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Mixed Waste Management at Fernald:

Making it Happen Quickly, Economically and Compliantly

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ABSTRACT

At the end of calender year 1992, the Fernald Environmental Management Project (FEMP) had approximately 12,500 drums of mixed low-level waste in storage and the Fernald Environmental Restoration Management Corporation (FERMCO) had just begun to develop an aggressive project based program to treat and dispose of this mixed waste. By 1996 the FERMCO mixed waste management program had reduced the aforementioned 12,500 drums of waste once in inventory to approximately 5800 drums. Projects are currently in progress to completely eliminate the FEMP inventory of mixed waste. As a result of these initiatives and aggressive project management, the FEMP has become a model for mixed waste handling, treatment and disposal for DOE facilities.

Mixed waste management has traditionally been viewed as a singular and complex *environmental* problem. FERMCO has adopted the viewpoint that treatment and disposal of mixed waste is an *engineering project*, to be executed in a disciplined fashion with timely and economic results. This approach allows the larger mixed waste management problem to be divided into manageable fractions and managed by project. Each project is managed by problem solving experts, project managers, in lieu of environmental experts. In the project approach, environmental regulations become project requirements for individual resolution, as opposed to what had formerly been viewed as technically unachievable environmental standards.

With compliant disposition of mixed waste being the primary goal, and achieving compliant disposition as quickly and economically as possible being attendant goals, several general principles have been established in the FERMCO mixed waste program.

1. *Wastes must be treated using technology which is proven, reliable, and currently available. Technology development is not performed within the program. Newly developed technology may be considered when that technology will be readily available and proven within a period compatible with the project schedule.*

2. *Commercial vendors are utilized to the maximum degree possible. The economic incentives for commercial vendors to develop and market treatment technology are utilized and cultivated to the maximum extent prudent.*

3. *Treatment and disposal technologies which achieve results above and beyond what is compliant are generally undesirable.*

Experience at the Fernald site has demonstrated that successful mixed waste management can be achieved through aggressive management of mixed waste management tasks as projects. Projects must be managed around established scope, schedule and budgets. All actions necessary to ensure that the project is successful must be taken. No excuses are acceptable and the project schedule is managed strictly. All projects have a beginning. All projects have an end. Whatever is not on the line between these two events is secondary.

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FERMCO SUCCESS AND LEADERSHIP

At the end of calender year 1992, the Fernald Environmental Management Project (FEMP) had approximately 12,500 drums of mixed low-level waste in storage and the Fernald Environmental Restoration Management Corporation (FERMCO) had just begun to develop an aggressive project based program to treat and dispose of this mixed waste. FERMCO had also just assigned a manager with strong project management skills to manage and develop a staff to address the FEMP mixed waste inventory.

By 1996 the FERMCO mixed waste management program had reduced the aforementioned 12,500 drums of waste once in inventory to approximately 5800 drums. Projects are currently in progress to completely eliminate the FEMP inventory of mixed waste. As a result of these initiatives and aggressive project management, the FEMP has become a model for mixed waste handling, treatment and disposal for DOE facilities. The balance of this paper addresses fundamental elements of FERMCO's success over the past three years.

DESCRIPTION OF MIXED WASTE PROGRAM

The DOE complex has traditionally viewed mixed waste management as a singular and complex *environmental* problem. Therefore, personnel possessing expertise in environmental issues alone were assigned to resolve enormous perceived environmental dilemmas.

FERMCO has adopted the viewpoint that treatment and disposal of mixed wastes are *engineering projects,* to be executed in a disciplined fashion with timely and economic results. This approach allows the larger mixed waste management problem to be divided into manageable fractions and managed by project. Each of these projects is then managed by problem solving experts, project managers, in lieu of environmental experts. In the project approach, environmental regulations become project requirements for individual resolution, as opposed to what had formerly been viewed as technically unachievable environmental standards. The project approach allows waste treatment and disposal to be accomplished while meeting environmental requirements.

The FERMCO mixed waste program was initially established, and continues to be a project based program. Each project has a documented scope, schedule and budget, and a dedicated project engineer. The project engineer is responsible and accountable for all aspects of a specific project, including those activities performed by support organizations.

