PNNL-11839
UC-900

Final Project Report

CRADA with Onsite*Ofsite and Pacific Northwest National Laboratory (PNL-058):

Utilization of the TEES Industrial Onsite Demonstration Unit

D.C. Elliott

February 1998

**Prepared for U.S. Department of Energy
under Contract DE-AC06-76RLO**

**Pacific Northwest National Laboratory
Operated for the U.S. Department of Energy
by Battelle**

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Utilization of the TEES Industrial Onsite Demonstration Unit

Objective

The objective of this CRADA was to get the Industrial Onsite Demonstration Unit out into industry's hands so that the Thermochemical Environmental Energy System (TEES®) technology could be seen and operated by the potential users. The Unit was to be operated in industrial settings with the help of the industrial participants. The Unit also functioned as a showpiece in marketing TEES. This CRADA provided the framework in which Onsite*Ofsite, Inc. (O*O) could use the Unit in cooperation with Pacific Northwest National Laboratory (PNNL) to demonstrate and market the technology in concert with the U.S. Department of Energy (DOE).

Summary of Activities Performed

With the signing of the CRADA in May 1994, PNNL placed an announcement of the demonstration project in the Commerce Business Daily seeking industrial partners. Only one good contact of an actual industrial user was made through this effort and that application turned out to be a technical mismatch. During the initial months of the CRADA (summer 1994), O*O attempted to place the Unit for demonstration purposes. One potential site, McClellan Air Force Base, actively sought to have the Unit placed for treatment tests of groundwater contaminated with chlorohydrocarbon solvents. However, as the formal commitment point approached, the funding for the tests disappeared, as did the interest of the Air Force in the technology.

The Industrial Onsite Demonstration Unit underwent initial demonstration testing from September to December 1994. Simulated wastes were tested under the sponsorship of Onsite*Ofsite, Inc. at their Duarte, California, facility. Three tests were done with two different catalyst charges. The tests each lasted for several days and each involved a different model solution for the feedstock. Deficiencies in flow monitoring and temperature control were rectified early on in the tests, and the Unit provided good operability throughout the tests. Analytical support provided in the unit proved adequate to monitor the progress of the operation. The level of operator expertise increased during the tests. Careful control of process flowrates to match catalyst activity was underscored as a critical operating parameter. Complete analysis of the feedstocks was a crucial factor which was reconfirmed as needing careful attention in processing tests. PNNL provided assistance with equipment startup, analysis of products and catalysts, and assessment of processing results.

Following the tests, a number of food processing waste initiatives were made. O*O and PNNL attended a potato processor meeting in Idaho to present the technology, but state support for the proposed demonstration test was not forthcoming. PNNL made presentations at two food processor conferences in the Spring of 1995 to attempt to generate interest in the technology and initial tests were made with some food processing waste stream samples.

Through PNNL efforts, a consortium of brewers was arranged to discuss demonstration of the technology. But, in early June 1995, a DOE order was received to break off cooperation with food processors and to concentrate on chemical manufacturing wastes.

Since that time, contacts with chemical manufacturers have not progressed to the demonstration stage. O*O contacts have included several companies with potential waste disposal applications; two of which sent samples to PNNL for batch reactor tests. In both cases, significant concentrations of inorganic components in the wastes in the presence of low levels of organics precluded process development past the batch reactor stage. Continuous flow reactor tests would have required preconditioning of the wastes to remove the inorganics and such preconditioning was judged uneconomical in light of the limited amount of organic feedstock. O*O pursued an advertising campaign through the first year of this CRADA in an attempt to elicit industrial interest in the technology. They responded to many requests for additional information but no other cooperations were arranged. The mobile unit was transported by O*O to several sites for display and inspection by potential users, but no demonstrations were arranged.

PNNL contacts with chemical manufacturers have included a range of activities. An ongoing cooperation with one manufacturer finally came to an end after much laboratory testing and process development when the process costs were judged by the user to be noncompetitive. Progress on a second cooperation also progressed through laboratory testing and process development but is now on hold as it is being considered as part of a larger process redesign effort. A third cooperative effort has progressed in one application through batch reactor testing but the application is outside the U.S. and funding for the demonstration is not available; other applications within the same company are being explored. A PNNL presentation was made to over 30 industrial representatives at the Center for Waste Reduction Technologies, an association within the American Institute of Chemical Engineers. A cooperative project proposal was accepted and considered by 9 companies, and one still remains interested, but no testing has begun. A PNNL preproposal remains before the Chemical Industries Environmental Technology Projects, an association of major chemical manufacturers, but no near-term progress toward a demonstration of the technology is expected.

Significant Accomplishments

- The Industrial Onsite Demonstration Unit was operated, albeit only in the CRADA partner's shop. The unit was shown to be functional and the technology useful for conversion of organics in wastewater to a medium-Btu fuel gas.

- Many industrial contacts were made which may lead to future cooperations or research agreements. The technology is an innovative way of treating organics in wastewater which will require additional marketing effort to convince industry of its utility.

Significant Problems

Industrial collaboration never progressed to the point of placing the Unit at an industrial site for a demonstration. The elimination of half the target audience (food processors) by DOE edict at the midpoint of the CRADA, made much of the ground work laid by that point meaningless. Focus of the research on the chemical manufacturing industry concentrated the effort on a smaller target. The target industry appeared to have the more near-term potential with a more knowledgeable user; however, the audience also seemed to be less receptive to this innovative technology.

The limited resources of O*O were not enough to make a sufficient effort in marketing the technology to the point of demonstration. Other than published advertisements, their efforts were mostly limited to the Southern California area which is undergoing an economic slowdown. O*O's industrial contact base had been developed primarily in the food processing industry while the program was shifted at the midpoint to concentrate only on the chemical manufacturing industry. At that point, marketing of the technology and the demonstration program fell primarily to PNNL.

DOE/Laboratory Benefits Realized

A new waste reduction/pollution prevention technology was presented to a large number of industrial parties in the food processing industry and in the chemical manufacturing industry. Laboratory expertise was made known and relationships initiated. These relationships may serve as the basis for future cooperative research efforts.

Our understanding of the catalytic gasification technology was expanded through initial testing of a number of potential waste streams. 55 batch reactor tests and 10 continuous reactor tests were made in the laboratory in anticipation of onsite demonstrations. Each of these was a learning experience for the researchers in the project.

We learned details of waste treatment requirements within a number of food processing and chemical manufacturing product lines. 7 plant visits were made by PNNL staff to see first hand the processing requirements.

Industry Benefits Realized

A new waste reduction/pollution prevention technology was presented to a large number of industrial parties in the food processing industry and in the chemical manufacturing industry. Although they did not take the next step of trying an actual demonstration of the technology, at least the basic understanding of the technology was presented to them. The CRADA partner also holds the license for the technology and has received invaluable exposure through our efforts. Although no sales have yet been closed and the project did not progress as far as expected in demonstration of the technology, the basis has been laid for future commercialization. O*O now has first-hand experience in operating the process equipment.

Recommended Follow-on Work

Market resistance to this technology may indicate that it is ahead of its time. Continued industrial interactions are needed to make an initial breakthrough with the technology. Testing of actual waste stream samples from interested industrial parties should be undertaken. Other DOE programs such as the Alcohol Fuels Program should consider the application of this technology to its wastewater treatment requirements.

Potential Benefits from Pursuing Follow-on Work

Economic assessments of this technology suggest that it is competitive with other waste disposal technologies, but it remains untested and, therefore, a higher risk option. Continued pursuit of an industrial demonstration of this technology is important to facilitate a market breakthrough.

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