OFF-SITE TREATMENT OF HAZARDOUS AND MIXED WASTES FOR THE DEPARTMENT OF ENERGY FACILITIES

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ABSTRACT

Chem-Nuclear Environmental Services, Inc., (Chem-Nuclear), has conducted two mixed waste soils treatment demonstrations, one in 1988 and another in 1989 for Martin Marietta Energy Systems, Inc., on the United States Department of Energy (DOE) former Oak Ridge Gaseous Diffusion Plant (K-25 Site) and for the DOE Y-12 Plant, respectively. A third mixed waste oil treatment demonstration for the Y-12 Plant was initiated in late 1990 and is well under way.

A proposal for demonstrating treatment of a surrogate mixed waste groundwater is pending. Chem-Nuclear has also received, assessed and bid on several other proposals for mixed waste treatment demonstration as well as production scale treatment and/or disposal of radioactive, hazardous and mixed wastes. Most of this work has been proposed for off-site of the DOE facilities due to the high cost and delay of meeting on-site safety, health, and environmental protection documentation requirements.

These recent, ongoing and proposed projects are categorized as off-site treatability demonstrations (DEMO), off-site treatment of demonstration and/or full scale quantities of waste (TREAT) and off-site disposal of wastes (DISPOSE). The individual Requests for Proposals (RFPs) or Solicitation and Offers are briefly described in terms of the primary treatment objectives and management and/or regulatory concerns. The objective of this overview is to help provide commercial enterprises with awareness of some of the waste treatment and disposal challenges facing the DOE and its operating contractors.

In the proposed treatability study of a surrogate mixed waste groundwater, Chem-Nuclear has proposed to demonstrate the Chemical Waste Management, Inc. PO*WW*ER™ evaporation and catalytic oxidation system. A simplified process schematic is provided.

INTRODUCTION

The DOE operating contractors are increasingly utilizing commercial, off-site treatment of hazardous, radioactive and mixed wastes, due in part to the growing complexity, cost and delay in satisfying on-site safety, health protection and environmental impact documentation and training. Commercial disposal of hazardous wastes is also on the rise under increasing pressure from the DOE, state and federal regulators, and the public to reduce the backlog of stored and stockpiled wastes.

Several categories of off-site treatment and disposal are developing including: 1) Off-site waste treatment demonstrations where the secondary radioactive and mixed wastes generated from the process are returned to the DOE facility (refer to as DEMO), 2) Off-site treatment of demonstration and/or full scale quantities of waste with the disposal of stabilized byproducts, (refer to as TREAT), and 3) Off-site disposal (with increasing requirements for stabilization) of bulk hazardous wastes at Environmental Protection Agency (EPA) permitted landfills, (refer to as DISPOSE). The increasing requirements for waste treatment and/or stabilization referred to in the DISPOSE category is due to the implementation of the Land Ban regulations of the Hazardous and Solid Waste Amendments (HSWA). Therefore, it is expected that categories 2 and 3, TREAT and DISPOSE are effectively becoming one category for an increasing number of candidate waste streams.

This trend of DOE off-site demonstrations, and full scale treatment and disposal operations are significant to the waste treatment and disposal industry because the DOE will increasingly need commercial treatment capability and capacity. This applies particularly to cases where the segregation of hazardous and radioactive components will allow the disposal of the hazardous components while returning the radioactive and mixed waste components to the DOE facilities for on-site storage for future disposal in compliance with DOE Order 5820.2A.

DEMO

Recent examples of off-site waste treatment DEMO include: a) two types of mixed waste soils from the Y-12 Plant, one containing PCB's and uranium and the other mercury and uranium, b) Y-12 Plant EPA-listed (F006) mixed wastewater sludges containing uranium, c) Y-12 Plant mixed waste oils and solvents containing beryllium and uranium, and d) the Office of Technology Development sponsored demonstrations of the treatment of a complex, surrogate, mixed waste groundwater.

Mixed waste soils from the Y-12 Plant which were included in the FY-1990 treatability demonstration conducted by Chem-Nuclear are representative of many waste

streams throughout the DOE complex to the extent that a large mass of soil is contaminated with RCRA/TSCA hazardous contaminants as well as uranium and other isotopes. (1) The fundamental challenge at this time is basically one of how to handle and process this large mass of soil to the minimal degree necessary, as close to the site as possible, so that the contaminants are captured in as concentrated a form as feasible, for ease of transport for off-site treatment. Successfully decontaminated soil is either returned to the site, if suitable as backfill, or it can be disposed as low-level radioactive or hazardous waste.

