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Recommended Citation
Rogers, B. and Loveland, K., "Envirocare of Utah: Expanding Waste Acceptance Criteria to Provide Low-Level and Mixed Waste Disposal Options." (2003). *All U.S. Government Documents (Utah Regional Depository)*. Paper 11.
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ENVIROCARE OF UTAH: EXPANDING WASTE ACCEPTANCE CRITERIA TO PROVIDE LOW-LEVEL AND MIXED WASTE DISPOSAL OPTIONS

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ABSTRACT

Envirocare of Utah operates a low-level radioactive waste disposal facility 80 miles west of Salt Lake City in Clive, Utah. Accepted waste types includes NORM, 11e2 byproduct material, Class A low-level waste, and mixed waste. Since 1988, Envirocare has offered disposal options for environmental restoration waste for both government and commercial remediation projects. Annual waste receipts exceed 12 million cubic feet.

The waste acceptance criteria (WAC) for the Envirocare facility have significantly expanded to accommodate the changing needs of restoration projects and waste generators since its inception, including acceptable physical waste forms, radiological acceptance criteria, RCRA requirements and treatment capabilities, PCB acceptance, and liquids acceptance.

Additionally, there are many packaging, transportation, and waste management options for waste streams acceptable at Envirocare. Many subcontracting vehicles are also available to waste generators for both government and commercial activities.

INTRODUCTION

Envirocare of Utah, Inc. (Envirocare) has continually demonstrated its ability to expand its WAC to meet the needs of both government and commercial remediation projects. Last year, nearly one-third of Envirocare's waste receipts were attributed to license and waste acceptance criteria changes made in the last two years. The majority of these new waste receipts were the result of PCB waste acceptance and the ability to directly dispose large, oversize debris. Today, the Envirocare waste acceptance criteria offers waste generators both a wide window for Class A waste acceptance and an expansive list of methods by which waste can be delivered to the Envirocare facility.

FACILITY HISTORY AND CAPABILITIES

The initial selection of the Envirocare disposal site location dates back to the late 1970s when the Department of Energy (DOE) and the State of Utah began the cleanup of an abandoned uranium mill site. The Vitro mill site, located in central Salt Lake City, was one of the first sites cleaned up under the DOE Uranium Mill Tailings Remediation Action (UMTRA) Program. From 1984 to 1988, the Vitro tailings were relocated to Clive and placed in an aboveground disposal cell.

The vision of the Envirocare project was to provide a private disposal option for cleanups similar to Vitro. The Environmental Protection Agency (EPA), DOE, Department of Defense, and private companies would carry out these cleanups across the country. At that time, these agencies

had very few options for offsite disposal of radioactive wastes. In hoping to provide a new option for these contaminated materials, Envirocare purchased the land adjacent to the completed Vitro pile and submitted a license application to receive and dispose of Naturally Occurring Radioactive Materials (NORM). Since 1988, Envirocare's Radioactive Material License has been amended several times, expanding the types of radioactive materials to include radioactive waste (LLRW), in addition to NORM.

Located approximately 75 miles west of Salt Lake City, the South Clive, Utah facility serves government and commercial customers for the treatment, storage and disposal of radioactive waste. Technologies designed to treat waste for RCRA constituents have been developed and licensed at the facility. Current treatment capabilities include chemical stabilization, polymer macroencapsulation, and polymer microencapsulation.

Envirocare has developed Waste Acceptance Criteria (WAC) to assist waste generators and their contractors by providing information about the capabilities and requirements of Envirocare's disposal facility. The waste acceptance processes discussed in these guidelines include: waste characterization and profiling; sampling and analysis; waste packaging, transportation and delivery; waste receipt, sampling and acceptance; and waste treatment and disposal. The waste profile process requires that waste streams be evaluated from three broad perspectives: radiological characterization, chemical and land disposal permits and regulations, and physical characteristics.

SITE DESCRIPTION

Envirocare's operations are conducted in Section 32, Township 1 South, Range 11 West, SLM, Tooele County, Utah. The facility is located approximately 75 miles west of Salt Lake City and about three miles south of Interstate 80, Exit 49. Tooele County has designated the area around the Clive facility as a Hazardous Industrial District MG-H. This designation limits, through zoning, the future uses of land in the area of the Envirocare facility to heavy industrial processes (General Industrial District M-G type uses) and to industries dealing with hazardous wastes, by the issuance of conditional use permits. The Hazardous Industrial District MG-H designation does not provide for any other types of land use.

