waste acceptance criteria and regulatory approval of the facility, the design criteria and worker protectiveness standards followed at the facility, the transportation receipt and unloading available at the facility, and, of course, the cost for transportation and disposal at each facility under consideration. A related consideration is the procurement vehicles available to arrange for the transportation and disposal. USACE uses many different types of contracts, and mechanism, considering cost, maintaining contractor responsibility for completion of the project, administrative convenience for the government, and the fundamental procurement requirements of fair and open competition and selection of a responsive and responsible contractor. Any contract, which is used for disposal of FUSRAP materials, should include all necessary information and require appropriate documentation and government approvals to ensure that all health and safety and regulatory requirements have been satisfied.

10.7 COMMERCIAL LOW-ACTIVITY RADIOACTIVE WASTE FACILITIES

10.7.1 Procedural Requirements to Dispose of FUSRAP Waste

All disposal facilities have waste acceptance criteria as part of their operating permit(s) or license(s). All potential disposal facilities should be contacted to verify any waste acceptance criteria listed here. All potential disposal facilities should be contacted to verify their pre-acceptance process and time requirements necessary to get determinations. Facilities will need to have the waste accurately profiled for radioactivity and chemical constituents to be sure their facility can accept the waste. In some cases, the disposal facility will need to take the information to their state or federal regulators to seek approval to accept the waste. Ideally, all the disposal options should be known prior to solicitation of bids or issuing task orders to ensure there is no delay in project execution. Some alternate disposal facilities may require a determination from their state regulators before they can accept the material for disposal. Some of the disposal options might require an amendment to their NRC licenses (e.g. accept FUSRAP material as alternate feed for uranium mill processing) which can take several months to accomplish.

If the specific activity in the waste material exceeds 2000 pCi/g, averaged over the entire contents of the package, or there is a reportable quantity of a CERCLA hazardous substance, or the material is mixed with a hazardous waste, transportation of the waste material to waste disposal facility must be performed in accordance with U.S. Department of Transportation regulations at 49 CFR Subchapter C, “Hazardous Materials Regulations.” If FUSRAP waste is also RCRA regulated hazardous waste, EPA manifest requirements will be applicable, as well as DOT shipping requirements. Failure to comply with all applicable requirements may result in civil penalties for the agency, and/or criminal penalties for the responsible individuals.

ER 385-1-80m Ionizing Radiation Protection; EM 385-1-1, Safety and Health Requirements Manual; and policy memorandum of 17 November 1997, USACE Implementation of DOD Charter for LLRW Disposal Program require that the USACE HTRW Center of Expertise (CX) be notified of all radioactive waste disposal including FUSRAP wastes.

10.8 ADDITIONAL USACE REQUIRMENTS FOR RADIOACTIVE MATERIAL/WASTE TRANSPORTATION AND DISPOSAL

10.8.1 HTRW CX Notification Requirements

All USACE Districts and Field Operating Agencies are required to coordinate disposal of all radioactive waste, to include FUSRAP radioactive materials, with the HTRW CX prior to shipment (ER 385-1-80, paragraph 17.a.). As required by HQ USACE, the HTRW CX maintains a database from the District notifications for upward reporting to HQ USACE on the quantities and types of radioactive wastes and materials that are disposed by USACE. The notification form may be found in EM1110-35-1, paragraph 12-10, page 12-4. The initial notification, prior to shipment, may be an estimate of radioactive materials. Final shipment quantities shall be provided to the HTRW CX upon completion of the work.

10.8.1.1 Chain-of-custody

Some radioactive waste materials from remediation sites may not be regulated during the course of transportation by the DOT, the EPA or the NRC due to the characterization or the activity of the materials. In these instances, USACE requires that a chain-of-custody form be used for each shipment of material to track the material from the point of generation to the ultimate placement or disposal location. The chain-of-custody form requires information very similar to a DOT bill of lading. The form shall include a certification that the material being shipped contains low-activity levels of radionuclides and is not NRC licensed material and is not DOT regulated as a radioactive material or a reportable quantity of a radionuclide. An example chain-of-custody form is included in EP 200-1-2 on pages A-81 and A-82.

10.8.1.2 Marking Sticker

All shipments of radioactive waste materials must comply with the applicable DOT, NRC and EPA regulations. In addition, USACE requires the use of a secondary non-DOT communication "marking sticker" (Federal Railroad Administration (FRA) designation) on all containers of radioactive material regardless of whether the material is a DOT hazardous material or not. The label indicates the destination of the shipment and a telephone number of a USACE point of contact with knowledge of the shipment. This additional marking sticker duplicates existing information that is required on shipping papers when the shipment is a DOT hazardous material. The FRA has reviewed and approved the marking sticker with the understanding that the marking sticker color (purple, pink or chartreuse) will not create any confusion or violate any DOT requirements. Marking stickers shall be placed in visible locations on the exterior sides of transport vehicles and the top of the container liner (e.g. burrito bag in rail car gondola) to ensure the workers observe the information prior to emptying the container or rail car (intermodal or gondola). A bulk container should have the marking sticker on all four sides and if the transport vehicle is an open gondola car, there should be at least two stickers on top of the closed inner liner. An example of the marking sticker may be found in EM 1110-35-1, paragraph 11-5, b. The HTRW CX may be contacted for potential suppliers of the marking stickers.

10.8.1.3 Certificate of Disposal

A Certificate of Disposal/Destruction or Placement is required for all off-site shipments of FUSRAP materials. The comeback copy of shipping papers (Uniform Hazardous Waste Manifest, Uniform Low-Level Radioactive Waste Manifest) does not satisfy the requirement for a Certificate of Disposal/Destruction or Placement. The comeback copy of the shipping papers typically acknowledges receipt of the material by the facility but does not state that the material has been properly disposed of. The certificate must correlate to each shipment of material to the facility and the corresponding shipping papers. This policy may be found in EP 415-1-266 in Section 7, page 12.

10.8.1.4 Spill Reporting Procedures

USACE policy on spill reporting procedures for USACE personnel involved with HTRW and radioactive projects may be found in EP 415-1-266 on page 12 of Section 7. The EP directs the reader to spill reporting procedures at: http://www.environmental.usace.army.mil//guide_comp.htm. The Internet site includes a useful flowchart that explains reporting responsibilities for three common types of spill scenarios. The USACE spill policy memorandum outlines the major reporting requirements and delineates reporting responsibilities. USACE ER 500-1-1, chapter 11, requires all Districts to have a designated Emergency Operations Center or an Emergency Management Office (EOC/EMO) and have a plan outlining the upward reporting requirements should a natural disaster or hazardous material spill occurs. Each District should build upon the existing emergency response structure by including any additional reporting requirements within their existing plans. Some additional basic steps should be taken to ensure the District emergency response plan adequately addresses radioactive spills at the project site or while the material is in transportation.

10.9 COMMERCIAL LARW WASTE FACILITIES

10.9.1 Commercial LARW Waste Facilities – Alphabetical Listing by Facility

Company	Facility	City, State, Zip	Type	Rem.
Chemical Waste Management	same	Emelle, AL 35459	landfill	3
Thomas Gray & Associates, Inc.	same	Orange, CA 92868	landfill	1
Perma-Fix Environmental Services, Inc.	Perma-Fix of Florida	Gainesville, FL 32653	Treatment	2
US Ecology Idaho Inc.	same	Grand View, ID 83624	landfill	2
Envirosafe Services of Ohio, Inc	Envirosafe Services Otter Creek Road	Oregon, OH 43616-1242	landfill	2
Von Roll America, Inc.	same	East Liverpool, OH 43920	Treatment	1
Waste Management	Chemical Waste Management of the Northwest	Arlington, OR 97812	landfill	3
Chem-Nuclear Systems, LLC	Barnwell Disposal Site	Columbia, SC 29210	Radioactive waste facility	1
Perma-Fix Environmental Services, Inc.	Diversified Scientific Services Inc. (DSSI)	Kingston, TN 37763	incinerator	2
Waste Control Specialists	WCS Texas	Andrews, TX 79714	landfill	3
US Ecology Texas	same	Robstown, TX 78380	landfill	1
US Ecology Washington, Inc.	same	Richland, WA 99352	landfill	1

1. Facility was contacted, however no information was received.
2. Facility provided general facility information, however no cost information was received.
3. Facility provided both general facility and cost information.