General Program Principles

Compliant treatment and disposal of waste is an obvious absolute requirement for any mixed waste program. Cost and schedule together form a secondary critical project parameter. Cost and schedule are typically opposing project elements and must be balanced based upon relevant internal and external factors, and good management practice. Scope must be controlled within the confines of good management practice and potentially dynamic technical and regulatory

requirements. With compliant disposition of waste being the most important goal in any mixed waste project, and achieving compliant disposition as quickly and economically as possible being attendant goals, several general principles have been established in the FERMCO mixed waste program.

1. *Wastes must be treated using technology which is proven, reliable, and currently available. Technology development shall not be performed within the program. Newly developed technology may be considered when that technology will be readily available and proven within a period compatible with the project schedule.*

   Time is of the essence in any mixed waste treatment and disposal project. Waste must be treated and disposed before the ever changing regulatory environment requires treatment and disposal in a more time consuming, more expensive, and potentially unavailable manner. Waste treatment methods that are proven, reliable, and currently available often are the same technologies which are economical, commercially prolific, and inherently low risk. Furthermore, DOE complex wide experience has demonstrated that prompt and decisive action is required to solve mixed waste treatment and disposal issues. New and complex treatment methods are not needed for a majority of mixed wastes. Managers of mixed waste programs must utilize the technologies they have available to them today and end their wait for the cure-all technology which is supposedly just around the corner. Mixed waste will never be more easily or economically treated than it can be today.

2. *Commercial vendors shall be utilized to the maximum degree possible. The economic incentives for commercial vendors to develop and market treatment technology must be utilized and cultivated to the maximum extent prudent.*

   Treatment of mixed wastes utilizing applicable hazardous waste treatment technologies occurs regularly in the commercial sector. Commercial vendors are becoming increasingly aware of the mixed waste challenges and opportunities to be found in the government facilities business area. An environment of such opportunity causes commercial vendors engaged in similar work in other business sectors to make their technology and expertise available within the DOE complex. Furthermore, commercial enterprises can be made aware of government sector mixed waste management issues and these commercial enterprises will perform the research and development to solve these issues at their own expense. Commercial sector vendors are assured to be able to perform any research and development more quickly and economically than the government sector. Mixed waste managers must allow commercial enterprise to work to our advantage and never reinvent the wheel.

3. *Treatment and disposal technologies which achieve results above and beyond what is compliant are generally undesirable.*

> In order to be successful, mixed waste managers must focus on compliant treatment and disposal, not technically ideal treatment and disposal. Mixed waste treatment technologies should be evaluated for compliance with RCRA requirements, including Land Disposal Restrictions, with cost and schedule being considered concurrently. Utilizing technology which achieves results above and beyond that which is compliant is generally more costly than those technologies which are simply compliant. Furthermore, technologies that achieve results above and beyond simple compliance are likely to have a longer planning and operational duration.
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> Expanding costs and extending schedules in implementing waste treatment and disposal activities which exceed regulatory requirements are not good business practices and do not represent proper stewardship of public funds.

At the genesis of the FEMP mixed waste program, the total FEMP inventory of mixed waste was divided into groups which could be treated and disposed, or directly disposed, together. These groupings were generally based upon like treatment standards and similar physical matrices. Each individual waste grouping was then defined as a project.

A scope statement is written for each project. This scope statement must define the project as necessary to completely define the established waste grouping, determine what treatment and disposal alternative will be utilized, implement treatment and disposal, and complete all project closure tasks. The scope statement will define these elements of the project in general terms as technical information available at that time in the project permits. Upon completion of the project scope statement, a detailed project schedule is prepared. This project schedule includes all tasks necessary to complete the project as defined in the project scope statement. The project schedule divides the entire project into tasks of sufficiently short duration that monthly schedule updates will demonstrate if the project is behind or ahead of schedule.

Each activity contained in the project schedule is resource loaded. The resources for each task include all project management personnel, support organizations, subcontractors and materials necessary to complete that task. The sum of the costs of all resources for all tasks constitute the project budget, excluding contingencies and management reserve. This budget includes all costs which can be attributed to the project from inception through final close-out. Each project is completely cost self-contained.

Disposal under Case-by-Case Variance to LDR - Debris Rule

On May 14, 1993, the U. S. EPA promulgated the second and final Case-by-Case Variance to the Land Disposal Restrictions (58 FR 28506). This variance applied to hazardous waste which met the definition of debris as published by U. S. EPA on August 18, 1992 (57 FR 37194). U. S.

