

CONF-970335-32

PRESIDENTIAL RAPID COMMERCIALIZATION INITIATIVE
FOR MIXED WASTE SOLVENT EXTRACTION

BY

Larry Honigford, Dan Dilday, and Dennis Cook*
John Sattler, DOE-FEMP

Fluor Daniel Fernald, Inc.*
Fernald Environmental Management Project
P.O. Box 538704
Cincinnati, OH 45253

For Presentation at the
Waste Management 1997
Tucson, Arizona
March 2 - 7, 1997

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

Portions of this document may be illegible
in electronic image products. Images are
produced from the best available original
document.

DISCLAIMER

PRESIDENTIAL RAPID COMMERCIALIZATION INITIATIVE FOR MIXED WASTE SOLVENT EXTRACTION

Authored by Larry Honigford, Fluor Daniel Fernald
Dan Dilday, Fluor Daniel Fernald
Dennis Cook, Fluor Daniel Fernald
John Sattler, DOE-FEMP
FDF with the U.S. Department of Energy,
under Contract No. DE-AC24-92OR21972

Disclaimer

This technical information was prepared as an account of work sponsored by an agency of the United States Government. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions or authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof, or Fluor Daniel Fernald, its affiliates or its parent companies.

ABSTRACT

The challenge of treating mixed waste at the Fernald Environmental Management Project (FEMP) is being answered through the implementation of numerous Federal programs and initiatives. The Department of Energy (DOE) complex has long been challenged by the difficult prospect of treating mixed waste generated through the production of nuclear materials for the United States defense programs. Until recently, the only answer to mixed waste treatment was storage and await the solution. But recently, the FEMP has made some major steps in mixed waste treatment which have taken it closer to meeting final remediation goals. The steps include the use of vendor provided transportable treatment services in coordination with available treatment and disposal outlets.

However, one major hurdle remains for the FEMP mixed waste treatment program, and that hurdle is tri-mixed waste. "Tri-mixed" is a term coined to describe low level waste containing RCRA hazardous constituents along with polychlorinated biphenyls (PCB). The prescribed method for disposal of PCBs is incineration. In mixed waste treatment plans developed by the FEMP with public input, the FEMP committed to pursue non-thermal treatment methods and avoid the use of incineration. The FEMP then began the task of identifying non-thermal treatment processes, which are rarely preferred by industry to incineration, to treat organic and PCB waste.

To locate potential treatment technologies, the FEMP searched numerous

informational sources including the Environmental Protection Agency (EPA) Superfund Innovative Technology Evaluation (SITE) Program. Through the SITE Program, the FEMP identified a non-thermal treatment technology which uses solvents to extract PCBs. The technology belongs to a small company called Terra-Kleen Response Group, Inc. A question arose as to how can this new and innovative technology be implemented by a small company at a Department of Energy (DOE) facility. The answer came in the form of the Rapid Commercialization Initiative (RCI) and the Mixed Waste Focus Area (MWFA). RCI is a program sponsored by the Department of Commerce (DOC), DOE, Department of Defense (DOD), U.S. EPA and various state agencies to aid companies to market new and innovative technologies. The MWFA was looking for new innovative treatment technologies for mixed waste treatment. The goal of implementing the technology at the FEMP also met the objectives of both programs and a team was born. Now the FEMP is in the midst of implementing the technology in the field and is doing this through the cooperative efforts of RCI, MWFA, DOE-FEMP, Terra-Kleen Response Group Inc., and Fluor Daniel Fernald.

INTRODUCTION

The current plans to treat the FEMP's 12,000 containers of mixed waste inventory began in October 1994. Prior to that the FEMP's original plan, as many other DOE sites, lay in the hope that some other facility would create the cure-all for the mixed waste treatment problem. Little was being done to develop mixed waste treatment capacities and mixed waste simply continued to accumulate and was placed in storage for an indefinite period of time. Then by urging of the states, Congress passed the Federal Facility Compliance Act (FFCA). The FFCA, in part required each federal facility with mixed waste to develop plans to manage their mixed waste and develop treatment capacities. The EPA provided temporary relief to the federal facilities from the land disposal restriction regulations through case-by-case extensions to land disposal restrictions. The plans were documented in the Site Treatment Plan (STP) which required state approval by October 6, 1995. The FEMP STP was developed through a formal process which required state and public input before approval could be obtained. The FEMP STP was approved on October 4, 1995 and included an extensive list of schedule milestones with final treatment to be completed by September 2001.