The design and operation of the Envirocare disposal site provides a long-term disposal solution with a minimal need for active maintenance after closure. Envirocare uses an aboveground-engineered disposal cell. The design of these cells is patterned after DOE and EPA specifications for the VITRO embankment. Each licensed embankment meets or exceeds the regulatory requirements.

The site can be conveniently accessed by both highway and rail transportation. Envirocare receives waste shipped via bulk truck, containerized truck, enclosed truck, bulk rail, rail boxcars, and rail intermodals. The transportation access allows Envirocare to operate throughout the entire year. The all-weather road to the site is maintained by Envirocare and has been improved to an asphalt-paved road from Exit 49 south to the site.

Envirocare is served by the Union Pacific Railroad at Envirocare's private siding. Envirocare maintains over 5 miles of track and 3 locomotives to allow rail cars to be unloaded, decontaminated and released.

LICENSES AND PERMITS

The type, form, and quantity of LARW, NORM, Naturally Occurring or Accelerator-Produced Radioactive Material (NARM), 11e.(2), and mixed waste that Envirocare can receive for treatment and disposal is limited by the various licenses and permits under which Envirocare operates. Envirocare has been issued an Agreement-State Radioactive Material License (RML)[1] by the Utah Division of Radiation Control (DRC). This license authorizes Envirocare to receive and dispose of the following waste types: LLRW containing source, byproduct, and/or Special Nuclear Material (SNM), NORM, and NARM waste. Envirocare is also licensed directly by the Nuclear Regulatory Commission (NRC)[2] to receive and dispose of uranium and thorium mill tailings byproduct material as defined by section 11e.(2) of the Atomic Energy Act of 1954, as amended.

In addition to the Radioactive Material License, Envirocare has been issued a RCRA Part B Permit[3] (Permit #UT 982598898, as amended) by the DSHW to treat and dispose of hazardous waste that is also contaminated with LARW, NORM, or NARM wastes (mixed waste). Early in 1999, Envirocare received a Permit modification that authorized the receipt and disposal of "Radioactive – PCB" wastes. Envirocare also holds a Hazardous and Solid Waste Amendments (HSWA) Permit issued by the EPA authorizing the treatment, storage in tanks and containers, and disposal in landfill cells of mixed wastes.

Envirocare's disposal site is also regulated by an Air Quality Approval Order and a Groundwater Quality Discharge Permit issued by the Utah Division of Air Quality and the Utah Division of Water Quality, respectively.

EXISTING WASTE ACCEPTANCE CRITERIA (WAC)

As an introduction to the Envirocare WAC, a summary of the existing general license conditions is provided. All waste must first meet the minimum requirements as stated below. All WAC changes and alterations are then resulting expansions to the requirements stated in the WAC.

Licenses and Waste Classification

In accordance with Envirocare's Radioactive Materials License, Envirocare is prohibited from accepting radioactive waste that is classified as Class B or C waste. Each waste container or bulk transport vehicle must be classified to determine its waste class in accordance with the requirements of the Utah Administrative Code (UAC) R313-15-1008, Classification and Characteristics of Radioactive Waste. The Utah Waste Classification System is similar to the NRC Waste Classification System in 10 CFR 61.55 with the exception of Radium-226 which has been added as a Table I radionuclide.

Determination of Waste Class involves two considerations. First, consideration must be given to specific long-lived radionuclides listed in Table I of UAC R313-15-1008. Second, consideration must be given to specific short-lived radionuclides listed in Table II of UAC R313-15-1008. The waste is Class A if the radionuclides listed in either Table I or Table II are not present in the waste. All waste must fit within these radiological parameters. After demonstrating compliance with the radiological portion of the WAC,

Special Nuclear Material

Condition 13 of the Radioactive Materials License (Amendment #4) incorporates the Special Nuclear Material (SNM) Exemption issued by the NRC (64 FR 27826, May 21, 1999). Under specified conditions, the exemption allows Envirocare to possess waste containing SNM in greater mass quantities than prescribed in 10 CFR Part 150 without obtaining an NRC license pursuant to 10 CFR Part 70. The conditions are based on concentration limits of SNM in the waste and have been established by the NRC to ensure criticality safety.

The NRC developed the SNM Exemption conditions based on criticality studies and independent calculations. A variety of scenarios were analyzed to determine limiting criticality conditions for waste materials containing SNM. The NRC determined that several conditions in addition to concentration limits would be required to assure criticality safety. A discussion of their approach is documented in the *Safety Evaluation Report Regarding the Proposed Exemption from Requirements of 10 CFR Part 70* (SER) (Docket 40-8989).