EPA defined debris as any man-made material or nonindigenous rock or soil which is at least 60 mm in one dimension. U. S. EPA recognized that many waste streams which contain debris also contain other materials which do not individually meet the definition of debris. For these waste streams, U. S. EPA stated that any waste stream which contains a mixture of debris and non-debris is to be managed as debris if the waste stream is primarily debris based upon visual inspection. Within specified limits, hazardous waste which met this definition of debris could be disposed directly to the land without treatment. U. S. EPA required that all individuals who wished to dispose hazardous debris waste under this variance provide to U. S. EPA no later than August 12, 1993, proof that the individual had made a good faith effort to identify treatment capacity for the hazardous debris waste in question. U. S. EPA stated that contact with ten potential treatment vendors would constitute a good faith effort. The May 14, 1993 variance expired on May 8, 1994.

FERMCO published a Commerce Business Daily (CBD) announcement on June 18, 1993 seeking qualified vendors which could supply capacity to treat mixed debris waste in storage at the FEMP. 50 potential vendors responded to the CBD announcement. No qualified vendors were identified. FERMCO utilized the data collected from the various responses to the CBD announcement to document a good faith effort to identify a qualified treatment vendor in a document pursuant to the U. S. EPA rule making of May 14, 1993 (58 FR 28506). This document was approved by the Department of Energy - Fernald Area Office and transmitted to the U. S. EPA on August 9, 1993. An informational copy of the document was also transmitted to the Ohio EPA.

FERMCO identified 368 containers of mixed debris waste which would qualify for land disposal under the aforementioned rule making. All 368 containers were inspected for free liquids using real-time radiography. Containers which held free-liquids were emptied onto a sorting table. All mixed debris waste was placed back into the container from which it was removed and liquid waste removed from the container was placed into storage for disposition as part of the Liquid Mixed Waste Project discussed later in this document.

The mixed debris waste identified for land disposal was divided into two groups for the purpose of sampling, analysis and profiling pursuant to Envirocare of Utah's waste acceptance criteria. These groupings were established based upon the physical nature of the debris waste, the manner in which the debris waste was generated and the potential contaminates of concern present in the waste.

Samples were extracted from a statistically determined number of randomly selected waste containers in each waste grouping by FERMCO hazardous materials workers. These samples were analyzed by a State of Utah certified analytical laboratory. Envirocare waste profiles were completed by FERMCO Hazardous and Mixed Waste Management personnel for each waste grouping based upon the Utah certified data and transmitted to Envirocare for review and approval. Upon approval of these profiles, Envirocare provided FERMCO with a Notice to

Transport (EC-1800). This notice documents Envirocare's approval to ship the waste described on the submitted profile. FERMCO released the first shipment of six total shipments of mixed debris waste to Envirocare on April 12, 1994 and released the sixth shipment on April 21, 1994.

All mixed waste at the FEMP which met the definition of debris and was eligible for disposal at Envirocare was disposed during the aforementioned waste disposal campaign.

Disposal of D018-D043 & F-Listed Waste

On September 19, 1994 (59 FR 48045), U. S. EPA promulgated a final rule establishing the treatment standards for newly identified toxicity characteristic waste. The types of waste referred to are those hazardous wastes carrying waste codes between D018 and D043 inclusive. This rulemaking went on to state that for hazardous wastes carrying these waste codes which also contain radioactive materials, the effective date of the rule is September 19, 1996. Because this final rule does not apply to mixed waste until September 19, 1996, mixed wastes carrying waste codes between D018 through D043 inclusive may be disposed to the land without treatment until that date.

In response to this rulemaking, FERMCO identified all mixed waste carrying only waste codes between D018 and D043 inclusive. As a part of the same campaign, FERMCO identified a population of listed mixed wastes carrying 'F' codes which exhibited concentrations of the RCRA treatment constituent of concern below the established RCRA Land Disposal Restrictions treatment standard. Listed wastes which meet treatment concentration standards without treatment may be disposed as if that waste had been in fact treated. The specific waste streams identified were a D018 through D043 trash waste stream and a cement stabilized F-listed waste stream.