The FEMP STP identified the use of the Toxic Substances Control Act (TSCA) Incinerator to treat liquid organic waste streams, the FEMP Wastewater Treatment System (WWTS) for aqueous waste streams, and the use of vendor provided mobile/transportable units for treatment of the remaining inventory. Having treatment systems brought to the site answered the problem of a limited number of permitted facilities for acceptance of mixed waste. Use of mobile services also met the FEMP mixed waste treatment needs and addressed stakeholder concerns without establishing more permanent treatment facilities at the site. More

permanent facilities would have a short required life span, require remediation after use, and be expensive to establish. Finally, because the FEMP is a Comprehensive Environmental Restoration Compensation and Liability Act, as amended (CERCLA) National Priorities List (NPL) site, RCRA permits for treatment units would not be required (treatment will be authorized as part of a CERCLA Removal Action, and use of the mobile treatment processes on-site could be easily established.

Even with these plans in place, the FEMP was still faced with the challenge of tri-mixed waste. Tri-mixed waste contains radiological, Resource Conservation and Recovery Act, as amended (RCRA), and TSCA regulated contaminants. The liquid tri-mixed waste was easily dispositioned through the TSCA Incinerator. However, the FEMP also has tri-mixed waste in the solid form including debris, soils, and sludges. The problem was the lack of permitted facilities available to accept tri-mixed waste in a solid form. The specified technology for treatment of PCBs under TSCA is incineration. Incineration could not be brought to the site per the public input provided during the STP development. An alternative treatment to incineration could be utilized but required EPA approval, a process estimated to take up to 18 months. Development of an alternative technology was not desirable for the FEMP due to time constraints and associated cost.

TECHNOLOGY SEARCH

The task was to identify an existing alternative treatment technology to incineration for the FEMP's tri-mixed waste. The search focused on the identification of a non-thermal treatment technology, which was approved or could easily be approved for treating PCBs, was transportable so that it could be brought on-site, and could treat other RCRA hazardous constituents in addition to PCBs.

The search began with a notice published in the Commerce Business Daily requesting qualifications and capabilities from vendors expressing interest in the treatment of a number of FEMP mixed waste categories. These categories included PCBs, corrosives, barium salts, reactives, oxidizers, debris, soils, and sludges. Responses to the announcement indicated that solutions for many of the waste categories existed and could be implemented at the FEMP. However, none included acceptable non-thermal treatment for tri-mixed waste. As a result, the FEMP continued its technology search to answer the tri-mixed problem.

The search continued with evaluations of technologies from the EPA SITE program. The SITE program was established by the EPA in 1986 and was tasked with the purpose of demonstrating and evaluating innovative treatment technologies that may significantly reduce the toxicity, mobility, or volume of hazardous waste. The SITE program studies technologies to develop reliable performance and cost information for use in evaluating cleanup alternatives to be used at other contaminated sites. The FEMP's search focused on technologies that were past the developmental stage and had proven successful in the field.

Several potential technologies were identified, but the Terra-Kleen Solvent Extraction Technology proved the most desirable for the FEMP needs. The Terra-Kleen Technology was first evaluated by the SITE program in October 1993. The technology focused on remediation of PCB contaminated soils as a cost effective alternative for large scale soil remediation projects. The technology is a batch system process that uses a non-toxic proprietary solvent selected to remove targeted organic contaminants. The "spent solvent" is then recovered through a solvent recovery unit where solvent is separated from contaminants and reused in the process.