Probably the most frequently used system to date for on-site hazardous waste treatment operations is incineration. However, as candidate wastes for on-site treatment get more complex, i.e., mixtures of contaminants of concern, and the criteria for airborne discharges become more stringent than other means of thermal, physical chemical and chemical means of segregation are becoming more attractive. This trend is observed in the increasing move towards low temperature thermal segregation systems such as the Chem-Nuclear/Chem Waste X*TRAX™ and similar systems by IT, Weston and others, as well as various soil washing/extraction techniques. Key elements to the success of such systems are ease of on-site permitting, avoidance of problematic secondary wastes, recovery of any reagents or media, and total system economics.

In another DEMO initiative, the Y-12 Plant is seeking innovative process technologies that have the potential to treat complex, mixed wastewater sludges for the selective removal of Uranium down to the very low levels of less than 32 pico-Curies per gram (pCi/g) total uranium. In the two example wastewater sludge streams offered for demonstrations by the Y-12 Plant, the challenge is two-fold. (2) First, for the vendor who processes the waste, the challenge is the uranium removal to such a low level without also causing the cross-contamination of the removed uranium stream with characteristically hazardous metals. Second, the Y-12 Plant operators still face the inescapable challenge of "delisting" one or more resultant waste streams since the sludge is considered listed under EPA Code F006. A rudimentary knowledge of the obstacles associated with both of these challenges suggests that neither one will be fast or cheap.

A DEMO now under way by Chem-Nuclear and another vendor is the decontamination of beryllium and uranium from mixed waste oils and solvents from the Y-12 Plant. (3) Assuming that beryllium concentration can be reduced to the treatment goal of less than 0.5 mg/kg (ppm), and uranium meets the less than 32 pCi/g Y-12 Plant free release limit, then the decontaminated oils and solvents can (presumably) be burned at the K-25 Site TSCA Incinerator.

Finally, the last example offered in the DEMO category is the treatment of a surrogate mixed waste groundwater with a composite profile of contaminants seen over a number of sites on the Oak Ridge Reservation as well as other DOE sites. See Table I., "Proposed Constituents for Surrogate Groundwater and Desired Treatment Standards", for a profile of the surrogate mixed waste groundwater. (4) Both "state of the art" commercial technologies, as well as innovative technologies have been proposed for this DOE-HQ Office of Technology Development sponsored project. One of the innovative technologies proposed for this DEMO is Chem Waste's PO*WW*ER™ treatment system, which utilizes an evaporation and catalytic oxidation process for destruction of organics and concentration of other contaminants. See Fig. 1, "CWM PO*WW*ER™ Treatment System" for a simplified process schematic.

One demonstration has been funded with one vendor while another vendor's proposal is awaiting funding from DOE-HQ.

TREAT

Current examples of the TREAT category include: a) the planned treatment and disposal of hazardous cooling tower wood from the Paducah Gaseous Diffusion Plant (possibly contaminated with furans and/or dioxins) and b) the treatment of mixed waste barium chloride salts containing uranium from the Feed Materials Production Center, Fernald, Ohio, and RMI Extrusion, Ashtabula, Ohio.

The Paducah Gaseous Diffusion Plant issued a major request for Expression of Interest in February 1990, to several hundred companies which described several different types of waste requiring demonstration of treatability leading to full scale treatment for disposal. (5) Waste streams are generally categorized as either PCB and uranium contaminated or suspected of containing dioxins, furans and/or chlorinated phenols. No RFP's have been issued to date due to the temporary loss of staff to other commitments, but the Paducah staff is preparing at least one RFP at this time for issuance subject to the availability of funds. It is understood that this first in a series of RFP's will propose the demonstration of treatment and disposal for a substantial stockpile of wood from dismantled cooling towers. The full range of contaminants are not yet defined, but because they may include furans and/or dioxins this waste could pose a problem for commercial treatment due to the lack of EPA defined treatment standards.