Acceptable Forms of Radioactive Waste

Envirocare's Radioactive Material License authorizes the receipt of radioactive waste in the form of soil or debris. Condition 56 of the license defines compactible soil as (A) having a graded material that will pass through a four (4") inch grizzly, and (B) as having a bulk density greater than seventy (70) pounds per cubic foot dry weight in accordance with ASTM D-698 (Standard Proctor Test). This same condition defines debris as any radioactive waste for disposal other than soil. Debris includes both decommissioning (cleanup) and routinely generated operational waste including, but not limited to, radiologically contaminated paper, piping, rocks, glass, metal, concrete, wood, bricks, resins, sludges, tailings, slag, residues, and personal protective equipment (PPE) that conforms to the debris size requirements.

The main difference between these two forms of material is how they are handled in the disposal cell. Waste material meeting the definition of soil can be disposed of directly by placing it into 12 inch lifts and compacting it to 90 percent of optimum density at a moisture content up to three percent above optimum moisture. Debris requires additional processing prior to disposal depending on the size of material.

Debris is defined into two broad categories based on size. The first category is standard debris and includes materials that are less than 10 inches in at least one dimension and no longer than 12 feet in any dimension. Debris that does not meet this size limitation is categorized as oversized debris.

Mixed Waste

Envirocare is authorized to receive mixed wastes for (1) disposal, or (2) treatment and disposal. Mixed waste is defined by Envirocare's RCRA Part B Permit (# UTD982598898) as: Waste defined by the Low-level Radioactive Waste Policy Act, Public Law 96-573; this is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined by section 11.e(2) of the Atomic Energy Act, and contains hazardous waste that is either listed as a hazardous waste in Subpart D of 40 CFR 261 and/or exhibits any of the hazardous waste characteristics identified in Subpart C of 40 CFR 261, or hazardous waste which also contains naturally occurring radioactive materials.

The specific EPA Hazardous Waste Codes that may be received by Envirocare are identified in its RCRA Part B Permit. In addition to compliance with this Permit, the radioactive constituents of the waste must also be in full compliance with Envirocare's Radioactive Material License. PCB wastes were added to Envirocare's Permit in 1999. Envirocare routinely receives "Radioactive – PCB" wastes for disposal.

Mixed Waste for Treatment and Disposal

Envirocare may also receive mixed waste that requires treatment in order to comply with the Land Disposal Requirements. Envirocare is approved under the RCRA Part B Permit and the EPA HSWA Permit to operate a mixed waste treatment facility. For mixed waste which requires specific treatment prior to disposal, Envirocare's treatment facility can provide some of the required technologies outlined in 40 CFR 268.42, Table 1. Technologies currently available include chemical stabilization, chemical oxidation, chemical reduction, chemical deactivation, neutralization, macroencapsulation, and microencapsulation. These technologies are identified by the following RCRA technology codes: STABL, CHOXD, CHRED, DEACT, NEUTR, and MACRO. Microencapsulation (MICRO) is also provided as an authorized alternate treatment technology.

REGULATORY PROCESS FOR WAC EXPANSION

The State of Utah is an NRC Agreement State, meaning that the NRC has delegated authority to the Utah Division of Radiation Control (DRC) to issue and manage Envirocare's RML for low-level radioactive waste treatment, storage and disposal. Additionally, the Utah Division of Solid and Hazardous Waste (DSHW) has authority to issue and manage Envirocare's RCRA Part B Permit.

When changes to the RML or RCRA Part B Permit are proposed, a request is issued to the regulatory agency detailing the proposed amendment or approval with supporting documentation. The regulatory agency determines the process by which the change will be executed and may include public comment periods, as determined by the prevailing regulatory requirements. Once the proposed change is approved, the subject license or permit is formally amended and reissued.

After license and permit changes, Envirocare updates affected forms, policies, procedures, and the Envirocare Waste Acceptance Guidelines (WAG) that

SIGNIFICANT WASTE ACCEPTANCE CRITERIA (WAC) CHANGES AND PROJECT EXAMPLES

Following are the most recent WAC changes that have positively assisted in the progress of environmental restoration projects in both the government and commercial waste management sectors. Specific project examples are provided to assist in demonstrating the significance of the changes.