Each container of D018 through D043 mixed waste was examined utilizing real-time radiography. Any container found to contain free liquids was excluded from shipment to Envirocare and re-assigned to the proper mixed waste treatment project.

Samples were extracted from a statistically determined number of randomly selected waste containers in the D018-D043 and F-listed waste streams by FERMCO hazardous materials workers. These samples were analyzed by a State of Utah certified analytical laboratory. Envirocare's waste profiles were completed by FERMCO personnel for each of the two subject waste streams based upon the Utah certified data and transmitted to Envirocare for review and approval. Upon approval of these profiles, Envirocare provided FERMCO with a Notice to Transport (EC-1800). This notice documented Envirocare's approval to ship the waste described on the submitted profile. FERMCO released the first of four total shipments of cement stabilized F-listed mixed waste to Envirocare on March 3, 1995 and released the fourth shipment on March 6, 1995. FERMCO released the only shipment of D018-D043 mixed waste on March 30, 1995.

Liquid Mixed Waste Project

The Liquid Mixed Waste Project encompasses approximately 2,300 containers of mixed liquid waste ranging in size from 5 gallons to 110 gallons. Like the Mixed Waste Stabilization Project and the Mixed Waste Chemical Treatment Project described later in this document, this project is being documented under CERCLA Removal Action 9, "Removal of Waste Inventories." The CERCLA Work Plan for this project was approved by the U. S. EPA and the Ohio EPA prior to the initiation of waste transfer operations. Many of these 2,300 containers hold both liquids and sludges. The liquids will be treated at the K-1435 TSCA Incinerator at the Department of Energy's Oak Ridge facility and will likely be disposed by TSCA Operations. The sludges in these drums will be treated and disposed as part of the Chemical Treatment Project described later in this document.

The TSCA Incinerator accepts liquid wastes in bulk tanker truck deliveries only. For this reason, the subject liquid wastes must be bulked before shipment. Furthermore, the 2,300 containers of waste included in this project represent in excess of 100 separate waste streams generated at different times and by various means, demonstrating that each of these waste streams is within the waste acceptance criteria at the TSCA Incinerator would be cost and schedule prohibitive.

For the purpose of bulking, the various waste streams were divided into compatibility groups based upon information available from the characterization file for each of the various waste streams. Five compatibility groups were identified which encompassed all of the waste streams within the 2,300 container population. In order to assure compatibility of the wastes when actual commingling of the wastes occurs in the field, samples of the various generic types of waste from each compatibility group were secured. These samples were combined in the FEMP analytical laboratory in the same order and ratios in which the actual wastes in the field would be combined. Laboratory commingling of these waste samples and monitoring the commingled waste for possible physical or thermal reactions was performed as per ASTM Method 5058, Standard Test Method A. No physical or thermal reactions were observed in any of the combined waste forms.

In order to combine the five compatibility groups of waste, portable tanks generically known as "Frac Tanks" were rented. A total of six tanks were rented in order to provide one backup tank in the event of a leak or other unplanned occurrence in any of the five primary tanks. The portable tanks are approximately 40 feet in length, 8 feet in width, 11 feet in height, and have a total capacity of approximately 21,000 gallons. Each tank is equipped with a single tandem axle for transport of the tank while empty only. The tanks are also equipped with side and top manways, OSHA compliant stairs and catwalks leading to the top manway, high-level alarms, bottom loading fittings with lockable ball valves, fluid level indicators, and carbon air emissions filters.

The six tanks were field installed within a poly compound inflatable containment system. This poly containment system is physically similar to and resembles a rubber raft. The secondary containment was fabricated of materials resistant to the various wastes to be placed in the portable tanks.

The design of the temporary waste storage area comprised of the six portable storage tanks and inflatable secondary containment was designed to comply with State of Ohio regulations regarding tank systems for storage of hazardous waste. The primary driver from Ohio RCRA regulations for the temporary waste storage area is the capacity of the secondary containment. The secondary containment must have a volume adequate to contain 10% of the total volume of waste stored in the various tanks within the containment or the volume of the largest tank within the containment, whichever is largest, in addition to a 25 year rain event occurring over a 24 hour period. In this project, the volume of the largest tank is the controlling factor.

