MSE-16

DOE/ID/12735--T37

PROJECTS AT THE WESTERN ENVIRONMENTAL TECHNOLOGY OFFICE

Quarterly Technical Progress Report
July 1 - September 30, 1995

Prepared by

MSE Technology Applications, Inc.
P.O. Box 4078
Butte, Montana 59702

Prepared for

U.S. Department of Energy
Under Contract No. DE-AC22-88ID12735

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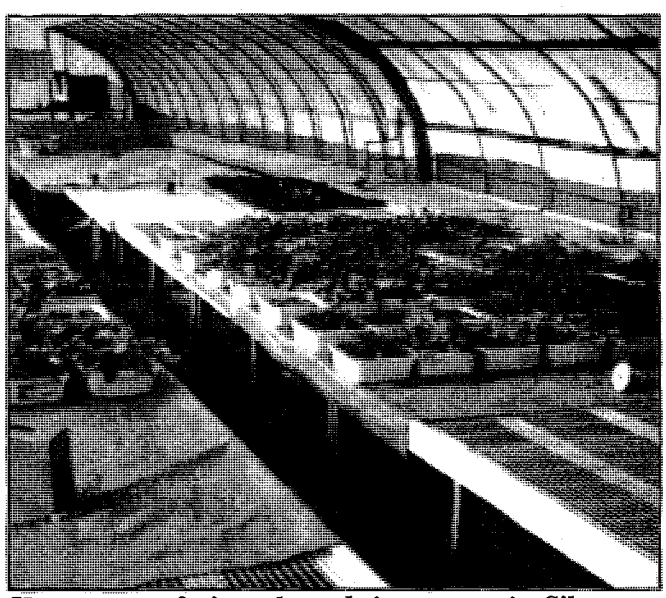
BIOMASS REMEDIATION PROJECT

The goal of this project is to demonstrate the technical and economic feasibility of commercializing a biotechnology that uses plants to remediate soils, sediments, surface waters, and groundwaters contaminated by heavy metals and radionuclides. This technology, known as phytoremediation, is particularly suited to remediation of soils or water where low levels of contaminants are widespread. Project objectives are to provide an accurate estimate of the capability and rate of phytoremediation for removal of contaminants of concern from soils and groundwaters at Department of Energy (DOE) sites and to develop data suitable for engineering design and economic feasibility evaluations, including methods for destruction or final disposition of plants containing contaminants of concern.

The bioremediation systems being evaluated could be less expensive than soil removal and treatment systems, given the areal extent and topography of sites under consideration and the investment of energy and money in soil-moving and -treating processes. In situ technology may receive regulatory acceptance more easily than ex situ treatments requiring excavation, processing, and replacement of surface soils. In addition, phytoremediation may be viable for cleanup of contaminated waters, either as the primary treatment or the final polishing stage, depending on the contaminant concentrations and process economics considerations.

Technical Accomplishments

Field tests of metals (cadmium and zinc) hyperaccumulating plants at the Silver Bow Creek Superfund site were conducted during the summer months of FY95. The test species were transferred from a local greenhouse to the Silver Bow Creek test plot in late June. In early July, the test plot flooded, and over two-thirds of the plants were destroyed. Following this, the same species were planted in soils from the test plot and grown in a local greenhouse starting in mid-July. The surviving plants at the field test plot were harvested in late August and are being analyzed for metals. Plants grown in the greenhouse tests reached maturity in mid-September, were harvested, and were prepared for analysis. Laboratory data needed to evaluate test program results will be available during the first quarter of FY96.



Hyperaccumulating plants being grown in Silver Bow Creek site soils.

Evaluation of cesium and strontium plant uptake from soils continued at the Idaho National Engineering Laboratory (INEL) Test Area North (TAN) during the fourth quarter. Selected plant species that were started in a local greenhouse were transferred to the TAN test plot in early August. The plants reached maturity and were harvested in late September. Laboratory analysis of harvested plant biomass and soils from the test plot is underway.

On-site testing of rhizofiltration technology was conducted by Phytotech, Inc., an MSE subcontractor, at a DOE site in Ashtabula, Ohio. Phase I testing focused on demonstrating the mass transfer of uranium from a wastewater stream into the roots of hydroponically grown terrestrial plants. Although complete analytical data is not yet available, preliminary Phase 1 test results indicate the objectives were successfully achieved. Uranium concentrations in plant roots were greater than 200 parts per million (ppm), and uranium concentrations in water were reduced to levels below regulatory standards (.03 ppm).

Hyperaccumulating plants being grown at the INEL TAN.

The U.S. Department of Agriculture/National Soil, Plant, and Nutrition Laboratory's hydroponic screening of potential radionuclide and heavy metals accumulating plant species was performed using solutions based on soils found at the Silver Bow Creek and INEL test sites. Findings from this work were incorporated into the field tests at these sites and are being used for planning of future tests and demonstrations of phytoremediation.

Testing Accomplishments

The field portions of studies to evaluate plant uptake of zinc and cadmium from the Silver Bow Creek Comprehensive Environmental Response, Compensation, and Liability Act site and studies of cesium and strontium uptake in plants growing in INEL TAN site soils were completed in the fourth quarter.