Acceptance of PCB Remediation and Bulk Product Waste

Since Envirocare began accepting for disposal all Polychlorinated Biphenyls (PCBs) deregulated under the PCB Mega-Rule, several significant environmental restoration projects have been able to send waste that previously did not have a disposition path. The State of Utah and Envirocare adopted the EPA PCB rules, which provide greater flexibility in PCB waste disposal options and enable expanded radioactive PCB acceptance and disposal capabilities. The result is Envirocare can now dispose of low-level radioactive PCB contaminated materials in the low-level radioactive waste cell, while Subtitle C remediation waste will be disposed in Envirocare's mixed waste cell.
Envirocare is the only licensed facility that can accept PCB waste regulated for disposal under 40 CFR 761 that also contains source, special nuclear, or by-product material subject to the regulations under the Atomic Energy Act of 1954, as amended, or naturally occurring or accelerator produced radioactive material. The EPA requires that generators with such materials consider both its PCB properties and its radioactive properties. Such waste may be received and disposed in the Envirocare low-level cell, providing that the materials meet the requirements of Envirocare's Radioactive Material License. Typical PCB/radioactive waste in this category is wire or cable plastic insulation; radio, computer or television casings; laminate furniture; applied dried paints, varnishes, waxes and other coatings or sealants; caulking and other non-liquid PCB bulk product from shredding of appliances from which PCB small capacitors have been removed. PCB remediation waste encompasses soil and gravel, dredged materials, sludges, and concrete and/or wood floors or structural elements.

Following is a complete list Envirocare's current capabilities in regard to acceptance of PCB material:

- Drained PCB Transformers (contained ≥ 500 ppm PCB concentration)
- Other Drained PCB Articles (≥ 500 ppm PCB concentration)*
- Intact, non-leaking PCB Small Capacitors (including intact, non-leaking light ballasts with PCB concentrations < 50 ppm in the potting material)*
- Drained PCB Hydraulic Machines (≥ 50 ppm PCB concentration)*
- Drained PCB-Contaminated Articles, including Electrical Equipment (≥ 50 ppm; < 500 ppm)
- Drained PCB Containers (previously contained PCBs at concentrations < 500 ppm)*

- PCB Bulk Remediation Waste, as defined in 40 CFR 761.3:
  - Non-liquid cleaning materials and personal protective equipment waste at any concentration, as described in 40 CFR 761.61(a)(5)(v)(A)
  - PCB concentrations < 50 ppm or PCB surface contamination < 100 μg/100 cm^2
  - PCB concentrations ≥ 50 ppm or PCB surface contamination ≥ 100 μg/100 cm^{2*}
- PCB Bulk Product Waste, as defined in 40 CFR 761.3
  - Leaches < 10 μg/L PCBs (including the wastes listed in 40 CFR 761.62(b)(1)(i))
  - Leaches ≥ 10 μg/L PCBs)*
- PCB Waste from Research & Development

* Any waste in groups marked with an asterisk must be disposed at Envirocare's Mixed Waste Facility.

The largest shipments to Envirocare of PCB waste material to date are from the Oak Ridge Operations Office (ORO), East Tennessee Technology Park (ETTP) K-29, K-31, and K-33 Building Decommissioning project. Starting in 2001, shipments of both PCB bulk product waste and PCB remediation waste from the dismantling and remediation of these buildings have been delivered to Envirocare's Clive facility. The waste was packaged in intermodal containers, delivered by flatbed railcars, and shipped under two separate waste profiles (one for bulk product waste and one for remediation waste).

The waste material mostly consists of miscellaneous metal debris, ductwork, transformers, and motors. The material is most often compacted prior to shipment. Without approval for the shipments to Envirocare, the project would have lacked a disposition path for some of the waste.

Large Debris and Components

Envirocare has begun to accept large equipment and debris labeled oversized debris at the Envirocare facility. In the past, Envirocare was only able to dispose of debris that was greater than ten (10) inches by eight (8) feet by eight (8) feet on a limited basis in the mixed waste cell, such as solidified monoliths. The recent service expansions now include the ability to accept large equipment such as pumps, generators, tanks, concrete blocks, etc. for disposal in the low-level cell. With the weight and dimensions of a given piece of oversize debris, each project is specifically engineered for placement in the disposal cell. Final disposal is accomplished with a grouting procedure using a flowable fill technology called Controlled Low Strength Material (CLSM). To date, Envirocare has received large debris objects weighing in excess of 200 tons.