10.9.1.1 Commercial LARW Waste Facilities – Alphabetical Listing by State

State	City	Facility	ID Number	Telephone
AL	Emelle, AL 35459	same	ALD000622464	(205) 652-8156
CA	Orange, CA 92868	same	CAD066151648	(714) 997-8090
FL	Gainesville, FL 32653	Perma-Fix of Florida	FLD980711071	(800) 365-6066 ext. 1342
ID	Grand View, ID 83624	same	IDD073114654	(916) 939-0967
OH	Oregon, OH 43616-1242	Envirosafe Services Otter Creek Road	OHD045243706	(800) 537-0426 ext. 226
OH	East Liverpool, OH 43920	same	OHD980613541	(330) 385-7337
OR	Arlington, OR 97812	Chemical Waste Management of the Northwest	ORD089452353	(206) 264-3061
SC	Columbia, SC 29210	Barnwell Disposal Site	SCD048372429	(803) 758-1825
TN	Kingston, TN 37763	Diversified Scientific Services Inc. (DSSI)	TND982109142	(865) 813-1303
TX	Andrews, TX 79714	WCS Texas	TXD988088464	(972) 448-1463
TX	Robstown, TX 78380	same	TXD069452340 -1	(916) 939-0967
TX	Richland, WA 99352	same		(916) 939-0967
UT	Salt Lake City, UT 84116	same	UTD982598898	(801) 649-2053
UT	Blanding, UT 84511	White Mesa Mill		(303) 389-4130
WA	Richland, WA 99354	Richland, WA - Radioactive Waste Disposal Site	WAD00600483 60	(509) 377-2411

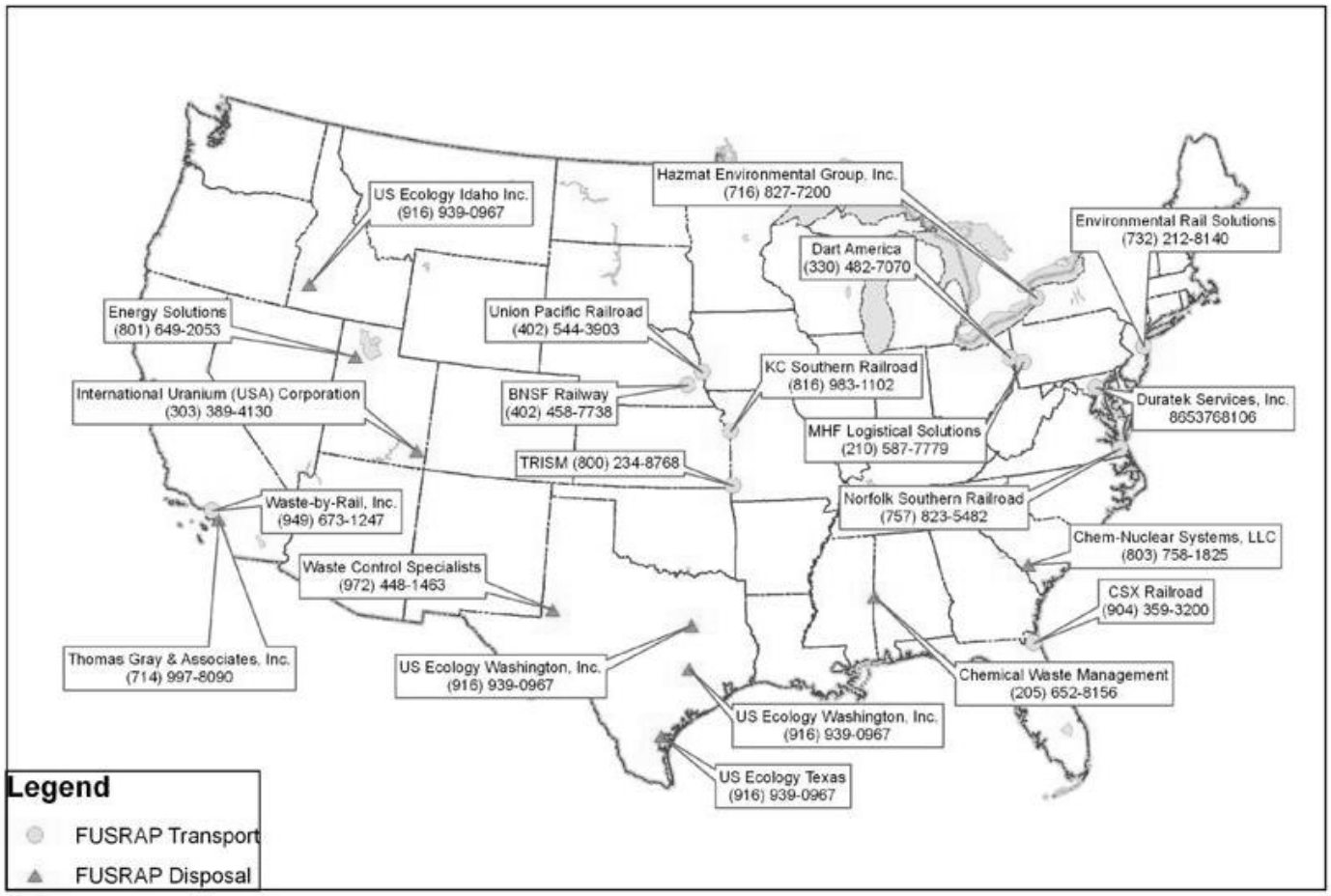

Figure 10.1: LARW Facilities

10.10 DISPOSAL COSTS

Disposal costs for waste from a project not currently under contract must be determined on a case-by-case basis due to the complexities that may be involved in dealing with hazardous waste. None of the facilities were able to provide a general cost estimate.

10.11 COMMERCIAL LARW TRANSPORTATION COMPANIES

10.11.1 Commercial LARW Waste Transporters – Alphabetical Listing by Company

Company	Facility	City, State, Zip	Remarks
Chemical Waste Management	Chemical Waste Management	Emelle, AL 35459	3
Chem-Nuclear Systems, LLC	Barnwell Disposal Site	Columbia, SC 29210	1
Energy Solutions	Energy Solutions	Salt Lake City, UT 84116	1
Envirosafe Services of Ohio, Inc	Envirosafe Services Otter Creek Road	Oregon, OH 43616-1242	2
International Uranium (USA) Corporation	White Mesa Mill	Blanding, UT 84511	1
Perma-Fix Environmental Services, Inc.	Diversified Scientific Services Inc. (DSSI)	Kingston, TN 37763	2
Perma-Fix Environmental Services, Inc.	Perma-Fix of Florida	Gainesville, FL 32653	2
Thomas Gray & Associates, Inc.	Thomas Gray & Associates, Inc.	Orange, CA 92868	1
US Ecology Idaho Inc.	US Ecology Idaho Inc.	Grand View, ID 83624	2
US Ecology Texas	US Ecology Texas	Robstown, TX 78380	1
US Ecology Washington, Inc.	Richland, WA - Radioactive Waste Disposal Site	Richland, WA 99354	2
US Ecology Washington, Inc.	US Ecology Washington, Inc.	Richland, WA 99352	1

10.11.2 Commercial LARW Waste Transporters – Alphabetical Listing by State

State	City	Facility	ID Number	Telephone
AL	Emelle, AL 35459	same	ALD000622464	(205) 652-8156
CA	Orange, CA 92868	same	CAD066151648	(714) 997-8090
FL	Gainesville, FL 32653	Perma-Fix of Florida	FLD980711071	(800) 365-6066 ext. 1342
ID	Grand View, ID 83624	same	IDD073114654	(916) 939-0967
OH	Oregon, OH 43616-1242	Envirosafe Services Otter Creek Road	OHD045243706	(800) 537-0426 ext. 226
OH	East Liverpool, OH 43920	same	OHD980613541	(330) 383-7337
OR	Arlington, OR 97812	Chemical Waste Management of the Northwest	ORD089452353	(206) 264-3061
SC	Columbia, SC 29210	Barnwell Disposal Site	SCD048372429	(803) 758-1825
TN	Kingston, TN 37763	Diversified Scientific Services Inc. (DSSI)	TND982109142	(865) 813-1303
TX	Andrews, TX 79714	WCS Texas	TXD988088464	(972) 448-1463
TX	Robstown, TX 78380	same	TXD069452340-1	(916) 939-0967
TX	Richland, WA 99352	same		(916) 939-0967

10.12 TRANSPORTATION COSTS

The most cost-efficient means of transporting FUSRAP waste is by rail. Trucking is utilized, but generally only to provide transport to and from the nearest rail spur. Barges may also be utilized, but in a similar capacity to trucking, in that it is mainly a means of transport to the nearest rail spur. The cost for transporting FUSRAP waste is dependent on a number of factors. For shipping by rail, the cost of transport is a function of the material being shipped, the type of rail car, the amount of material being shipped, the origin and destination of the material, the distance from the origin and destination to the nearest rail, the fuel surcharge, leasing, space available on the trains, and the number of rail service providers utilized from the origin to the destination. Most rail carriers operate on a market-base pricing structure as opposed to a Cost Plus pricing structure. This enables the rail carriers to pursue the most lucrative contacts. The cost of transport is a major component of the project cost, as transport costs often exceed the disposal costs. Due to the highly variable nature of fuel costs and other factors that go into determining transport costs, costs are generally provided on a case-by-case basis.

There are a number of additional factors that may affect the transportation costs such as rail capacity at the facility, the number of cars and parallel tracks affect the rate to stage, switch, and service the rail cars. The distance from the rail spur to the facility may also increase the transport cost and project duration if trucking is required to the rail spur. Also, as the number of shortline railroads increase, turn-around time also increases. This results in a demand for a greater number of intermodal containers and therefore a higher cost to complete the project. The amount of equipment used can also increase project costs. For example, when additional intermodal containers are used, the price per ton to transport the waste increases.