Phase 1 testing of rhizofiltration technology for removal of uranium from water is nearing completion at the DOE site in Ashtabula, Ohio.

Major Events

A paper on phytoremediation and the Biomass Remediation Project was presented at an American Chemical Society technical conference on emerging remediation technologies held in Atlanta, Georgia, on September 17-20, 1995.

Plans/Projected Activities

Biomass Remediation Project activities planned for the first quarter of FY96 include:

- completing laboratory analysis, evaluation of data, and preparation of draft reports on metals uptake in plants at the Silver Bow Creek site and radionuclide uptake in plants grown in soils at the INEL test site;
- completing laboratory analysis, evaluation of operational and analytical data, and preparation of a draft report on Phase 1 rhizofiltration technology tests at the Ashtabula, Ohio, site;
- finalizing the Phase 2 test plan and initiating Phase 2 rhizofiltration testing at the Ashtabula, Ohio site; and
- publishing reports summarizing the findings of studies on uptake of metals by aquatic plants.

DEVELOPMENT OF AN AIR-SPARGING OPTIMIZATION MODEL PROJECT

The project goal is to develop a user-friendly decision tool that will have two capabilities in the planning and implementation of the air-sparging technology: 1) use site- and contaminant-specific data to determine the applicability of the use of air sparging for a particular remediation scenario, and 2) analyze operating data from existing air-sparging systems and evaluate the performance of the systems based on factors such as removal effectiveness and operating efficiency.

Technical Accomplishments

The final version of the document from Parson Engineering Science outlining the work they completed regarding the literature and model review was received.

The conceptual decision tool with example templates and scenarios for this tool was received and represents the third milestone deliverable transmitted to DOE Headquarters.

Plans/Projected Activities

Development of an Air-Sparging Optimization Model Project activities planned for the first quarter of FY96 include:

- receiving a document outlining the work that was accomplished to initiate development of the conceptual decision tool;
- completing the software design of the conceptual decision tool; and
- completing the development of the prototypic user interface for the conceptual decision tool.

EVALUATION OF SOIL SAW PROJECT

This project addresses issues relative to the progress to date for developing the vertical soil saw and the horizontal emplacement tool. The objective of this project is to evaluate the vertical and horizontal technologies that are being developed by Haliburton. Evaluation of these technologies will focus on progress to date, performance, technical issues, cost for deployment, and the applicability of the technology at DOE sites. This evaluation will also include an assessment of the types of DOE sites where the technology should be considered for deployment and the sites where it is not applicable.

There are two tasks included under this project: 1) completing evaluation of the testing of the three horizontal tools, and 2) evaluating the vertical and horizontal soil saw technologies.

Plans/Projected Activities

Evaluation of Soil Saw Project activities planned for the first quarter of FY96 include:

- following the contacts presently in place and using DOE contacts and consulting subcontracts to obtain the required information; and
- drafting the evaluation report for the vertical and horizontal soil saws.

HEAVY METALS-CONTAMINATED SOIL PROJECT

Removal of fine-grained radioactive contaminants from soils is an environmental restoration problem common to many DOE sites. For this project, conventional mineral processing technologies were tested for use as fine particle recovery tools.

The benefits afforded by the proposed soil treatment systems include: 1) reduced remediation cost, 2) decreased volume of contaminants requiring disposal, and 3) availability of a developed technology.

MSE was funded by the DOE-Office of Technology Development (OTD) to oversee a test program consisting of two phases—an initial phase using clean soils spiked with nonhazardous metallic surrogates for plutonium and a second "hot" testing phase to be conducted at the University of Nevada-Reno's (UNR) MacKay School of Mines.

The initial surrogate test phase was conducted in Butte, Montana, at the Mineral Research Center. MSE provided test direction and engineering support and analytical services.

MSE subcontracted UNR to modify an existing laboratory at the university to support the second phase, which evaluated the capabilities of technologies to effectively and economically remove heavy metal contaminates (specifically plutonium and uranium) from soil. In addition to providing the facility to conduct the testing, the UNR characterized the soils to be tested and provided support during testing.

Plutonium- and uranium-contaminated soil for the second-phase effort was provided by Fernald Environmental Management Project, Los Alamos National Laboratory (LANL), the Hanford Site, INEL, and the Mound Plant. Soil sample analysis was performed at the Environmental Protection Agency's (EPA) National Air and Radiation Environmental Laboratory under an EPA/DOE interagency agreement.

The technologies tested during the second phase and the organization demonstrating the technologies were:

Denver automated flotation cell; UNR
tall column flotation; UNR
Knelson centrifugal concentrator; UNR
air-sparged hydrocyclone; Advanced Processing Technologies, Inc.
Campbell centrifugal jig; Trans Mar, Inc.
SEPOR air classifier; U.S. Naval Academy
high-gradient magnetic separator (HGMS); LANL

All technology demonstrations were performed at the UNR with the exception of the HGMS, which was conducted at LANL. The UNR sent soil samples to LANL for testing through the HGMS system.