The transfer of liquid waste is achieved with the use a 2 inch diameter dual diaphragm pneumatically powered pump. All wetted surfaces of the pump are stainless steel and the diaphragms are Teflon. The pump is connected to the bottom loading valve of the tank to which the liquid waste is to be transferred via a 2 inch diameter high pressure Teflon lined and wire reinforced hose. The suction side of the pump is connected via an identical hose to an approximately 48 inch long, 2 inch diameter stainless steel tube with a 1/16 inch stainless steal screen welded over the end of the tube. Each of these hose sets is equipped at each end with stainless steel ball valves and female stainless steel camlock fittings. The temporary storage tanks and pump are equipped with male stainless steel camlock fittings. The transfer of liquid waste is achieved by configuring the hoses in the aforementioned manner, starting the pump, and carefully placing the end of the stainless steel tube into the waste storage container until all liquids within the container have been transferred. All power tools utilized on this project are pneumatically driven and sparkless, all hand tools are sparkless, and all flashlights used are intrinsically safe.

Transfer of liquid phase waste from existing storage containers into portable tanks began on May 1, 1995 and was completed July 19, 1995. Sampling personnel from the Oak Ridge facility sampled Batch 1 pursuant to TSCA Incinerator Waste Acceptance Criteria on May 26, 1995 and Batch 5 on July 25, 1995. As of September 19, 1995, FERMCO has made twelve total tanker shipments of waste to the TSCA Incinerator. The first shipment was released from the FEMP on July 27, 1995 and the twelfth shipment was released on September 19, 1995. The twelve shipments of waste that have been made comprise a total of 165 cubic meters of liquid mixed waste. A total of 123 cubic meters of liquid waste remain to be shipped. Shipment of these liquid wastes is expected to be complete during the spring of 1996. Waste shipments are currently suspended for the winter due to cold weather and resultant thickening or freezing of the waste.

Mixed Waste Stabilization Project

Approximately 1,550 containers, primarily 55 gallon drums, of solid phase waste contaminated with RCRA regulated heavy metals are stored at the FEMP. This waste are being treated onsite utilizing mobile stabilization equipment and disposed at Nevada Test Site.

This project is being documented under CERCLA Removal Action 9, "Removal of Waste Inventories." Documenting this project as a Removal Action allows RCRA regulated wastes to be treated at the FEMP without a RCRA Part B permit for treatment. CERCLA and its implementing regulations, "The National Oil and Hazardous Substances Pollution Contingency Plan," state that actions under CERCLA are not subject to state administrative requirement, i.e. a RCRA Part B permit, in states with an authorized RCRA program, such as Ohio. However, actions under CERCLA are subject to state substantive requirements.

On December 19, 1994 a Commerce Business Daily announcement was published describing the waste to be stabilized, stating that a Request for Proposal for onsite stabilization of the waste described would be available in the future, and requesting that interested and qualified vendors provide a statement of interest to FERMCO. Approximately 70 statements of interest were received.

On April 10, 1995 a Request for Proposal (RFP) for mobile mixed waste stabilization services was transmitted to all respondents to the Commerce Business Daily Announcement. This RFP included descriptions of all waste to be stabilized, including a description of the general physical character of the waste and applicable RCRA waste codes for each waste stream. The RFP also included other documents necessary for a vendor to prepare a proposal, such as the Mixed Waste Stabilization Project approved Project Plan. Proposals were accepted on May 2, 1995 and the stabilization subcontract was awarded on May 30, 1995.

The Ohio EPA stated that their review and approval of detailed equipment drawings and process procedures for this project were necessary before treatment may begin. Many types of stabilization equipment are utilized for the stabilization of hazardous waste. Therefore, the details requested by Ohio EPA can not be provided until a vendor is chosen and the requested information can be submitted to FERMCO by the vendor. After award of the stabilization subcontract to the successful vendor, the vendor has approximately 30 days to submit documentation listed in the RFP to FERMCO, including detailed equipment drawings and operational procedures. This detailed information will be combined with various types of environmental information required in a CERCLA work plan and submitted to the U. S. EPA and Ohio EPA for review and approval. Once approval of the work plan is secured from both agencies, FERMCO will authorize the vendor to mobilize and begin stabilization activities. Stabilized waste will be placed in half height white metal boxes and shipped to the DOE Nevada Test Site for disposal.