10.12.1 Commercial Low-Activity Radioactive Waste Facilities – Facility Details by State

Alabama	
Company: Chemical Waste Management	**USEPA ID:** ALD000622464
Facility: same	**Phone:** (205) 652-8156
Hwy 17 N., mile marker 163	
Emelle, AL 35459	**Point of Contact:**
	Polly Goodwin
Mailing Address:	
P.O. Box 55	**Former/Alternative company name:**
Emelle, AL 35459	
Email Address:	**Web Page Location:**
pgoodwin@wm.com	
Hazardous Waste Operations:	
Chemical stabilization, micro and macro encapsulation. Assistance in shipping waste to other network facilities. Rail spur 13 miles from the facility.	
Waste acceptance criteria	
NORM waste is the only type of waste accepted, and is accepted on a case-by case basis only.	
Waste Groups Accepted:	
NORM, Acidic/corrosives, metals, cyanides, solvents, PCBs, halogenated organics, mercury.	
Capacity or restrictions	
No explosives or biological waste permitted. Limited case-by-case acceptance of reactive waste.	

California	
Company: Thomas Gray & Associates, Inc.	**USEPA ID:** CAD066151648
Facility: same	**Phone:** (714) 997-8090
1205 West Barkley Ave.	
Orange, CA 92868	**Point of Contact:**
	Richard Tallego
Mailing Address:	
1205 West Barkley Ave.	**Former/Alternative company name:**
Orange, CA 92868	
Email Address:	**Web Page Location:**

tga@tgainc.com	http://www.tgainc.com/
Hazardous Waste Operations:	
Corporate headquarters and is licensed/permitted for hazardous, mixed, and radioactive waste storage. TGA serves mainly as a consolidation point for these waste streams. No processing is conducted at the Orange facility. For waste disposal, TGA has establ	
Waste acceptance criteria	
Waste Groups Accepted:	
TGA/EMC will consider any or all of the following radioactive wastes for processing/reclamation/disposal: absorbed liquids, animal carcasses, articles/instruments, bactec vials, bulk aqueous liquids, bulk scintillation fluid (exempt, regulated, mixed), ch	
Capacity or restrictions	

Idaho	
Company: US Ecology Idaho Inc.	**USEPA ID:** IDD073114654
Facility: same	**Phone:** (916) 939-0967
Lemley Rd.	
Grand View, ID 83624	**Point of Contact:**
	Steve Welling
Mailing Address:	
P.O. Box 400	**Former/Alternative company name:**
Grand View, ID 83624	Envirosafe
Email Address:	**Web Page Location:**
swelling@usecology.com	http://www.americanecology.com/
Hazardous Waste Operations:	
Treatment, storage and disposal facility permitted under Subtitle C of RCRA and the TSCA. Treats and disposes RCRA and TSCA wastes, as well as a wide range of low-activity radioactive wastes from USACE FUSRAP projects, and Naturally Occurring Radioactive	
Waste acceptance criteria	
Each bulk load and 100% of all containers are uncovered/opened and inspected. Samples are collected from a minimum of 10% of containers and 100% of bulk loads. Large direct bulk disposal waste streams shipped over a short period of time are 10% sampled. T	
Waste Groups Accepted:	
RCRA hazardous wastes meeting 40 CFR 268 Land Disposal Restrictions ("LDR") RCRA hazardous wastes which may be treated to meet LDR standards, RCRA debris for encapsulation, RCRA hazardous soil with PCBs up to 1,000 ppm and/or organics up to 10xUTS, Natura	

Capacity or restrictions
Waste requiring a radioactive material license from the NRC may not be accepted. For debris managed by micro encapsulation: 1) The waste must meet the definition of debris in accordance with 40 CFR Part 268.2(h), 2) Meet Subpart CC VOC requirements, 3) No

South Carolina	
Company: Chem-Nuclear Systems, LLC	**USEPA ID:** SCD048372429
Facility: Barnwell Disposal Site	**Phone:** (803) 758-1825
740 Osborn Road	
Barnwell, SC 29812	**Point of Contact:**
Mailing Address:	
140 Stoneridge Drive	**Former/Alternative company name:**
Columbia, SC 29210	
Email Address:	**Web Page Location:**
services@duratekinc.com	www.barnwelldisposal.com
Hazardous Waste Operations:	
Waste acceptance criteria	
Waste Groups Accepted:	
LLRW, special nuclear material, hazardous waste, mixed hazardous and radioactive waste, waste containing chelating agents, NO liquid radioactive waste accepted	
Capacity or restrictions	
All waste accepted for disposal must be in a dry, solid form. No liquid waste is accepted for disposal. No toxic chemical waste or high-level radioactive wastes, such as spent fuel from nuclear reactors, are accepted at the disposal site.	

Texas top	
Company: US Ecology Texas	**USEPA ID:** TXD069452340-1
Facility: same	**Phone:** (916) 939-0967
3277 Country Rd 69	
Robstown, TX	**Point of Contact:**
	Steve Welling
Mailing Address:	

P.O. Box 307	**Former/Alternative company name:**
Robstown, TX 78380	
Email Address:	**Web Page Location:**
swelling@americanecology.com	http://www.americanecology.com/locations/teco/INDEX.ASP
Hazardous Waste Operations:	
The US Ecology Texas (USET) facility is permitted by the U.S. EPA and the Texas Commission on Environmental Quality to treat and dispose of a broad range of solid and hazardous wastes including Texas Class I non-hazardous solid wastes, and certain natural	
Waste acceptance criteria	
US Ecology Texas and WCS have the same disposal permit. Not as much space for waste as Idaho facility. Also, the disposal permit held by the Idaho facility allows for disposal of higher concentrations of radioactivity. US Ecology Texas has the following l	
Waste Groups Accepted:	
RCRA hazardous wastes meeting 40 CFR 268 Land Disposal Restrictions ("LDR"), RCRA hazardous wastes which may be treated to meet LDR standards, Texas Industrial Non-hazardous Waste Class 1, 2 and 3, Bulk or drummed solid waste, liquid waste requiring solid	
Capacity or restrictions	
Prohibited waste includes PCB wastes not requiring management at a TSCA approved facility, explosive and reactive waste, dioxin-containing waste, pressurized gases, wastes containing >10% cyanide or sulfide, bulk waste containing > 20% VOCs.	

Texas	
Company: Waste Control Specialists	**USEPA ID:** TXD988088464
Facility: WCS Texas	**Phone:** (972) 448-1463
9998 West Highway 176	
Andrews, TX 79714	**Point of Contact:**
	Tim Sweeney
Mailing Address:	
PO Box 1129	**Former/Alternative company name:**
Andrews, TX 79714	
Email Address:	**Web Page Location:**
tsweeney@valhi.net	http://www.wcstexas.com
Hazardous Waste Operations:	
Treatment, storage, and disposal facility. Chemical oxidation, chemical reduction, deactivation, macroencapsulation (debris only), neutralization, stabilization, controlled reaction, amalgamation. Waste containing high VOC's can be	

treated on a case by ca
Waste acceptance criteria
Limits are provided in the restrictions text box above. For an average concentration of the Special Nuclear Material (SNM) radionuclide with the highest concentration between the limit and one-tenth the limit WCS shall obtain one sample for every 1,500 k
Waste Groups Accepted:
WCS currently accepts 2,000-plus RCRA waste codes and TSCA (PCB) materials. LLRW, LLMW, waste mixed with Class A, B, C, GTCC, and TRU (radioactive waste is not disposed of onsite but is accepted). WCS is licensed to receive radioactive waste in any form (
Capacity or restrictions
Maximum allowable concentrations (pCi/g) of SNM in Individual Waste Containers are as follows: U-233 450,000, U-235 (<10% enrichment) 2100, U-235 (>10% enrichment) 1300, Pu-239 1.7E+07, Pu-241 2.3E+10. For a mixture of these isotopes, the sum-of-the-fract

Utah	**top**
Company: Energy Solutions	**USEPA ID:** UTD982598898
Facility: same	**Phone:** (801) 649-2053
Interstate 80, Exit 49	
Clive, UT	**Point of Contact:**
	Jose Jerez
Mailing Address:	
605 N 5600 W	**Former/Alternative company name:**
Salt Lake City, UT 84116	Envirocare of Utah, LLC
Email Address:	**Web Page Location:**
jjerez@energysolutions.com	http://www.envirocareutah.com/
Hazardous Waste Operations:	
Disposal of metal and concrete objects ranging from bioshield walls, small reactors, reactor vessel heads, reactor coolant pump motors, heat exchangers, rotors, turbine blades, duct work, cables, wiring, pipes, etc.; disposal of rubblized concrete; dispos	
Waste acceptance criteria	
Preshipment sample may be required. Sampling and radiological testing of waste containing SNM must be performed in accordance with the following: One sample for each of the first ten shipments of a waste stream; or one sample for each of the first 100 cub	
Waste Groups Accepted:	
Envirocare is licensed and permitted to receive Class A Low-Level Waste Radioactive Waste (LLRW), NORM/NARM, PCB Radioactive waste, asbestos-contaminated waste, Mixed Waste (i.e., both radioactive and hazardous), and 11e.(2) Byproduct Material. Envirocare	
Capacity or restrictions	

Envirocare accepts 11e.(2) byproduct material with an average concentration in any transport vehicle (truck or railcar) not to exceed 4,000 pCi/g for natural uranium or for any radionuclide in the Radium-226 series, 60,000 pCi/g for Thorium-230, or 6,000