All testing was completed by October 31, 1994.

Major Events

Project closeout was completed. Department of Energy equipment was inventoried by UNR, and appropriate forms were submitted to MSE; disposition of the equipment was accomplished through the Nevada Test Site. The UNR contract performance period was completed, and the contract was closed.

INDUSTRIAL WASTESTREAM POLLUTION PREVENTION PROJECT

In May 1994, MSE met with U.S. Army Corps of Engineers' Construction Engineering Research Laboratory (CERL) representatives to discuss potential projects for industrial wastestream remediation and minimization. The potential projects were development and demonstration of alternative technologies to treat Watervliet Arsenal's (WVA) flexible manufacturing system and development and demonstration of a technology to treat chromatic and other acidic wastestreams.

The 11 WVA projects that are planned, are in progress, or have been completed by MSE are listed below.

Project 1: Manufacturing Operation Oil Waste—MSE will provide engineering services, construction oversight, and technology testing services for selecting, designing, and testing a full-scale unit that will address fluid management and waste minimization concerns of the metal-working fluids (coolants) for the flexible manufacturing system and other machining facilities at WVA.

This project was divided into four phases: 1) selection, installation, and evaluation of a metal-working fluid management system at the flexible manufacturing system; 2) installation of a reverse osmosis system, which was purchased by CERL; 3) selection, installation, and evaluation of an oil-water separation technology at the flexible manufacturing system; and 4) selection and installation of two to three reverse osmosis units at other machining facilities at WVA.

Modifications to the original Scope of Work were made during the 4th quarter of 1995. Due to the effectiveness of the Santech Pioneer Coolant Recovery system, an oil-water separation system may not be required. Watervliet Management would like to install another Santech Pioneer Coolant Recovery system in Building 25. Due to limited funding, the cost to install the reverse osmosis system in the flexible manufacturing system, and the WVA Management decision to install another Pioneer system in Building 25, there will be no funding available to purchase an oil-water separation technology or another reverse osmosis system.

Project 2: Treatment of Chromium Wastestreams using Sulfate-Reducing Bacteria—MSE will demonstrate, at bench-scale, a bioreactor system to treat chromium-containing wastewaters with sulfate-reducing bacteria. The primary objective of the sulfate-reducing bacteria project will be to mitigate the hexavalent chromium-contaminated wastewater from WVA. A bioreactor system, in which hexavalent chromium-contaminated water will be treated, will be designed, constructed, and evaluated to achieve this objective.

Secondary objectives of the sulfate-reducing bacteria project are to evaluate the treatment system primarily for technology effectiveness and cost effectiveness.

Project 3: Instrument and Process Control Upgrade-Industrial Waste Treatment Plant—MSE will review an architectural and engineering firm's preliminary design of the instrumentation upgrade for the Industrial Waste Treatment Plant; perform a detailed design, procurement, and fabrication of the control system; and conduct final installation and training. The design affects the processing of chromic wastestreams handled by two redundant waste treatment lines in the Industrial Waste Treatment Plant.

Project 4: Chrome-Plating Facility Environmental Technology—MSE will provide engineering services, construction oversight, project management, and technology testing services for installing and testing pilot-scale demonstration units for chrome-plating bath purification and rinse water recycle.

The first demonstration, chrome-plating bath purification, will use a technology submitted by the U.S. Bureau of Mines. The second demonstration, rinse water recycle, will use a technology submitted by Norchem International, Inc., and Zenon Environmental, Inc.

The third demonstration, chromium emissions, which will use a closed loop fume eliminator submitted by Castle Hone, Inc., has been redesignated as Project 7.

Project 5: Waste Acid Detoxification and Reclamation—The objective of the Waste Acid Detoxification and Reclamation technology demonstration is to evaluate the effectiveness of this acid recovery system. The system will be tested on the sulfuric/phosphoric acid used in the WVA chrome-plating facility. MSE will support installation and evaluation of Viatech's technology in the 120 Chrome-Plating Area at WVA.

Project 6: Heavy Metals in Soils and Plume—This task includes identifying and characterizing contamination sources and determining the specific contaminants and the extent of the contamination if it exists. MSE will perform a site characterization, recommend technologies for the specific remediation situations, and ensure site cleanup is complete, using the best appropriate technologies.

Project 7: Hazardous Air Pollution Demonstration—MSE will provide engineering services, construction oversight, project management, and technology testing services for installing and testing Castle Hone, Inc.'s closed loop fume eliminator technology.

Project 8: Underground Storage Tank Monitoring Upgrade—This project involves providing engineering and installation services to link existing underground storage tank fluid level indicators and leak detection monitoring equipment to the WVA computer network. This project allows for remote monitoring of fluid level and leak detection information through the computer network to designated monitoring personnel and emergency response locations at WVA. This project was completed and closed out during the third quarter of 1995.

Project 9: Rinse Water Recycle System—This project is a continuation of Project 4 and will design a permanent rinse water recycle system in the 120 Facility in Building 35 at WVA.

Project 10: Sludge Minimization—This project is aimed at recycling and/or minimizing sludge from the Industrial Waste Treatment Plant, including evaluating options for disposing of chrome sludges and investigating opportunities for recycling and resource recovery.