The Feed Materials Production Center, (FMPC), Fernald, Ohio has a tremendous backlog of hazardous and mixed wastes stored on site. One of the better characterized wastes consists of a eutectic salt *mixture of primarily* barium chloride, potassium chloride and sodium chloride, from salt baths used in the extrusion of uranium metal at RMI Extrusion in Ashtabula, Ohio. (6) The majority of this material is stored at FMPC and is described as EP Toxic (EPA No. D005) for barium, with traces of other characteristically hazardous metals, plus low levels of uranium

TABLE I

Proposed Constituents for Surrogate Groundwater and Desired Treatment Standards

Heavy Metals	Surrogate Water Concentration Range (mg/L)	Groundwater Quality Standards (mg/L)
Barium	10 - 100	1.0
Cadmium	0.1 - 1.0	0.01
Chromium	0.1 - 1.0	0.05
Copper	10 - 100	1.0

VOCs	Proposed Concentrations (mg/L)	Water Quality Standards (mg/L)
Carbon Tetrachloride	0.01-5	0.005
Tetrachloroethylene	0.01-5	0.005
Trichloroethane	0.01-5	0.005
Vinyl Chloride	0.01-2	0.002
Methylene Chloride	0.01-2	0.002
Benzene	0.01-5	0.005
Toluene	20-100	2
Xylenes	50-100	10

Nitrates & PCBs	Proposed Concentrations (mg/L)	Water Quality Standards (mg/L)
Nitrates	30-250	10
PCBs	1	.001

Radionuclides	Proposed Concentrations & Valence	Water Quality Standards
Uranium-238	0.1-1 mg/L U_3O_8	0.01 mg/L
Technetium-99	10,000-1000 pCi/L TeO_4	900 pCi/L

Elemental Analysis & Miscellaneous Parameters	Proposed Concentrations (mg/L)	Water Quality Values
Calcium	50	TBD
Chloride	1	25
Iron	2	0.3
Magnesium	30	TBD
Manganese	.01	0.5
Potassium	2	TBD
Sodium	5	4.5
Zinc	10	5.0
Sulfate	30	25
Conductivity	300 UMHOS/cm	TBD