Utah	
Company: International Uranium (USA) Corporation	**USEPA ID:**
Facility: White Mesa Mill	**Phone:** (303) 389-4130
6425 S. Highway 191	
Blanding, UT 84511	**Point of Contact:**
	Dave Friedman
Mailing Address:	
P.O. Box 809	**Former/Alternative company name:**
Blanding, UT 84511	
Email Address:	**Web Page Location:**
richbartlett@citilink.net (Rich Bartlett's email)	www.intluranium.com
Hazardous Waste Operations:	
The Mill can accept up to 45 shipments (1,000 tons) per 16-hour day and up to 6,000 tons in a single week during the period of April through October. During November through March, up to 30 shipments per day can be accepted. Special arrangements can be ma	
Waste acceptance criteria	
Accepts NARM only in certain cases. Accepts pre and post-1978 11e.(2) byproduct material with and without hazardous waste. Accepts hazardous waste that is characteristic hazardous waste, but in most cases will not accept listed hazardous waste.	
Waste Groups Accepted:	
As a uranium milling operation, we are accustomed to receiving debris with mined ores. We have also received varying amounts of debris with alternate feed materials. Separating debris through the use of special equipment, like a trommel, is routine. Gener	
Capacity or restrictions	
Cannot accept listed RCRA hazardous waste. Acceptable Physical Characteristics: Any non-gaseous form, e.g. soil, ore, sands, slag, liquid slurry are acceptable. The mill can accommodate a large range of particle sizes and any moisture content, most forms	

Washington	
Company: US Ecology Washington, Inc.	**USEPA ID:**
Facility: same	**Phone:** (916) 939-0967
1777 Terminal Dr.	

Richland, WA	**Point of Contact:**
	Steve Welling
Mailing Address:	
1777 Terminal Dr.	**Former/Alternative company name:**
Richland, WA 99352	
Email Address:	**Web Page Location:**
swelling@americanecology.com	http://www.americanecology.com/locations/richland/INDEX.ASP
Hazardous Waste Operations:	
This facility offers one of only two full service Class A, B and C low-level radioactive waste disposal facilities in the nation. This desert site has successfully operated on the US Department of Energy's Hanford Reservation since 1965. Our facility also	
Waste acceptance criteria	
Basic requirements for disposal: All waste must be properly packaged in closed containers. All waste must be classified in accordance with 10 CFR 61, Washington Administrative Code (WAC) 246-249 and the current NRC "Low-Level Waste Licensing Branch Techni	
Waste Groups Accepted:	
LLRW generated in the Northwest Compact region (Oregon, Washington, Idaho, Montana, Wyoming, Utah, Alaska, Hawaii) & Rocky Mountain Compact region (Nevada, Colorado, New Mexico), NARM or Exempt Waste	
Capacity or restrictions	
Prohibited waste includes: Mixed waste; waste that contains or is capable of generating toxic gases, vapors or fumes; wastes containing pyrophoric, hazardous, dangerous or chemically explosive materials or materials which could react violently with water	

10.12.2 Commercial Low-Activity Radioactive Waste Transportation – Company Details by State

California	
Company: Waste-by-Rail, Inc.	**USEPA ID:**
Facility: same	**Phone:** (949) 673-1247
2240 Newport Blvd.	
Los Angeles, CA 92663	**Point of Contact:**
	Craig Barrett
Mailing Address:	
2240 Newport Blvd	**Former/Alternative company name:**
Newport Beach, CA 92663	
Email Address:	**Web Page Location:**
craig@wbrinc.com	
Hazardous Waste Operations:	
WBR, Inc. offers a complete custom transportation service for generators of all types of solid and hazardous waste, including direct transportation from the generator site to the disposal site or to a generator identified processing facility. Maintains a	
Waste acceptance criteria	
Waste Groups Accepted:	
FUSRAP waste by rail. Non-DOT regulated waste by rail, truck, and barge.	
Capacity or restrictions	
Waste that is placarded cannot go through the rail facility.	

Maryland	
Company: Duratek Services, Inc.	**USEPA ID:**
Facility: Hittman Transportation Services, Inc.	**Phone:** (865) 376-8106
10111 Old Columbia Rd.	
Columbia, MD 21046	**Point of Contact:**
	Paul Dick
Mailing Address:	
10111 Old Columbia Rd.	**Former/Alternative company name:**
Columbia, MD 21046	

Email Address:	**Web Page Location:**
services@duratekinc.com	www.duratekinc.com
Hazardous Waste Operations:	
Our licensed 240,000 square foot Memphis facility is specifically designed to handle large components such as steam generators, turbine rotors, heat exchangers, large tanks, and similar components. Duratek has configured this facility to safely, efficient	
Waste acceptance criteria	
They accept post 1978 11e.(2) byproduct and high level radioactive waste as well. Capable of transporting just about anything.	
Waste Groups Accepted:	
LLRW	
Capacity or restrictions	
Transporter of LLRW in US and Canada by rail, barge, & truck. Core truck fleet equipment include:flatbeds, closed vans, single and double drops (standard and extendible),open tops, casks cask trailers, shielded van, heated van, pan vans 10 axle, 65-ton mu	

Missouri	
Company: Tri-State Motor Transit Company (TRISM)	**USEPA ID:**
Facility: same	**Phone:** (800) 234-8768 ext. 2658
8141 E. 7th St.	
Joplin, MO 64802	**Point of Contact:**
	Donnie Lester
Mailing Address:	
P.O. Box 113	**Former/Alternative company name:**
Joplin, MO 64802	
Email Address:	**Web Page Location:**
donnie.lester@tsmtco.com	www.tsmtco.com
Hazardous Waste Operations:	
Tri-State Motor Transit Co. is the Secured Materials segment of the company and one of the largest nationwide carriers of hazardous materials for the Department of Defense and the Department of Energy. TSMT holds authorities to transport all classes of ex	
Waste acceptance criteria	
Waste Groups Accepted:	

Everything except for infectous materials.
Capacity or restrictions
They do not transport infectous materials.

Nebraska	
Company: Union Pacific Railroad	**USEPA ID:**
Facility: same	**Phone:** (402) 544-3903
1400 Douglas Street	
Omaha, NE 68179	**Point of Contact:**
	Roger Dolson
Mailing Address:	
1400 Douglas Street	**Former/Alternative company name:**
Omaha, NE 68179	
Email Address:	**Web Page Location:**
	www.uprr.com
Hazardous Waste Operations:	
Waste acceptance criteria	
Waste Groups Accepted:	
Capacity or restrictions	

New Jersey	
Company: Environmental Rail Solutions, Inc. (ERS)	**USEPA ID:**
Facility: same	**Phone:** (732) 212-8140
94 Cypress Neck Rd.	
Lincroft, NJ	**Point of Contact:**
	David Ardito
Mailing Address:	
94 Cypress Neck Rd.	**Former/Alternative company name:**
Lincroft, NJ 07738	

Email Address:	**Web Page Location:**
ersdavid@comcast.net	
Hazardous Waste Operations:	
Rail and truck transportation.	
Waste acceptance criteria	
Waste Groups Accepted:	
Capacity or restrictions	
STIPULATIONS: 21 ton minimum, 23 ton maximum per intermodal; minimum 4 intermodals per railcar on 4-position railcar; minimum 6 intermodals on 6-position railcar; any intermodal sent from Painesville empty will be charged at the fate for the disposal site	

New York	
Company: Hazmat Environmental Group, Inc.	**USEPA ID:**
Facility: same	**Phone:** (716) 827-7200 ext. 720
60 Commerce Dr.	
Buffalo, NY 14218	**Point of Contact:**
	Nancy Copelin
Mailing Address:	
60 Commerce Dr.	**Former/Alternative company name:**
Buffalo, NY 14218	
Email Address:	**Web Page Location:**
ncopelin@hazmatinc.com	www.hazmatinc.com
Hazardous Waste Operations:	
Full service transporter of waste materials throughout the United States and Canada. Also offer environmental training and consulting to help you satisfy RCRA, DOT, and OSHA requirements. Permitted to transport hazardous waste in the Continental U.S. (inc	
Waste acceptance criteria	
Waste Groups Accepted:	
Pre-11e.(2) byproduct, NORM, NARM, mixed waste, and LLRW.	
Capacity or restrictions	
Will not transport source material, SNM, or TENORM.	