Project 11: New Boiler Installation and Demonstration—This project includes replacing two oil-fired boilers with a low oxides of nitrogen dual-fueled Donlee boiler. The new boiler will be oil- and natural gas-fired and will be used to demonstrate pollution reduction. The project will also include the demolition of two boilers, installation of a new access rollup door and landing for the new boiler, and the installation and testing of the Donlee boiler.

Technical Accomplishments

Project 1—Manufacturing Operation Oil Waste

Installation of the Santech Pioneer Coolant Recovery system was completed on September 8, and commissioning of the system and training of WVA personnel was completed from September 11 through 14. The first evaluation of the Pioneer system started on September 15 and was completed on October 15. A second evaluation of the Pioneer system is planned for March 18, 1996, and is scheduled to last 7 days.

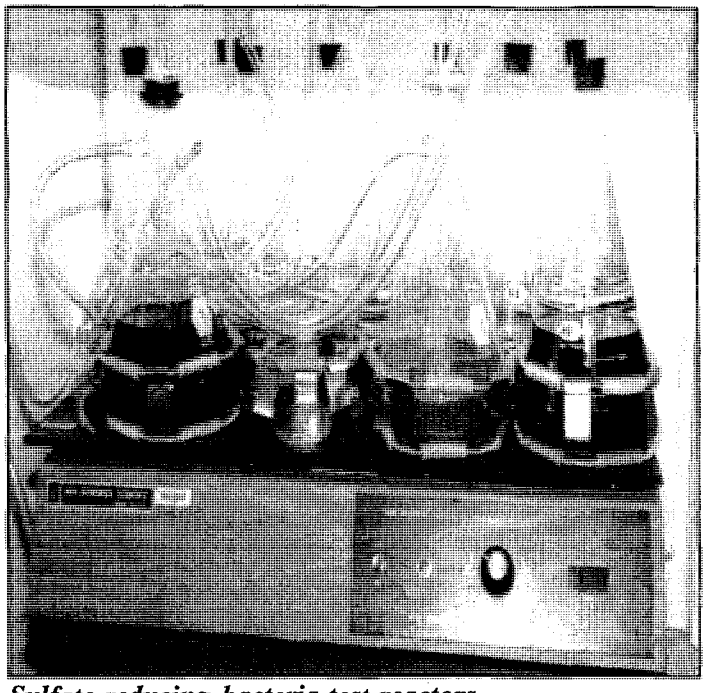
Preliminary field results show that the Pioneer system works as advertised. The system removes the tramp oils and reduces the bacteria to levels of a new mixture. Initially, the tramp oil removed from the coolant system was done so at a rate of approximately 2 gallons per minute (gpm). The last week of the evaluation of the Pioneer system, the tramp oil was being removed at a rate of approximately 0.6 gpm; this shows that the amount of tramp oil in the coolant was reduced substantially over the evaluation period.

Laboratory results from the evaluation are scheduled to be received in early November. Field analyses have indicated that the operators of the flexible manufacturing system were running excessive oil in their coolant mixture. Normally the water-to-oil ratio is 20:1 or 5%; however, during the evaluation, the total oil in the coolant mixture was as high as 20%. Personnel at the flexible manufacturing system are taking steps to remedy the problem.

The project work plan was completed and sent to CERL in October but has not been signed off by the Technical Project Officer or the Program Manager. A request for proposal (RFP) for the metalworking fluid management system was prepared and sent to 15 vendors; 3 vendors have replied. A selection process was organized, and the fluid management system was selected. Confirmation by WVA personnel will be completed after a review of the proposal and inspection of an operating unit. Preliminary drawings for facility modifications are being developed for installation of the fluid management system.

Project 2—Treatment of Chromium Wastestreams Using Sulfate-Reducing Bacteria

A series of test experiments was performed to determine the rough kinetics and growth curve of sulfate-reducing bacteria in the presence of Chromium VI. The test experiments included observing sulfate-reducing bacteria in a range of Chromium VI concentrations (0 to 30 ppm); slower reactions were observed in higher concentrations of Chromium VI. The test experiments also indicated the reducing



Sulfate-reducing bacteria test reactors.

capacity of the organic itself (used to feed the microbes) without the activity of sulfate-reducing bacteria.

Problems in the reactor setup were noted and corrected. For example, it was not practical to keep an argon blanket on the reactors because the tank depleted quickly even with very low gas flows; consequently, sulfate-reducing bacteria were subsequently grown without the argon blanket. The modified reactor design includes stoppered flasks with offgas venting through a mineral-oil bubbler; air is prevented from flowing into the reactors through the offgas tubing by the mineral-oil bubbler.

Work on the laboratory test plan was delayed until the growth kinetics could be better defined through the test experiments. Thus, the most appropriate laboratory test design can be made with the learned information.

Project 3—Instrument and Process Control Upgrade-Industrial Waste Treatment Plant

MSE has procured the major equipment and material for the project. The subcontract drawings and specifications for installation at the Industrial Waste Treatment Plant are in their final review. The control panel construction and software programming was started.