Upon further inquiry, the FEMP discovered that Terra-Kleen had applied for and received approval for the solvent extraction technology as an alternative technology to incineration for treatment of PCB wastes from the EPA Office of Pollution Prevention and Toxics. The technology has been implemented full scale, at U.S. Navy sites treating soils with PCBs and pesticide contamination. The process treats PCBs to concentrations below 2 parts per million, which is required to meet the TSCA criteria for the alternative technology approval.

With this discovery, the FEMP had identified the ideal technology for its tri-mixed waste. However, the technology to this point had only been treating PCB and pesticide contaminated soils. Treatability studies were performed by the FEMP that indicated that organic contaminants can be significantly reduced even in oily sludges. However, the FEMP waste included debris, oily sludges, and soils, which included a wider variety of RCRA contaminants for which the technology had not been tested. This would require a demonstration phase prior to full scale initiation of the technology. Terra-Kleen, a small company, did not have the funding and resources to perform a demonstration of their technology at a DOE Facility. They needed assistance which came from the Presidential Rapid Commercialization Initiative (RCI) and the Mixed Waste Focus Area (MWFA).

TECHNOLOGY IMPLEMENTATION

The FEMP approached members of RCI for assistance in establishing the Terra-Kleen Solvent Extraction Technology on-site. RCI developed a team of Federal agencies to assist in establishing the technology demonstration at the FEMP. A major part of that team was the MWFA, which backed the plan by providing funding in the hope that a successful demonstration would establish that the technology could be applicable in other DOE Facilities. RCI is comprised of DOD, DOC, DOE, U.S. EPA, and various states agencies. The U.S. EPA and state agencies serve as third party verifiers which oversee the demonstration.

RCI was put in place December 1994 and was set forth as the President's national environmental strategy to aid companies with innovative environmental technologies. It is designed to take proven technologies that have never been used in federal cleanups and partnering the companies with federal facilities to

demonstrate the technology. After successful demonstration, the RCI would assist the company to overcome barriers and successfully market those technologies.

RCI has two short-term goals to achieve its directive. The first is to provide services to companies to address the three key barriers to establishing a technology which are: a) assist in identification of appropriate sites for demonstration/testing of the technologies b) assist in verification of performance and cost of the technology, and c) assist in facilitating and expediting permitting. A proposer for a technology may request assistance in any one, two, or all of the three barriers. The second goal is the identification of other barriers such as unpredictable commercialization pathways, improving market data, and streamlining regulations and processes to meet the goals of the initiative. This information will be used for future consideration and planning relative to the long term goal of RCI to reduce those barriers.

Eligible technologies must be ready for implementation, because technology development is not within the scope of RCI. Also, the lead of the responding team must be a private business with the capacity to commercialize the technology. However, other types of organizations can be part of the respondents team and teaming arrangements, like the one in place at the FEMP, are encouraged.

Under the initiative, a developer pays the cost of a technology demonstration, and the DOE assists in the preparation and funding for the demonstration's Health and Safety plans, procedures, and engineering staff. The RCI program does not provide funding, but relies on the collaboration between federal agencies and allows officials from a number of participating states to oversee results. If a developer wins approval from a project team representative, it can implement a technology in those participating states without going through separate demonstrations. The implementation of the technology is the first test of a program to expedite use of a new technology on a multi-state level.

The Mixed Waste Focus Area was crucial in supporting the establishment of the technology at the FEMP. The Mixed Waste Focus Area was created by the DOE Headquarters in 1993 to develop and facilitate implementation of technologies to meet commitments made under the Federal Facility Compliance Act to treat mixed waste. The goal of the MWFA is to develop mixed waste treatment systems to the point of implementation. The goal is to be accomplished in three steps. The first two are identification of treatment deficiencies and prioritization of treatment needs.

The identification of treatment deficiencies was performed by visiting DOE sites and review of each facility's STP. Through this the MWFA identified the primary treatment needs of the DOE complex and categorized those needs. Step two was the prioritization of these needs, which is a three phase process. Phase I was prioritization of the treatment process flows. Phase II was the prioritization of the

technology needs associated with the project flows. Phase III combined the two prioritization efforts to develop a final list of priorities. The third step uses the information from the first two steps to develop a technical baseline. The Technical Baseline Development Process integrates the treatment needs with the research and technology development activities supported by the MWFA. This approach made the focus group the integrator between the DOE sites so that treatment development would be a cost-effective team effort.