Ohio	
Company: Dart America	**USEPA ID:**
Facility: same	**Phone:** (330) 482-7070 ext. 231
P.O. Box 60	
Columbiana, OH 44408	**Point of Contact:**
	Debbie Celli
Mailing Address:	
P.O. Box 60	**Former/Alternative company name:**
Columbiana, OH 44408	
Email Address:	**Web Page Location:**
	www.dartamerica.com
Hazardous Waste Operations:	
Equipment includes 285 tractors, 145 dump trailors, 310 van trailers (48 x 102), 27 flatbed trailers, 50 roll-off trailers, 550 roll-off boxes, 6 roll-off straight trucks, 6 liquid tankers, and 40 walking floors.	
Waste acceptance criteria	
Waste Groups Accepted:	
Non-hazardous, hazardous waste and LLRW and mixed radioactive waste.	
Capacity or restrictions	
Permitted for Hazardous, Industrial and Municipal Solid Waste in 48 states and the provinces of Quebec and Ontario. Equipment: vans, roll-offs, walking floors, dumps, liquid tankers, and other specialty equipment. Dart America carries pollution liability	

Pennsylvania	
Company: MHF Logistical Solutions, Inc. (MHF-LS)	**USEPA ID:**
Facility: same	**Phone:** (724) 772-9800
800 Cranberry Woods Drive, Suite 450	
Cranberry Township, PA 16066	**Point of Contact:**
	Patrick Alcorn
Mailing Address:	
800 Cranberry Woods Drive, Suite 450	**Former/Alternative company name:**
Cranberry Township, PA 16066	

Email Address:	**Web Page Location:**
patrick_alcorn@mhfls.com	www.mhfls.com
Hazardous Waste Operations:	
MHF-LF provides transportation services for all types of bulk solid, bulk liquid, packaged material and cargo, combining rail, truck and marine conveyance systems as necessary, from any origin to any destination in the world. MHF-LS is particularly noted	
Waste acceptance criteria	
Waste Groups Accepted:	
Hazardous & Radioactive Materials; Hazardous, Radioactive & Mixed Wastes; Non-Hazardous & Industrial Wastes; TSCA-PCB Regulated Waste; Municipal Solid Waste; Construction & Demolition Debris; Overweight Cargo/Overdimensional Cargo; Machinery/Transformers,	
Capacity or restrictions	
none listed	

10.13 REFERENCES

49200 Federal Register. Volume 58, No. 182, Rules and Regulations: September 22, 1993.

Code of Federal Regulations: 40 – Protection of the Environment. Parts 260-299. Washington, D.C.: U.S. Government Printing Office, July 1996.

Hall, Ridgway M., Jr., et al. 1993. RCRA Hazardous Waste Handbook. 10th ed. Rockville, Maryland: Government Institutes, Inc.

Management Guidelines For Working With Radioactive and Mixed Waste, EM 1110-35-1. USACE, July 2005.

National Research Council. 2003. Improving the Regulation and Management of Low-Activity Radioactive Wastes - Interim Report on Current Regulations, Inventories, and Practices. Washington D.C.: National Academic Press.

Rast, Richard R. 1997. Environmental Remediation Estimating Methods. Kingston, Massachusetts: R.S. Means Company, Inc.

U.S. Environmental Protection Agency. "What is LARW?" November 30th, 2004. Low Activity Radioactive Waste. November 11, 2005. <http://www.epa.gov/radiation/larw/larw.htm>

Wentz, Charles A. 1989. Hazardous Waste Management. New York: Mc-Graw Hill, Inc.

HAZARDOUS WASTE PACKAGING

11.1 GENERAL DISCUSSION

Packaging of hazardous wastes safely and efficiently before transporting for disposal is one of the important aspects of managing hazardous wastes. This section briefly describes regulations that apply to packaging and list some of the most commonly used containers at USACE projects with prices if they are available. Costs for packaging are listed from a representative distributor of each type of packaging at the time of report preparation. Some types of packaging are only available from a few vendors.

COST COMPARISONS WITH THE 1998 TSDFR

NOT AVAILABLE TO THE GENERAL PUBLIC

STATE TAXES AND FEES

13.1 GENERAL DISCUSSION

State taxes and fees on hazardous waste are changing every year, fees that distinctly focus on out-of-state wastes in particular. Most states administer a variety of fees related to hazardous waste generation and management. Examples include charges for Treatment, Storage, and Disposal (TSD) facility permit applications, annual TSD facility licensing fees, post-closure fees, TSD facility maintenance and inspection fees, generator fees, disposal fees, and others.

Cost Engineers should be aware that charges other than direct landfill fees may be associated with the disposal of hazardous wastes. State taxes and fees may be categorized as an additional charge and should be considered when preparing an estimate. This section of the report summarizes the taxes and fees that states impose on generators, remedial action contractors, and other responsible parties for land disposal, incineration, treatment, and storage of hazardous wastes. When estimating remediation projects, the classifications to consider are direct treatment and disposal fees. These classifications affect thirty-five (35) states listed in categories 3, 4, and 5 on the table which follows. Tax and fee expenditures can impact total disposal costs of hazardous wastes. Consequently, they should be reviewed by cost engineers for relevancy on a case by case basis.

State agencies for all fifty (50) states and the District of Columbia were contacted to obtain fees imposed on treatment, storage, and disposal. A table on the following page summarizes information that was collected from these state agencies. The table shows major categories of taxes and fees. Following this summary table, each individual state's taxes and fees for hazardous waste disposal are presented.

13.1.1 Summary of Major Tax/Fee Categories

Table 9.1.1: Major State Taxes and Fees

Category	State	Number of States
No taxes or fees imposed	Alaska, District of Columbia, Hawaii, North Dakota	4
Hazardous waste management fees but no direct treatment or disposal fees	Florida, Indiana, Louisiana, Maryland, Massachusetts, Mississippi, Montana, New Mexico, Rhode Island, Tennessee, Virginia, Wyoming	12
Direct treatment or disposal fees	Alabama, Georgia, Idaho, Iowa, Michigan, Minnesota, Missouri, Nebraska, Pennsylvania, South Carolina, Utah, Vermont, West Virginia	13
Hazardous waste management fees and direct treatment disposal fees	Arizona, Arkansas, California, Colorado, Delaware, Illinois, Kansas, Kentucky, Maine, Nevada, North Carolina, Ohio, Oklahoma, Oregon, South Dakota, Washington, Wisconsin	17
Direct treatment or disposal fees that also specifically target out-of-state waste	Connecticut, New Hampshire, New Jersey, New York, Texas	5
Total		**51**

OVERVIEW OF REGIONAL INTERSTATE LLRW COMPACTS

14.1 GENERAL DISCUSSION

In 1980, Congress passed the Low-Level Radioactive Waste Policy Act, requiring every state to take responsibility for waste created within its borders. As originally stated, the law allowed each state to choose between developing a disposal facility or forming a compact with other states to collectively construct a facility. As a result of limited response to the law, Congress amended the Act in 1985 to create site opening deadlines and penalties for states failing to meet these deadlines. In addition, the amendments stated that each of the three (3) existing Low Level Radioactive Waste (LLRW) disposal facilities could refuse to accept waste produced outside their compact regions as of January 1, 1993. The amendments also enabled the existing facilities to impose limits as to the volume of LLRW accepted based on availability of disposal capacity.

Title II of the amended act defined nine (9) "Low-Level Radioactive Waste Interstate Compacts" which states were eligible to join. Federal policy stated that disposal of LLRW is more effectively managed on a regional basis. Within each region, one or more facility will provide sufficient capacity to manage all LLRW generated within that region. Facilities will be developed, managed, and regulated by host states. The host state is also responsible for licensing procedures, standards development, control of the facility, and handling of LLRW. The host state must satisfy the requirements of the Federal Regulation governing LLRW.

The Nuclear Regulatory Commission (NRC) is responsible for licensing and regulating facilities for the disposal of LLRW generated by commercial facilities. Regulatory control is specified through 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste." The regulation defines licensing procedures, performance objectives, technical requirements, inspections, and additional conditions relative to LLRW land disposal facilities. Part 61 contains procedural requirements and performance objectives applicable to any method of land disposal. Facility designs will vary depending on the characteristic of the site. Archetypes include shallow landfill burial, modular concrete canister, below grade vault, and earth-mounded above grade vault.

The NRC divides LLRW into three categories (Class A, Class B, or Class C). Class A waste must be disposed of in separate cells at the disposal site, unless it meets stability characteristics. This category represents the least radioactive of the three classes and is considered to decay within 100 years to levels not propagating a threat to public health and safety. More than 90 percent of LLRW falls under the category of Class A waste. To the extent practicable, Class B and C waste forms should be designed to maintain stability and identity for over 300 years. Special packaging requirements are also imposed. Class C waste must be disposed of at a greater depth than other classes, or within intruder barriers such as concrete covers. The effective life of these barriers should be 500 years.

Prior to 1970, six (6) commercial disposal facilities operated and accepted LLRW in the United States. During the 1970's, three (3) of the sites closed. The remaining sites were located in Barnwell, South Carolina, Beatty, Nevada, and Richland, Washington. The facility in Beatty, Nevada closed in 1992. The two (2) remaining facilities are Chem-Nuclear Systems, Inc. in Barnwell, SC and U.S. Ecology in Richland, WA. Currently, the Chem-Nuclear Barnwell facility is accepting LLRW from all U.S. states with the exception of North Carolina. U.S. Ecology at Richland only accepts waste from eleven (11) western States. Currently, the Department of Defense (DOD) has contracts with both facilities. The following phone numbers should be referenced for further facility or pricing information

Ms. Cheryl O'Neil	(309) 782-2068	DOD Contract Division
Chem-Nuclear Systems	(803) 259-1781	
U.S. Ecology	(509) 377-2411	

An additional disposal facility, Envirocare located in Clive, Utah, is currently accepting mixed waste nationwide. This is the only disposal facility in the United States licensed to accept mixed waste. Envirocare also accepts LLRW. Disposal pricing is determined on a project by project basis. The facility has a contract with the U.S. Army Corps of Engineers for waste acceptance. The following contacts are available for more information:

Ms. Susan Rice	(801) 532-1330	Envirocare
Mr. Tom Urbaniak	(816) 983-3580	USACE - Kansas City District

14.2 INTERSTATE COMPACTS

To date, a total of forty-two (42) States are members of compacts. Following is a summary of the Low-Level Radioactive Waste Disposal Compact Membership. Additional information regarding State Compacts may be obtained from the U.S. Environmental Protection Agency at (202) 233-9203.