Project 4—Chrome-Plating Facility Environmental Technology

The following was accomplished for each of the Project 4 activities.

Rinse Water Recycle Demonstration—The last series of lab results for this demonstration was received, with the exception of the chrome speciation and the analysis for additional elements.

Chrome-Plating Bath Purification—The Bureau of Mines is moving forward with equipment assembly for demonstration of their chrome recovery process; however, they are experiencing delays in the project, and their future is uncertain. The schedule will slip into November for initiation of the demonstration due to these delays at the Bureau.

Project 5—Waste Acid Detoxification and Reclamation

Installation of the Waste Acid Detoxification and Reclamation unit was completed. The unit was then started and operated by representatives from Battelle Pacific Northwest Laboratory. Representatives from Pacific Northwest Laboratory returned to Richland, Washington, but will return to Watervliet on October 15 to carry out an extended test. One of the electropolish acid tanks is out of service, providing an opportunity to operate the unit.

Project 6—Heavy Metals in Soils and Plume

Funding for this project has not yet been received.

Project 7—Hazardous Air Pollution Demonstration

Castle Hone and Lap, Inc., received the RFP from MSE, and an agreement should be in place within the next reporting period. This demonstration should be underway in late October.

Project 9—Rinse Water Recycle System

No input for progress on this project was reported.

Project 10—Sludge Minimization

Detailed process information is being gathered at WVA, and samples of sludge from both the acid waste and oily wastestreams were collected. Chrome recycling options were evaluated, and a chrome recycler was identified and contacted. A subcontractor to provide technical support on sludge dewatering improvements was identified.

Project 11—New Boiler Installation and Demonstration

An initial workscope meeting was held at WVA with CERL, WVA, Donlee, and MSE personnel. Donlee provided CERL and MSE with operating specifications for the 3,000-horsepower Turbofire boiler. MSE personnel have stared the work plan for the project.

Plans/Projected Activities

Industrial Wastestream Pollution Prevention Project activities planned for the first quarter of FY96 include the tasks given below.

Project 1—Manufacturing Operation Oil Waste

- completing the Sanborn demonstration tests;
- preparing the Sanborn test report;
- installing additional process tanks;
- selecting a metal-working fluid management technology;
- preparing subcontracts;
- completing the final design package; and
- completing procurement of all equipment.

Project 2—Treatment of Chromium Wastestreams Using Sulfate-Reducing Bacteria

- continuing preparation of the Laboratory Test Plan with an attached Quality Plan;
- completing the test reactor experiments; and
- performing the actual experiment.

Project 3—Instrument and Process Control Upgrade-Industrial Waste Treatment Plant

- completing construction and testing of the control panels;
- receiving all major procurements; and
- having the subcontract in place.

Project 4—Chrome-Plating Facility Environmental Technology

Rinse Water Recycle Demonstration

- completing testing of the RETEC and Zenon rinse water recycle equipment; and
- analyzing the test results and preparing the test report.

Chrome-Plating Bath Purification

- completing fabrication of the Bureau of Mine's chrome-plating bath purification unit; and
- installing the unit at WVA and conducting performance tests.

Project 5—Waste Acid Detoxification and Reclamation

- completing installation;
- conducting demonstration tests; and
- training operators.

Project 6—Heavy Metals in Soils and Plume

- receiving a defined workscope and funding for the project.

Project 7—Hazardous Air Pollution Demonstration

- negotiating the vendor contract;
- developing the demonstration plan; and
- preparing the installation design package.

Project 9—Rinse Water Recycle System

- developing the work scope.

Project 10—Sludge Minimization

- evaluating sludge samples by a chrome recycler;
- identifying process improvements; and
- making recommendations based on the process improvements identified.

Project 11—New Boiler Installation and Demonstration

- completing the work plan;
- completing work on a demolition subcontract to remove the two existing boilers;
- starting the permitting process for the new boiler installation; and
- securing funding.

MHD SHUTDOWN

The main focus for FY95 is to perform dry lay-up of all magnetohydrodynamic (MHD) systems; continue preventive maintenance, where possible, to maintain integrity; decontaminate and decommission those systems identified as excess; and provide an MHD Program Summary Report.

Operations Accomplishments

Discharge of water from the east evaporation pond to the publicly owned treatment works was completed. Progress was slow due to excessive moisture, which continued to hamper efforts to dry out the open pond; regardless, most of the sludge was removed and placed on the coal pad to dry out. Final cleanup efforts remain to ensure all MHD-related contaminants are removed from the pond.

The MHD system preventative maintenance activities, as identified in the MHD Program Shutdown Plan, were terminated as project task funds had previously been depleted.

The as-built drawings for the removal and cleanup of the liquid seed system and ancillary equipment in Building 20 were completed, and the task was closed out.

Removal of the coal unloading and stockpiling system was completed. The as-built drawings were also completed, and the task was closed out.

The as-built drawings on the primary cooling water instrumentation, which was removed in conjunction with MHD cleanup efforts, were completed, and the task was closed out.

As-built drawings on the coal system, which had been previously updated, were completed to adequately portray the system as it now appears after various MHD components were removed.