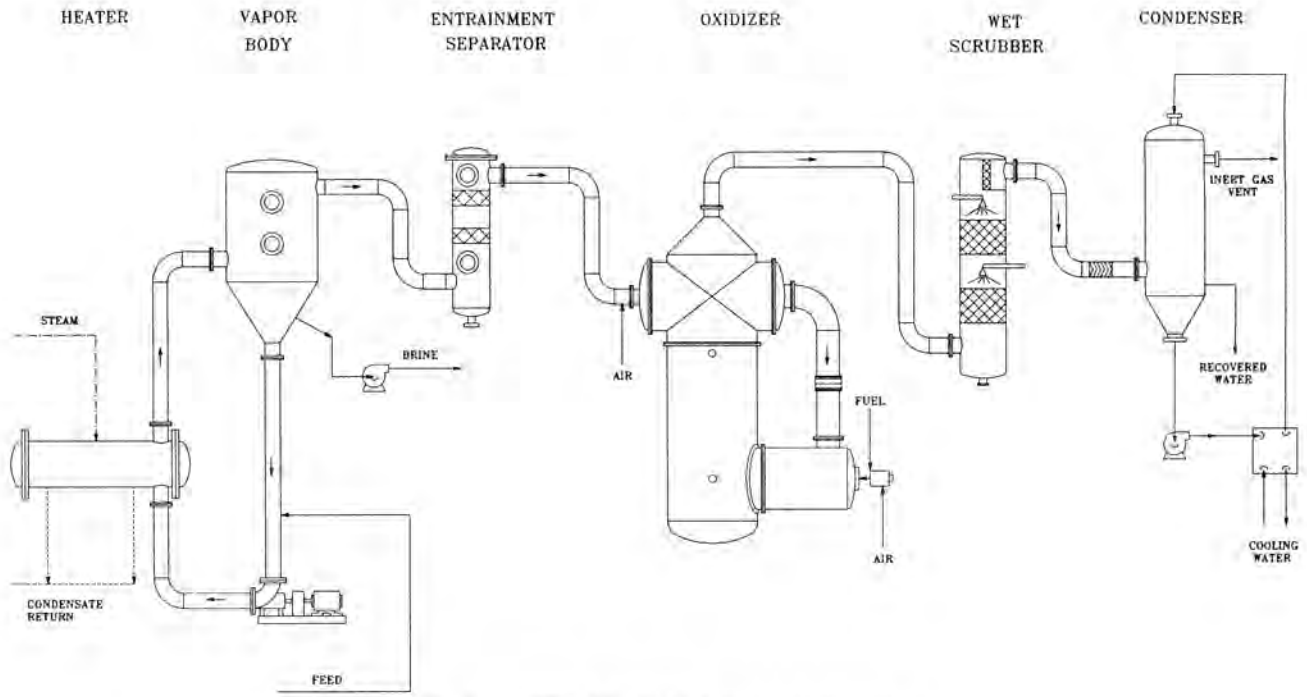

Fig. 1. CWM PO*WW*ER treatment system.

contamination, uranium daughters and traces of technetium-99. The treatment goal is to meet EPA treatment standards for barium in accordance with RCRA Land Disposal Requirements. Final disposition of the waste is burial at the Nevada Test Site (NTS) under the Westinghouse Materials Company of Ohio permit. The vendor will be responsible for meeting the NTS waste acceptance criteria.

DISPOSE

The DISPOSE category includes numerous unit priced solicitations for disposal from the various DOE Oak Ridge Operations facilities. These often include multiple categories with varying waste quantities from very small to very large. Sometimes the Operating Contractors insist upon the incineration of certain waste streams, due to their uncertainty regarding pending Land Ban restrictions or concern for future liability if waste recycling (e.g. solvent recovery or fuels blending) or direct land disposal were to be used.

Two recent DISPOSE examples stand out as significant in magnitude. The first is the disposal of PCB contaminated askarel, mineral oil and dielectric fluids followed by the disposal of transformers and capacitors. The second is the hauling of over 800 tons of mercury-contaminated scrap metal from the Y-12 Plant to Chem Waste's Emelle, Alabama, hazardous waste landfill for disposal.

The former Oak Ridge Gaseous Diffusion Plant, now referred to as the K-25 Site, has initiated a program for the systematic disposal of PCB's in priority order of high-PCB askarel dielectric fluid, then PCB-contaminated mineral oil and finally the shutdown transformers and other devices that contained these fluids. The main things that distinguish this project from commercial PCB disposal operations is the need to verify that the transformers are not radioactively-contaminated prior to the removal of PCB - contaminated materials from the site. Also the K-25 Site continues to exercise a high degree of plant security so that uncleared workers will require cleared escorts. The recent Solicitation and Offer (7) for PCB - askarel fluid disposal requested qualifications and pricing for over 125,000 gallons, which is over 1.6 million pounds, at about 13 pounds per gallon. This will involve the draining of over 80 transformers and tanks which will eventually require flushing and disposal.

In the other example, a Solicitation and Offer was issued for the off site disposal of over 800 tons of mercury contaminated scrap metal from non-uranium operations at the Alpha 4 building of the Y-12 Plant. The levels of mercury contamination were shown to be sufficiently low so that the main problem for transportation became how to provide for reasonable size reduction and allow for optimal truck loading for price competition.

Finally, an example of a project which might have largely been a DISPOSE project at a secure, hazardous waste landfill (supplemented by solvent recovery and/or fuels blending) was deemed a TREAT scenario because Martin Marietta Energy Systems, Inc., insisted that most these wastes be incinerated. (8) Included in the variety of categories were: EPA waste code D001, waste paint and gasohol/water; EPA waste codes D006, D007 and D008,

condenser cleaning solutions; EPA waste codes D006 and D008, lead acid, nickel cadmium and Gel Cell batteries; EPA Waste Code F001 PCB/TCE spill cleanup debris and trichloro solvents; and EPA Waste Code U228 TCE spill cleanup materials. This sample listing is a small example of the great diversity of the DOE's hazardous wastes awaiting treatment and disposal.

CONCLUSION

These examples underscore the fact that commercial sector waste management companies must prepare in advance in order to successfully respond to the many hazardous, radioactive and mixed waste treatment and disposal needs of the DOE and its operating contractors. Preparation for response includes developing facilities with treatment and analytical systems as well as properly trained operation personnel who can meet not only the treatment performance requirements of the RFP, but also the environmental, safety and health regulatory compliance requirements that are mandated.

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