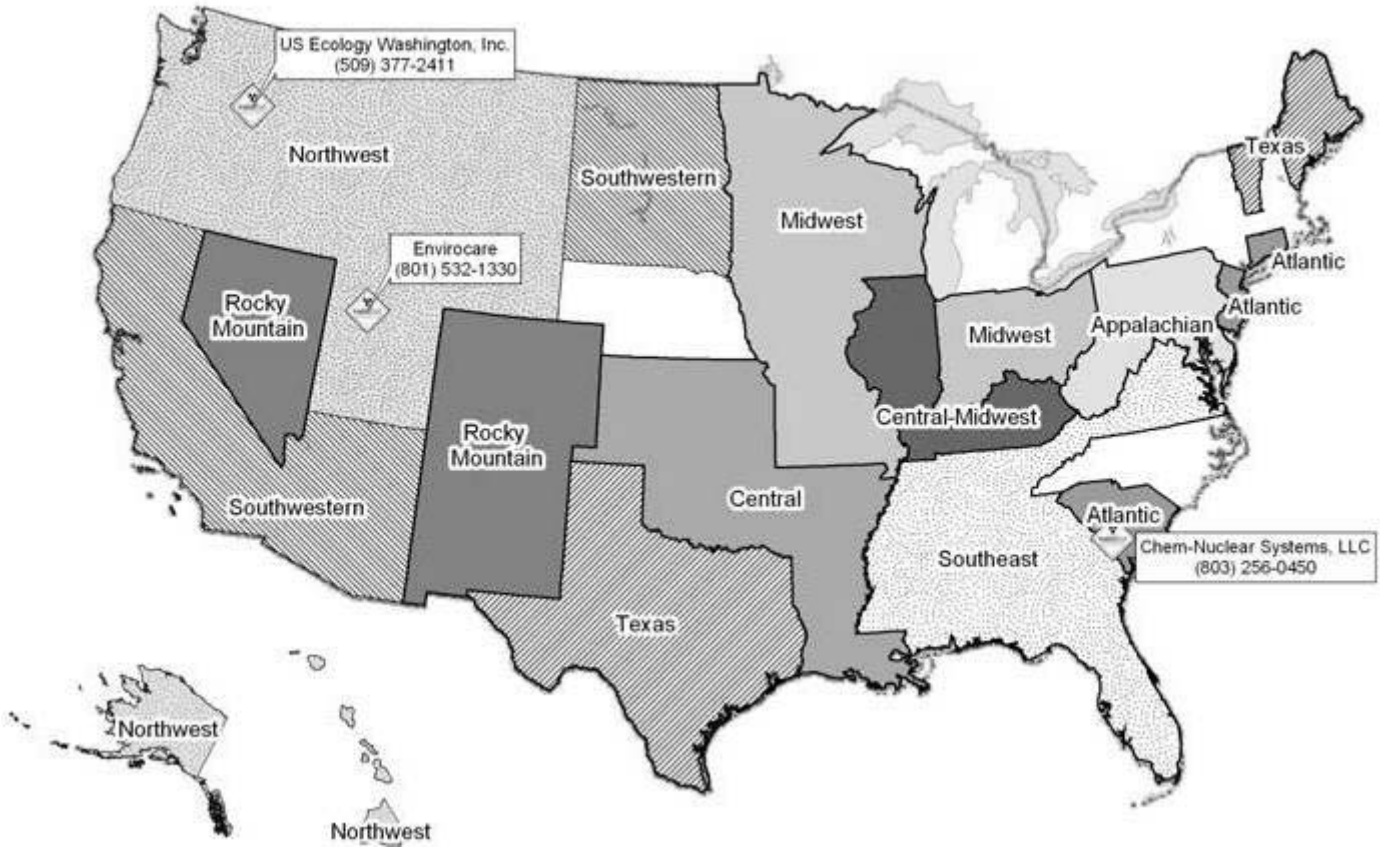

Figure 14.2: Map of Interstate Compacts and Mixed Waste Disposal Facilities

14.2.1 Appalachian Compact

Contact: Rich Janati
Email:
Add: P.O. Box 1181, 200 One Keystone Plaza, Harrisburg, PA - 17108-1181
Tel: (717) 787-2147
Fax: (717) 238-0575
web:
http://www.dep.state.pa.us/brp/Nuclear_Safety_Division/RadWasteEmergencyRespSection/appalach.htm

Governing Body: Appalachian States Low-Level Radioactive Waste Commission

Member States: Delaware, Maryland, Pennsylvania, West Virginia

Compact Established: The compact was established February 19, 1986, and ratified by Congress on May 19, 1988. The commission's first organizational meeting was held April 30, 1990.

Current Waste Management: As of January 2005, waste may be shipped to the disposal facility in Barnwell, South Caroli na and Envirocare, Utah.

Host State: Pennsylvania

Regulatory and Program Responsibility: Bureau of Radiation Protection, Department of Environmental Protection (DEP)

Siting Responsibility: PA Department of Environmental Protection

Other Involvement: DEP Low-Level Waste Advisory Committee and Environmental Quality Board

Disposal Technology: earth-mounded above-ground vault

Siting: Host State (PA) suspended it's siting process in December 1998.

Licensing:

Disposal Facility Operational: None.

14.2.2 Central Compact

Contact: Rita Houskie
Email: rita@cillrwcc.org
Add: P.O. 1033 "O" Street, Suite 53, Lincoln, NE - 68508
Tel: (402) 476-8247
Fax: (402) 476-8205
web: http://www.cillrwcc.org/

Governing Body: Central Interstate Low-Level Radioactive Waste Commission

Member States: Arkansas, Kansas, Louisiana, Oklahoma

Compact Established: The compact was established May 12, 1983. The commission's organizational meeting was held June 29, 1983.

Current Waste Management: Export authorization process to export to Envirocare in Utah and Barnwell in SC. There is no contract with another compact.

Host State:

Regulatory and Program Responsibility:

Siting Responsibility: US Ecology, Inc.

Disposal Technology: above-ground vault

Siting Property:

Licensing:

Disposal Facility Operational: None.

Other Information: Nebraska was sued and fined for not setting up a disposal facility and later removed from the compact.

14.2.3 Central-Midwest Compact

Contact:
Email:
Add: 1035 Outer Park Drive, Springfield, IL - 62704
Tel: (217) 785-9982
Fax:
web:

Governing Body: Central Midwest Interstate Low-Level Radioactive Waste Commission

Member States: Illinois, Kentucky

Compact Established: The compact was established in September 1984, ratified by Congress effective January 1986, and most recently amended and ratified in October 1994.

Current Waste Management: As of January 2005, the compact waste maye be exported to commercial facilities Envirocare, Utah and Barnwell, South Carolina.

Host State: Illinois

Regulatory Responsibility: Illinois Department of Nuclear Safety

Program and Siting Responsibility: Low-Level Radioactive Waste Task Group; Illinois State Geological Survey and State Water Survey; Facility Developer; and Illinois Department of Nuclear Safety

Disposal Technology: above-grade, earthen-covered concrete vault

Siting: Halted until 2032 when waste from the decommissioning of nuclear power plants will be available for disposal..

Licensing:

Disposal Facility Operational: None.

14.2.4 Midwest Compact

Contact:
Email: mwllrcw@midwestcompact.org
Add: P.O. Box 2659, Madison, WI - 53701-2659
Tel: (608) 267-4799
Fax: (608) 267-4799
web:

Governing Body: Midwest Interstate Low-Level Radioactive Waste Compact Commission

Member States: Indiana, Iowa, Minnesota, Missouri, Ohio, Wisconsin

Compact Established: The compact was established in October 1983 and was given the consent of Congress in December 1985. Compact amendments were enacted by Ohio and Wisconsin in 1995 and by Indiana, Iowa, Minnesota, and Missouri in 1996. These amendments will now be submitted to Congress for consent.

Current Waste Management: As of January 2005, the compact waste may be shipped to the disposal facility in Barnwell, South Carolina. In addition, waste may be shipped for disposal at the Envirocare facility..

Host State: Initially - Michigan; Since 1991 – Ohio.

Other Information: On June 26, 1997, the Midwest Compact Commission halted development of a regional disposal facility in Ohio. Citing significant declines in Midwest Compact waste volumes, the potentially high cost of developing new disposal capacity, and continued access to the Barnwell and Envirocare of Utah disposal facilities, the commission also relieved Ohio of its host state designation and its obligation to site and operate a regional facility. The commission plans to conduct a review of the Midwest Compact's functions during the year following the decision to halt development. The commission also will work with generators to examine options that provide a greater assurance of long-term access to existing disposal facilities.