The CERCLA Work Plan for the stabilization project, including the engineering mentioned above, was provided to the Ohio Environmental Protection Agency (Ohio EPA) and the U. S. Environmental Protection Agency on September 7, 1995. The FEMP received approval to proceed with stabilization field operations from the Ohio EPA on September 29, 1995. FERMCO authorized the stabilization subcontractor to proceed with mobilization of treatment equipment immediately. FERMCO completed an Operational Readiness Assessment of the Stabilization Project on November 20, 1995 and received DOE-Ohio Field Office permission to proceed with operations on November 21, 1995. The stabilization subcontractor began stabilizing waste on November 16, 1995 and as of February 9, 1996 had stabilized a total of approximately 1100 drums of waste.

Mixed Waste Chemical Treatment Project

This project encompasses approximately 4,000 containers of mixed waste which represent all the mixed waste which will remain in the FEMP mixed waste inventory after completion of the previously discussed projects. The wastes included in this project represent the most challenging wastes to treat at the FEMP. A majority of the wastes in this project will require multiple treatment steps or technologies to achieve compliance with RCRA Land Disposal Restrictions. This project is termed the Chemical Treatment Project because the multiple treatment steps required to treat these wastes will be chemical in nature.

A Commerce Business Daily announcement was published on March 16, 1995 requesting expressions of interest from qualified parties to provide chemical and physical treatment for various types of mixed waste. As of May 30, 1995, 36 responses to the announcement had been received. Responses have been received from well established and proven vendors as well as previously unknown vendors of unknown capability. The expressions of interest received have varied in form from detailed explanations of the vendor's experience and capabilities to simple requests to receive any future Request for Proposal.

Current schedule projections indicate that the Request for Proposal for mobile Chemical Treatment will be issued near the end of February 1996. Completion of the Chemical Treatment Project is scheduled for November 1997.

Treatment flow diagrams for the various waste streams in this project have been developed. Treatment processes with multiple treatment steps for one waste stream are referred to as "treatment trains." Various combinations of the following technologies are anticipated to be necessary:

1. Solvent Extraction - Sludges and Soils
2. Decontamination - Lead Solids
3. Macroencapsulation - Lead Solids
4. Deactivation - Reactives and Oxidizers

5. Neutralization - Acids and Caustics
6. Precipitation - Barium Salts and Mercury Salts
7. Washing - Debris
8. Amalgamation - Elemental Mercury
9. Chemical Oxidation - Waste Waters

CONCLUSIONS

Remove Historic Barriers to Success: Mixed waste can be managed compliantly, effectively and economically in a timely manner. Do not allow the traditional reasons why mixed waste can not be treated and disposed prevent project progress. Barriers to successful management of mixed waste are usually issues of perception, not fact. Aggressively remove barriers to success.

Utilize Technology Which Exists: Utilize mixed waste treatment technology which is proven, reliable and currently available. Technology exists to treat and dispose most mixed waste streams. Avoid spending time and money on developing new technologies or further researching existing technologies. Do not accept the "not invented here" argument. Implement mixed waste treatment projects utilizing current technology now. If an option exists; use it. Mixed waste treatment is cheaper now than it will ever be again.

Take Advantage of Commercial Sector Resources: Utilize subcontractors to treat waste whenever possible. The private sector recognizes their potential for profit if they can solve the DOE complex's mixed waste challenges. Allow subcontractors to absorb the cost of research, development, equipment procurement, and process risk. Take advantage of commercially proven expertise in waste treatment. Do not perform work in house that someone else can do for you cheaper, faster and better.

Be Compliant, Not Perfect: Plan treatment and disposal projects which achieve compliance, not the perfect solution. The ideal or most advanced technology to treat waste is not necessary. Use the quickest, most economical, safe and compliant treatment and disposal option available.

Projectize the Work: Divide your total inventory of waste into manageable portions that have a beginning and an end. Determine the scope, schedule and budget for the work. Assign responsibility, authority, accountability, and resources. Everything has a beginning. Everything has an end. What is not on the line is irrelevant. Get on the line. Start now. Finish!

Take Action: If waste can be disposed without treatment; dispose it. Determine what compliant treatment is available for waste requiring treatment and aggressively move forward to accomplish that treatment. Take advantage of regulatory latitude. Do not wait for new technology. Tomorrow never comes. Move forward today. Their is no excuse for failure to act on available treatment and disposal options. Start! Finish!