A commercial disposition project offered the largest component disposal project to date and was the largest ever single shipment of low-level radioactive large components. The shipment consisted of five steam generators and one pressurizer originating from commercial nuclear power plants in Maine and Wisconsin. Each unit weighed in excess of 200 tons and had an overall length between thirty-two (32) and forty-three (43) feet with a diameter ranging from eleven (11) to fourteen (14) feet. A dedicated train of specially designed eight (8)- and twelve (12)- axle railcars transported the components on the final leg of the journey to Envirocare's facility for disposal in the low-level waste cell. Disposal of the nearly three (3) million pounds of components represents the completion of a project which took almost a year of planning and preparation.

Macroencapsulation of Large Items

Until mid-2002, Envirocare only accepted lead and debris items for treatment by macroencapsulation that fit within a standard B-25 box (nominally less than four (4) feet by four (4) by eight (8) feet). This requirement was restrictive and required potential waste generators to often conduct significant size reduction activities prior to shipment for treatment and disposal. Today, Envirocare has developed a larger expandable mold to accommodate items requiring macroencapsulation that have a size up to five (5) feet by nine (9) feet by nine (9) feet.

The mold adjusts to fit the outer dimensions of the article requiring treatment. Treatment of the waste includes placing the waste item(s) in a mold and then pouring molten low-density polyethylene around the waste item(s), thus encasing the waste item with low-density polyethylene and meeting treatment standards for radioactively contaminated lead. This treatment process is categorized as macroencapsulation. Envirocare has developed methods of pouring the molten plastic around the large item in a manner that reduces cracking and allows for safe transportation of the treated object to the disposal cell for final disposition.

The Rocky Flats Environmental Technology Site (RFETS) was the first to send material for treatment using this new methodology. Gloveboxes that have leaded windows, gloves, and shielding were being stripped of the leaded items prior to disposition. Envirocare's new macroencapsulation methodology now allows all existing lead items to remain intact to the glovebox and the entire item is treated. This method lowers operational costs for glovebox management because the costs of lead removal are eliminated and potential physical and radiological risks to workers are reduced because less intensive physical handling of the glovebox is required.

Vacuum-Assisted Thermal Desorption

Envirocare is in the process of deploying vacuum-assisted thermal desorption (VTD) for the treatment of organics and PCBs, including waste with dioxins and furans. Envirocare has contracted with TD*X for treating waste using their patent pending high performance waste thermal desorption system with a capacity of 32 drums per day. This system has been used for the removal of PCB's, mercury and organic contaminants that include dioxins and furans from solid wastes. The system operates at sufficiently high temperatures to desorb organic materials and is assisted by a vacuum and mixing system to ensure efficient separation.

Approval for deployment of this technology included not only specific approval from the State of Utah, but license and WAC changes to accept higher levels of organics and liquids. Both of these items were previously prohibited for receipt at the Envirocare facility.

Envirocare has received approval to conduct treatability studies in March 2003 with a new, full-scale unit built for deployment specifically at the Envirocare facility. Fluor Fernald has contracted performance of this work to Envirocare for the purpose of treatment and disposal of approximately one hundred and fifty (150) drums of waste contaminated with organic constituents and heavy metals.

SUBCONTRACTING OPTIONS

All commercial waste generators contract with Envirocare directly for treatment and/or disposal services. However, several contracting options are available to federal waste generators and their contractors such as the Department of Energy, Department of Defense, and Environmental Protection Agency. For waste disposal, mixed waste treatment, and mixed waste disposal, national contracts exist that can be accessed for expeditious contracting.

Waste disposal is contracted through the Department of Energy Ohio Field Office and US Army Corps of Engineers. Mixed waste disposal is contracted through the Oak Ridge Operations Office and the US Army Corps of Engineers. Mixed waste treatment is contracted through the Department of Energy Chicago Field Office and the US Army Operations Support Command. Additionally, direct disposal contracts between government contractors and Envirocare are available. Under these contracts, several transportation, packaging and payment methods are allowed.

REFERENCES

[1] *Utah Department of Environmental Quality Division of Radiation Control Radioactive Material License*, Licensee Envirocare of Utah, Inc., License Number UT 2300249, Amendment #15, Expiration Date October 22, 2003

[2] *US Nuclear Regulatory Commission Radioactive Materials License*, Licensee Envirocare of Utah, Inc., License Number SMC-1559, Amendment No. 43, Expiration Date November 30, 2003

[3] *State of Utah Plan Approval (RCRA Part B Permit)*, Permittee Envirocare of Utah, Inc.
EPA Identification Number UTD982598898, Expiration Date November 30, 2000 (currently under timely renewal)