ABOUT THE TECHNOLOGY

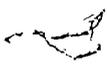
The Terra-Kleen solvent extraction technology was chosen as a qualified technology to demonstrate through RCI. The Terra-Kleen solvent extraction technology was developed to treat soils contaminated with PCBs and other organic constituents. The technology uses a proprietary extraction solvent at ambient temperatures to extract organic contaminants from waste media to a liquid phase. The solvent containing the contaminants is then filtered and passed through a solvent purification unit to reclaim the solvent and remove the contaminants. The recovery process can recycle as much as 90 percent of the solvent. The reclaimed solvent is then returned to the process to perform additional extraction. The solvent extraction process is repeated until the desired cleanup levels are attained.

At the FEMP, the Terra-Kleen technology will be used to extract PCBs and RCRA regulated organic compounds from three basic types of low-level radioactive mixed waste media: soils, sludge, and debris. The media will be treated in a two-step process consisting of vapor extraction to reduce elevated levels of moisture and volatile organic compounds, followed by solvent extraction to remove the remaining organic constituents and PCBs to meet RCRA Land Disposal Restrictions levels and disposal facility waste acceptance criteria, and reduce PCB levels to less than 2 parts per million. Use of the Terra-Kleen technology provides the FEMP with the ability to use transportable treatment units to perform on-site treatment as required by the FEMP Site Treatment Plan and meet stakeholders' requests to avoid incineration.

The project will be performed in three phases. Phase I is preparation of documents and work plans for regulatory agency approval and for implementation in the field. Phase II is the demonstration phase of the technology. The FEMP has chosen approximately 6 cubic meters of tri-mixed consisting of three waste streams representing the three matrices of waste; sludges, soils, and debris. Phase III will begin after successful demonstration and will include full scale treatment of the remaining organic contaminated mixed waste inventory at the FEMP.

STATUS

Currently, the project is in Phase I. A Work Plan detailing the project has been submitted to the Ohio EPA and U.S. EPA for review and approval. The facilities



where the treatment will be performed has been modified for the technology's specific needs. The demonstration is scheduled to begin in March 1997 and full scale treatment could begin as early as April 1997. The results of the demonstration will be evaluated prior to full scale operations. The evaluation will determine if there is a need for any modification of the system. Based on the results, the project will progress to full scale and treatment will be performed on the remaining waste inventory of approximately 1500 drums of mixed and tri-mixed waste.

Following extraction, the solid residues will be stabilized via cement stabilization, sampled and analyzed to ensure compliance with land disposal restrictions and disposal facility waste acceptance criteria, then shipped for disposal at a permitted disposal facility. The extracted contaminants and waste solvent will be bulked in on-site tanks, sampled and analyzed for acceptance at the TSCA Incinerator, then transferred to tank trucks and shipped to Oak Ridge for incineration.

CONCLUSION

The FEMP has successfully utilized numerous Federal programs and initiatives to address complex environmental cleanup requirements. Implementation of this technology will expedite the schedule for completing treatment under the STP by up to two years. Completion of the mixed waste treatment will also aid the overall goals for FEMP remediation as outlined in its 10-year cleanup plan which began in 1995. By removing waste inventory from the site, the need for buildings used for waste storage is minimized and additional facilities can be decommissioned and dismantled earlier than previously thought.

Several Federal agencies, departments, initiatives and programs have come together to aid the FEMP to meet cleanup objectives and schedules. The FEMP has used the RCRA Superfund Innovative Technology Evaluation (SITE) Program to identify alternative treatment technologies, for meeting remediation goals. The RCI program provides assistance in direction and coordination; the MWFA for funding and support; Terra-Kleen for technology and technical expertise; and the DOE-FEMP and Fluor Daniel Fernald to oversee and coordinate efforts in the field.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