The as-built drawings on the removal of the secondary cooling water piping and valves that were blocking access to the new open area in Building 50 were completed, and the task was closed out.

Removal of extraneous structural steel in the nitrogen tank farm area was completed; however, the as-built drawings were not completed due to lack of project funds.

The coal dust and dirt removed from the storm water ditches and railroad ballast adjacent to the coal pad was properly disposed. This task was performed in response to the storm water ditch contamination that was identified in the June 1994 Argonne National Laboratory Property Assessment Report. Late summer rains exposed some areas where further efforts will be required for complete removal of unsightly coal dust.

Technical Accomplishments

Landfarming of the 40 yards of contaminated soil continued; the odor of the contaminated soil has decreased to an almost undetectable level. The soil has residual contamination from the fuel oil spill that occurred in January 1990 and was stored on site when the underground fuel oil tank was

removed. The Montana Department of Health and Environmental Sciences (MDHES) had determined that on-site landfarming will probably alleviate the contamination. A report documenting the results of that landfarming will be submitted to MDHES for final determination and closure action.

Comments were received from the Program Coordinator on the draft of the MHD Program Summary Report; those comments were incorporated into a final version of the report, and a management review is being conducted. Memos were forwarded to Property Management requesting that the Resistive Load Banks, Iron-Core Magnet, High-Voltage Room, and Transrex power supply be excessed in place. Memos on excessing the pertinent spares for each of those systems were also prepared.

The associated paperwork to procure the technical support services of TRW and Gilbert/ Commonwealth was completed. These services will assist in the orderly closeout and archiving of those companies' MHD programs in coordination with MSE's.

Plans/Projected Activities

MHD Shutdown activities planned for the first quarter of FY96 will be covered by a small amount of carryover funds and will include:

- performing program management tasks;
- completing the internal management review of the MHD Program Summary Report; and
- issuing the final report to DOE.

MINE WASTE TECHNOLOGY PROGRAM

The objective of the Mine Waste Technology Program (MWTP) is to provide a technology test and evaluation program through a collaborative effort among the EPA, DOE, MSE, and Montana Tech of the University of Montana (Montana Tech) that:

- identifies national mine waste problems that most severely affect human health and the environment at the local, regional, and national levels;
- prioritizes the most promising mine waste treatment technologies based on their engineering and economic value;
- provides documented demonstration, test, and evaluation data on the most promising mine waste treatment technologies;
- promotes accelerated commercialization and transfer of technologies for selected mining waste treatment technologies that are developed, tested, and evaluated; and
- systematically trains users and establishes education programs.

The statement of work provided in the Interagency Agreement (IAG) identifies six activities to be completed by the MWTP.

Activity I—Montana Tech will establish screening criteria to identify and prioritize technical issues and promising innovative treatment techniques. Based on this criteria, a prioritized list and narrative discussion of each technical issue and treatment technique will be produced; these will then be considered as candidates for demonstration projects. Technical issues of primary interest will be acid generation, mobile toxic constituents in water, mobile toxic constituents in air, cyanide, and nitrates. Wasteforms that will be reviewed relating to these issues include, but may not be limited to, point- and nonpoint-source acid mine drainage, abandoned mine acid mine drainage, streamside tailings, impounded tailings, contaminated soils, heap leach cyanide/acid tailings, sulfide-bearing mine dumps, and storm water runoff.

Activity II—Montana Tech will deliver a generic Quality Assurance Project Plan (QAPP) that will provide specific instructions on how data is to be gathered, analyzed, and reported for all activities of the MWTP. As part of the requirements of Activity II, MSE will work with Montana Tech and incorporate DOE requirements into the generic QAPP; DOE requirements are met in MSE's Quality Management Manual. A project-specific QAPP will be developed for each demonstration under Activities III and IV.

Activity III—MSE will conduct and report on large pilot- or field-scale demonstrations of innovative technologies for remediation of mine waste. The demonstrations chosen will be the result of a thorough investigation of the technical issue, an identification of the specific wasteform to be tested, and a sound engineering and cost determination of the appropriate technology. MSE will rely on the list of technologies and wasteforms produced in Activity I; however, others may be proposed if they follow the basic criteria outlined in the IAG.

Activity IV—Montana Tech will develop and conduct bench- or small pilot-scale research of several innovative techniques that show promise for cost-effective remediation of mine waste. Project-specific QAPPs will be written as projects are identified.

Activity V—MSE will be responsible for preparing and distributing all reports for the MWTP. These include routine weekly, monthly, quarterly, and annual reports and technical progress and final reports for all MWTP activities. MSE will also publicize information developed under the MWTP in

local, regional, and national publications. Any necessary public meetings and public relations will also be addressed in this activity. In addition, MSE and Montana Tech will develop and conduct a series of workshops and symposia to convey the progress and results of the MWTP.

Activity VI—Montana Tech will develop a graduate or post-graduate degree program for environmental remediation and waste management. The program will contain elements of geophysical, hydrogeological, environmental, geochemical, mining and mineral processing, extractive metallurgical, and biological engineering. Also, Montana Tech will offer short courses relating to mine waste.