14.2.5 Atlantic Compact (legally referred to as the Northeast Compact)

Contact: Max Batavia
Email: dwilson@gs.sc.gov
Add: 1201 Main Street, Suite 600, Columbia, SC - 29201
Tel: (803) 737-1833
Fax: (803) 737-5023
web: http://www.atlanticcompact.org

Governing Body: Atlantic Compact Commision

Member States: Connecticut, New Jersey, and South Carolina

Compact Established: Congress ratified the compact in 1985, and it was signed into law by the President in 1986. Shortly thereafter, two of the four original member states—Delaware and Maryland—joined the Appalachian Compact. In 1987, the remaining member states of Connecticut and New Jersey were designated as dual host states. South Carolina petitioned to join, and since they had the landfill, they became the host state.

Current Waste Management: Waste is shipped to the regional facility in Barnwell, South Carolina..

Host State: South Carolina

Regulatory Responsibility: South Carolina Department of Health and Environmental Controls

Program Responsibility: South Carolina Department of Health and Environmental Controls

Siting Responsibility:

Other Involvement:

Disposal Technology: ChemNuclear Geotech.

Siting: The compact has a regional facility in Barnwell, South Carolina. The facility will be accepting waste from generators outside the compact through 2008, after which Barnwell will serve only generators in the Compact states..

Licensing: South Carolina Department of Health and Environmental Controls.

Disposal Facility Operational: Barnwell, SC.

14.2.6 Northwest Compact

Contact: Mike Garner
Email:
Add: P.O. Box 47600, Olympia, WA - 98504-7600
Tel: (360) 407-7107
Fax:
web: http://www.radiationcontrol.utah.gov/nwi_cmpc.htm

Governing Body: Northwest Low-Level Waste Compact Committee

Member States: Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, Wyoming

Compact Established: The compact was established in 1981 and ratified by Congress in December 1985.

Current Waste Management: The Compact uses the existing Richland disposal facility located on Hanford site in Washington.

Host State: Washington

Regulatory Responsibility: Washington Department of Health

Program Responsibility: Washington Department of Ecology

Disposal Technology: Allow land burial of packaged and stabilized waste into large, unlined trenches.

Siting: Richland, Washington, disposal site stopped accepting out-of-region LLRW as of January 1, 1993, except for that volume agreed to in the Rocky Mountain Compact (RMC) contract..

Licensing: The site operator's current materials license was issued by the Washington State Department of Health on May 29, 1992. The license is currently under timely renewal.

Disposal Facility Operational: The compact's regional disposal facility has been in operation since July 1965.

Other Information: The compact's low-level radioactive waste disposal site is not permitted for mixed waste. The compact is working with other states and compacts to encourage DOE to provide for management of the compact's mixed waste.

In addition, subject to the Northwest Compact amended resolution and order of April 20, 1995, out-of-region low-level radioactive wastes meeting Envirocare of Utah's license conditions are provided access to the region for disposal at Envirocare. The Envirocare of Utah facility is licensed to accept mixed waste, low-level radioactive waste within Class A limits, naturally-occurring radioactive materials (NORM), and uranium and thorium mill tailings. Envirocare predominantly receives large volume, low activity waste from federal and commercial remediation projects throughout the United States. Envirocare is prohibited from receiving Class B and C low-level radioactive waste. Concentration limits for individual radionuclides are specified in the license.

14.2.7 Rocky Mountain Compact

Contact: Leonard Slosky
Email: rmb@slosky.com
Add: 1675 Broadway Suite 1400, Denver, CO - 80202
Tel: (303) 825-1912
Fax:
web: http://www.rmllwb.us/

Governing Body: Rocky Mountain Low-Level Radioactive Waste Board

Member States: Colorado, Nevada, New Mexico

Compact Established: The compact was established in 1983 and ratified by Congress in December 1985.

Current Waste Management: The Rocky Mountain Board has a contract with the Northwest Interstate Compact Committee and the State of Washington for disposal at the Northwest compact's regional commercial disposal facility in Hanford, Washington. In addition, subject to the Northwest Compact amended resolution and order of April 20, 1995, wastes meeting Envirocare of Utah's license conditions are being shipped for disposal at the Envirocare facility. Certain NARM wastes meeting the State of Washington's conditions are being shipped to the Hanford facility.

Host State: None

Other Information: Export authorization is required for all waste generated within the compact region that is sent outside of the region. Import authorization is required to bring out-of-compact waste into the region for management. One facility within the compact region is currently authorized to receive out-of-compact waste. The compact has jurisdiction (including import and export authority) over NORM/NARM.

14.2.8 Southeast Compact

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Governing Body: Southeast Compact Commission for Low-Level Radioactive Waste Management

Member States: Alabama, Florida, Georgia, Mississippi, Tennessee & Virginia

Compact Established: The Southeast Compact was established in 1983 and ratified by Congress in 1985. The compact law was amended in 1989.

Current Waste Management: As of January 2005, the compact waste is send to Utah (Class B and C) and South Carolina (Class A)..

Host State: None

Regulatory Responsibility:

Program and Siting Responsibility:

Other Involvement:

Disposal Technology:

Siting:

Licensing:

Disposal Facility Operational:

Other Information:

14.2.9 Southwestern Compact

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web: http://swllrwcc.org/

Governing Body: Southwestern Low-Level Radioactive Waste Commission

Member States: Arizona, California, North Dakota, South Dakota

Compact Established: The compact was established in July 1988 and ratified by Congress in November 1988. North Dakota and South Dakota joined the compact in 1989.

Current Waste Management: As of January 2005, the compact waste may be shipped to the disposal facility in Barnwell, South Carolina. In addition, waste may be shipped for disposal at the Envirocare facility.

Host State: California

Regulatory and Program Responsibility: Department of Health Services (DHS)

Siting Responsibility: US Ecology, Inc.

Other Involvement: U.S. Department of the Interior

Disposal Technology: enhanced shallow land burial

Siting: The property designated as the preferred site by the state is currently owned by the federal government. The U.S. Department of the Interior announced in February 1996 that it would prepare a second Supplemental Environmental Impact Statement (SEIS) before deciding whether and under what conditions to transfer the property to the state. California considers the SEIS to be without legal or technical basis, is not participating in its preparation, and has sued the Department of the Interior to resolve the issue.

Licensing: A license was issued by DHS on September 16, 1993, conditioned on DHS ownership of the land. On June 1, 1994, the Superior Court of the State of California ordered DHS to "reconsider its approval of the license." The Court of Appeal of the State of California, Second District, overturned the lower court decision and reinstated the license. On January 18, 1996, the Supreme Court of California denied the plaintiffs' petition to review the appellate court's decision. There are no further avenues for appeal available in the state court system.

Disposal Facility Operational: Projected by early to mid-1999, contingent upon land transfer.

Other Information: At the request of the U.S. Interior Secretary, a National Academy of Sciences committee reviewed seven technical issues related to the site and found no obstacles to proceeding with development. Based on this analysis, in May 1995 the Department of the Interior indicated willingness to transfer land for the facility to the state, subject to certain "enforceable commitments." In February 1996, the Department of the Interior changed its

position. (See "Siting.") Members of the U.S. Congress support a legislative transfer of the land. The license issued by DHS does not include mixed waste disposal. The Southwestern Commission and DHS are working with other states and compacts to encourage DOE to provide for management of commercial mixed waste.

14.2.10 Texas Compact

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web:

Governing Body: Texas Low-Level Radioactive Waste Disposal Compact Commission

Member States: Texas, Maine, Vermont

Compact Established: In June 1993, the Governor of Texas signed into law legislation establishing a low-level radioactive waste compact with Maine and Vermont. Maine completed its approval process with the passage of a referendum on November 2, 1993. Vermont adopted the compact on April 25, 1994. The compact was submitted to the U.S. Congress for consent in the summer of 1994, but action was not taken. The compact was resubmitted in 1995 and brought up for a vote on the suspension calendar of the U.S. House of Representatives. On September 19, 1995, the House voted against the motion to suspend debate on the legislation and enact the bill. No action was taken in 1996, but new compact legislation was filed in early 1997. At the end of 1999, legislation passed by the Texas Legislature and signed into law abolished the TLLRWDA.

Current Waste Management: As of July 1, 1995, waste may be shipped to the disposal facility in Barnwell, South Carolina. In addition, subject to the Northwest Compact amended resolution and order of April 20, 1995, wastes meeting Envirocare of Utah's license conditions are being shipped for disposal at the Envirocare facility. Certain NARM wastes meeting the State of Washington's conditions are being shipped to the commercial disposal facility in Hanford, Washington.

Host State: Texas

Regulatory Responsibility: Texas Natural Resource Conservation Commission (TNRCC)

Program Responsibility: Texas Low-Level Radioactive Waste Disposal Authority

Siting Responsibility: Texas Low-Level Radioactive Waste Disposal Authority

Other Involvement: Texas Department of Health

Disposal Technology: below-ground concrete canisters

Siting: The Authority began statewide site-screening activities under newly enacted state law in 1983. Initial efforts identified several desirable sites in south Texas. In 1985, the Texas

Legislature instructed the Authority to give preference in its site search to state-owned land. In 1987, the Authority identified several possible sites in Hudspeth County, Texas, including a site at Fort Hancock. El Paso County and others filed a lawsuit to enjoin the Authority from selecting the Fort Hancock site, and the site was abandoned in early 1991. In May 1991, the Texas Legislature amended the Authority's statute, to require the selection of a site in a 400-square mile area near Sierra Blanca in Hudspeth County. In February 1992, the Authority selected a site within this area on the Faskin Ranch for the state's proposed low-level waste disposal facility. The ranch was purchased and site characterization began. Site characterization concluded in November 1993.