Technical Accomplishments

Activity I—Screening Criteria

Development of the Pyrite volume was completed. This volume details the economics of resource recovery related to pyrite and the technologies available that address the removal of pyrite from mine wastes.

Activity II—Quality Assurance

Development of a number of QAPPs for Activity III and Activity IV projects continued.

Activity III, Project 1—Remote Mine Site Demonstration

The field system was started during the fourth quarter of FY94, and monitoring of the system was continued on a full-time basis during this reporting period. Corrective and preventive maintenance was conducted on the system. Activities associated with operating the system for a second year in the field were started, which included filling the reagent hopper.

Activity III, Project 2—Clay-Based Grouting Demonstration

Analysis of data generated during the first phase of grout injection continued during the reporting period. The second phase of grout injection was cancelled, and the field operations at the Mike Horse Mine will be closed out.

Activity III, Project 3—Sulfate-Reducing Bacteria Demonstration

Work on the sulfate-reducing bacteria laboratory report was completed during the reporting period.

The field system was started during the fourth quarter of FY94, and monitoring of the system continued on a full-time basis during this reporting period. Monitoring of the field portion of the project will be on-going for 3 years.

Activity III, Project 4—Nitrate Removal Demonstration

Site activities began during the reporting period. Work on a final design was initiated for the field-scale demonstration device. Vendor equipment was procured, and some of the equipment was delivered.

Activity III, Project 5—Biocyanide Demonstration

Activities during the reporting period consisted of completing a site access agreement, developing a field test plan, and conducting laboratory work to determine values for working parameters that will be applied to the field reactor.

Activity III, Project 6—Arsenic Oxidation

This project was initiated during the reporting period. The work plan was completed and sent to EPA for approval, National Environmental Policy Act documentation was completed and sent to DOE-Pittsburgh Energy Technology Center for approval, and a site access agreement was initiated with ASARCO in East Helena, Montana.

Activity IV, Project 1—Berkeley Pit Water Treatment Research

Work on the final report for the project continued throughout the reporting period.

Activity IV, Project 2—Sludge Stabilization Demonstration

During the reporting period, sludges were produced using sulfide-reducing bacteria and water from the Crystal Mine. Work continued on methods of separating solids from liquids, producing dense sludges, and developing an arsenic analysis method to determine the presence of organic arsenic species in acid drainage.

Activity IV, Project 3—Photoassisted Reactions

Work continued on optimizing the oxidation of cyanide. In a second phase of this project, work was performed that was oriented toward removing dissolved metals from waters. A number of technical papers were delivered at seminars and technical meetings.

Activity IV, Project 4—Neutral Chelating Polymers

A number of experiments were conducted to quantify literature-determined methodologies for producing polymers. A new software system that models the energy involved in different polymeric configurations was used to develop a number of models of possible polymer configurations. Laboratory work began on methods of synthesizing electrically conducting polymers and attaching them to a substrate.

Activity V—Reporting, Technology Transfer, and Documentation

Presentations were held for groups of people interested in the MWTP, including a number of international groups. The fourth annual Mine Waste Conference was held at Fairmont Hot Springs in August, and approximately 150 people attended.

Activity VI—Education

Summer field work was conducted by a number of mineral waste emphasis graduate students on environmental problems associated with several mines. Some of these projects will continue into future semesters and will serve as thesis topics for a number of the students.

Plans/Projected Activities

Mine Waste Technology Program activities planned for the first quarter of FY96 include the tasks given below.

Activity I—Screening Criteria

No new activities are planned at this time.

Activity III, Project 1—Crystal Mine Treatment

Monitoring of the project will continue throughout the next quarter.

Activity III, Project 2—Grouting

A small-scale search for a different site on which to perform the grouting project will be undertaken. Analysis of data generated from the first phase of grout injection will be completed.

Activity III, Project 3—Sulfate-Reducing Bacteria

Monitoring of the project will continue throughout the next quarter. A number of field activities will be undertaken to provide a new source of data to the project. These activities will include drilling a new bore hole into the mine workings between the portal and the position of the substrate in the tunnel.

Activity III, Project 4—Nitrates

Project activities will continue. A field demonstration is scheduled for the November - December 1995 timeframe.

Activity III, Project 5—Biocyanide Remediation

Project activities will continue. A field demonstration is scheduled for the December 1995 - January 1996 timeframe.

Activity III, Project 6—Arsenic Oxidation

Project activities will continue. A field demonstration of the technology is scheduled for the June - July 1996 timeframe.

Activity III, Development Projects

The project to install underground sulfate-reducing bacteria reactors will be initiated during the next reporting period, pending the allocation of funding.

Activity IV, Montana Tech Research Project 1—Berkeley Pit Water Treatment

This project will be completed during the next quarter.

Activity IV, Montana Tech Research Project 2—Sludge Stabilization

The project will be completed during the next reporting period. A number of long timeframe storage samples will be stored for future analysis through a no-cost extension of the project. Final reporting on the project will be completed.