Licensing: The license application was submitted to the TNRCC in March 1992. The TNRCC issued a draft license and environmental assessment on April 1, 1996. Administrative hearings on the application began in August 1996.

Disposal Facility Operational: Projected by late 1999.

14.3 STATES UNAFFILIATED WITH REGIONAL COMPACTS

Six (6) States, the District of Columbia, and Puerto Rico are currently listed as unaffiliated with the Low-Level Waste Disposal Compact Membership.

14.3.1 Massachusetts

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Primary Regulatory Responsibility: Department of Public Health

Secondary Regulatory Responsibility: Department of Environmental Protection and Low-Level Radioactive Waste Management Board

Program and Siting Responsibility: Low-Level Radioactive Waste Management Board

Disposal Technology: Shallow land burial is prohibited in Massachusetts; the chosen technology must allow monitoring and package retrieval. After a site is selected, the disposal technology will be chosen by the sited community from methods certified by the Management Board.

Current Waste Management: As of January 2005, Massachusetts has access to three disposal facilities in the country that accept LLRW: Barnwell, South Carolina; Clive, Utah; and Richland, Washington. Barnwell accepted Class A, B, C and HVLA LLRW, but no waste mixed with, or exhibiting characteristics of, toxic chemical hazardous material (called mixed waste). The Clive site accepted Class A and HVLA LLRW while Richland facility accepted only Massachusetts waste from naturally-occurring or accelerator-produced radioactive material (NARM).

Siting: As a result of the renewed access to the Barnwell disposal site in July 1995 and the expanded availability of the Envirocare facility, the Management Board voted in March 1996 to

cease its activities involving statewide mapping and screening—the first major stage of its in-state siting efforts—and to monitor changes in the national low-level radioactive waste management situation. The board agreed, however, to continue various site-planning tasks so that they could be completed in case in-state siting becomes necessary in the future.

These site-planning endeavors include (1) finalizing a Draft Siting Plan that would serve as a "road map" to aid the public in understanding the various roles and responsibilities of federal, state, and local governments in the siting process; (2) completing a Draft Statewide Mapping and Screening Protocol and Procedures document, to be used if the Management Board returns to active in-state siting; (3) reviewing and establishing Management Board policies pertaining to the application of "conditional" and "preference" siting criteria in the siting regulations promulgated by DEP; (4) completing the plan for the Volunteer Sites Program; and (5) collecting data from all low-level radioactive waste generators and other sources to prepare a "source term" analysis that assesses the volume and activity of low-level radioactive waste requiring management in a licensed disposal facility and making that data available for negotiations with other states and compacts.

Licensing: A projected date is not available.

Disposal Facility Operational: A projected date is not available.

14.3.2 Michigan

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web: http://www.michigan.gov/deq/

Regulatory Responsibility: Michigan Department of Environmental Quality and U.S. Nuclear Regulatory Commission (Michigan is not an Agreement State)

Program and Siting Responsibility: Michigan Low-Level Radioactive Waste Authority

Disposal Technology: State law limits disposal technology to above- or below-ground vaults or above-or below-ground modular canisters. No final determination has been made on facility design.

Current Waste Management: In July 1991, the Midwest Interstate Low-Level Radioactive Waste Compact Commission voted, to revoke Michigan's membership in the Compact. Only two licensed LLRW disposal facilities in the United States accept LLRW from Michigan generators. The facilities are the Duratek, Inc., facility, located in Barnwell, South Carolina, and the Envirocare, Inc., facility, Utah.

Siting: A policy advisory board issued a series of recommendations in September 1995. The board's report included specific recommendations regarding the conduct of a volunteer host community process, revisions to state siting criteria, and consideration of compact options. Amendments to state law must be enacted before these recommendations can be implemented and a new siting process pursued.

Licensing: A projected date for submittal of a license application is not available.

Disposal Facility Operational: A projected date is not available.

14.3.3 New York

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Regulatory Responsibility: Department of Environmental Conservation (DEC)

Program Responsibility: New York State Energy Research and Development Authority (NYSERDA)

Siting Responsibility: in transition (see "Siting" below)

Other Involvement: Department of Health; New York City Department of Health; Department of Labor; and New York State Citizens Advisory Committee on Permanent Disposal Facility Siting and Disposal Method Selection

Current Waste Management: As of January 2005, the waste may be transferred to licensed LLRW disposal facilities in Barnwell, South Carolina (Chem-Nuclear); Clive, Utah (Envirocare); and Richland, Washington (U.S. Ecology). The Barnwell facility accepts most types of LLRW, the Clive and Richland facilities are more restrictive. The Clive facility accepts most Class A waste, but do not accept Class B or C waste. The Clive facility can also accept, treat, and dispose of most solid, mixed waste (i.e., LLRW that also contains hazardous chemicals) that meets the site's radioactivity concentration limits. The Richland facility accepts limited volumes of LLRW containing small quantities of naturally occurring radioactive material (e.g., uranium, thorium) from New York State generators.

Disposal Technology: State law bars shallow land burial; above-grade vaults identified as tentative preferred technology.

Siting: New York's siting program is in transition. The State Budget for FY 1995-96 phased out the activities of the Low-Level Radioactive Waste Siting Commission, which was established in 1987 to select a site and disposal method. The state, under Governor George Pataki, is reevaluating its approach to low-level radioactive waste management. Several relevant proposals have been put before the state legislature, including one that would provide for a volunteer siting process. No new schedule has been developed. Regulations governing site and disposal method selection were adopted by DEC in 1987.

Licensing: NYSERDA is responsible for obtaining a DEC permit to construct and operate a land disposal facility and a DOL radioactive materials license, once a site and a disposal method are selected.

Disposal Facility Operational: The DEC issued financial assurance regulations in September 1991 and regulations for design, construction, operation, closure, post-closure and institutional control in March 1993. NYSERDA is responsible for construction and operation.

14.3.4 North Carolina

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Regulatory Responsibility: North Carolina Radiation Protection Commission

Program Responsibility: Department of Environment and Natural Resources

Other Involvement: Chem-Nuclear Systems, Inc.

Current Waste Management: Disposal is available for almost all LLRW produced by North Carolina generators at either the Barnwell, South carolina site or the Envirocare facility, Utah. For the small amount of remaining LLRW, on-site storage is a safe alternative.

Disposal Technology: below-grade vaults

Siting: The siting process in North Carolina was halted in late 1997.

Licensing: A license authorizing possession and storage of waste at the Barnwell facility was first issued on November 6, 1969. On April 13, 1971, the license was amended to authorize disposal. The license has been renewed for a five-year period ending July 31, 2000.

Disposal Facility Operational: The Barnwell facility has been in operation since 1969.

Other Information: On April 21, 1999, the Southeast Compact Commission voted to notify North Carolina Governor and the State legislative leadership that the State has not met its legal obligations as the Compact's host state. On July 26, 1999, the Governor of North Carolina signed legislation to remove the State from the Southeast Compact.

14.3.5 New Hampshire

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Regulatory Responsibility: Nuclear Decommissioning Financing Committee

Current Waste Management: As of January 2005, only two licensed LLRW disposal facilities in the United States accept LLRW from Michigan generators. The facilities are the Duratek, Inc.,

facility, located in Barnwell, South Carolina, and the Envirocare, Inc., facility, Utah. It primarily sends lightly contaminated dry waste to Envirocare.

Siting: New Hampshire has no plans to site a disposal facility due to the small amounts of low-level radioactive waste generated.

Other Information: The Governor's Ad Hoc Committee, with the assistance of the State Radiation Advisory Committee, continues to welcome an opportunity to discuss contracts or compacts with any interested state.

14.3.6 Rhode Island

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Fax:
web:

Regulatory Responsibility: Rhode Island Department of Health

Program Responsibility: Rhode Island Atomic Energy Commission

Other Involvement: Rhode Island Radiation Advisory Commission

Current Waste Management: As of January 2005, the compact waste may be shipped to the disposal facility in Barnwell, South Carolina. In addition, waste may be shipped for disposal at the Envirocare facility

Siting: There are no plans for a Low Level Radioactive Waste disposal facility in Rhode Island.

Other Information: The Rhode Island Atomic Energy Commission has assumed responsibility for low-level radioactive waste management and compact participation from the Department of Environmental Management effective January 1996.

14.3.7 District Of Columbia

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Regulatory Responsibility: Department of Consumer and Regulatory Affairs (DCRA)

Program Responsibility: Service Facility Regulation Administration, Department of Consumer and Regulatory Affairs

Current Waste Management: As of January 2005,, only two licensed LLRW disposal facilities in the United States accept LLRW from District of Columbia generators. The facilities are the

Duratek, Inc., facility, located in Barnwell, South Carolina, and the Envirocare, Inc., facility, Utah.

Siting: There are no plans for a Low Level Radioactive Waste disposal facility in District of Columbia.

Other Information: The District of Columbia is continuing efforts either to join a compact or to contract with one.

14.3.8 Puerto Rico

Puerto Rico is not planning to site a disposal facility. Further information is unavailable at this time.

14.4 BIBLIOGRAPHY

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