Activity IV, Montana Tech Research Project 3—Photoassisted Reactions

A number of substantial improvements in the oxidation of cyanide are expected during the next reporting period. Activities should also accelerate on the second portion of the project, which is metals removal from water.

Activity IV, Montana Tech Research Project 4—Neutral Chelating Polymers

The synthesis and characterization of the polymers will be continued next quarter as will the attachment of the polymers to various substrates.

Activity V—Reporting, Technology Transfer, and Documentation

Technology transfer activities will continue.

Activity VI—Education

Initiation and planning of summer field activities for K-12 students and teachers will be conducted.

RESOURCE RECOVERY PROJECT

The Resource Recovery Project (RRP) was funded in August of 1992 for the purpose of evaluating, testing, and demonstrating technologies for recovering water, metals, and other resources from surface and groundwater that are contaminated with dilute solutions of heavy metals.

The primary purpose of the RRP is to determine, through bench- and pilot-scale testing and demonstrations, which technologies or combinations of technologies can be used by DOE and others to recover clean, usable water from surface/underground systems contaminated with dilute solutions of heavy metals. The project will also recover valuable resources, including heavy metals and compounds. Economic analyses of each technology and the resources recovered will be used to project resource recovery/remediation costs for similar DOE and industrial sites using similar technologies. The project focuses on resource conservation and end-use application of the recovered resources by maximizing resource use and minimizing nonusable by-products.

The Berkeley Pit, an inactive open-pit copper mine filled with water contaminated with dilute solutions of metals, is the test bed for the project. The WETO facility is within the boundaries of the Silver Bow Creek/Butte Area Superfund site making execution of the project fall under the jurisdiction of the Superfund regulations of the State of Montana. The EPA considers the waters of the Berkeley Pit to be exempt from the Resource Conservation Recovery Act under the Bevile amendment.

For FY95, the project has been divided into seven tasks: project management, general support, technology selection, technology demonstration, water acquisition, facility modification and maintenance, and technology transfer.

Technical Accomplishments

Task 1—Project Management

Plans were initiated to allocate the funds that will be made available to the project when the landlord account is allocated. The supplementary funds will be used to test one or two additional technologies.

Butte-Silver Bow Metro Sewer officials have not yet issued a sewer user's discharge permit for the project due to revisions of discharge standards internal to them. The project will adhere to the agreed upon limits in the draft permit as if it were in place.

Task 3—Technology Selection

The *Commerce Business Daily* announcement was published. The Request for Information was finalized and is ready to be sent out early next quarter.

Task 4—Technology Demonstration

Electrochemical Design Associates (EDA)—An executive summary covering the Phase I testing was written by MSE and will be sent out as a cover to the Final Report prepared by EDA.

E-Rem—The contract to have E-Rem do a bench-scale demonstration of their clathrate concentration technology was signed. E-Rem submitted a test plan which, after some modifications, was approved. Equipment and supplies necessary to do the testing were ordered, received, assembled, and tested. Clathrate testing is set to begin and should be completed next quarter.

IBC Advanced Technologies Inc.—Demonstration of this molecular recognition technology continued this quarter. The demonstration is in the monitoring phase in which IBC's proprietary SuperLig® material is being monitored for degradation in capacity and selectivity. The demonstration flow rate will be 500 milliliters per minute. As budget permits, near the end of the demonstration, the system will be operated at a flow rate of 1 gallon per minute with larger columns to gather engineering data such as flow distribution, pressure drop, etc., for scaleup purposes.

ChromatoChem—The subcontract for this demonstration was approved by DOE, and work was begun. The current schedule indicates that bench testing and equipment assembly will be completed by the end of the first quarter of FY96. Demonstration of the technology at WETO will be done during January 1996.

Task 5—Water Acquisition

A total of 20,300 gallons of Berkeley Pit water was transported to WETO this quarter.

Task 6—Facility Modification and Maintenance

Installation of equipment and utilities to support the thickener tank modifications was completed. The system operating test procedure was completed and used to develop standard operating instructions for operation of the completed system.

Task 7—Technology Transfer

A conference entitled *Resources Through Technology Conference '95—Solutions to Remediation,* was held September 12-13. Approximately 100 people from industry, academia, and Government, attended the conference, which showcased the technologies previously and currently demonstrated under the RRP.

Information generated by the Resource Recovery Fellowship Program-Mineral Economics graduate student is being used to develop the economic evaluation of the IBC demonstration. This student is currently working on the evaluation of evaporation and crystallization processes that would be applied to metal-sulfate solutions. Metal-sulfate solutions are products of the current IBC demonstration as well as the planned CCI demonstration.

Work continued on the water economics effort. The Resource Recovery Fellowship Program-Water Economics graduate student presented and published a paper entitled, *The Economic and Social Value*

of Recovered Berkeley Pit Water Resources, at the Universities Council on Water Resources' Annual Meeting in Portland, Maine, on August 3. The research described in the paper focused on evaluation of the recreational, agricultural, and hydropower values of recovered Berkeley Pit water released for instream flows. A similar presentation was also given at the *Resources Through Technology Conference '95—Solutions to Remediation,* held in September 1995.

Plans/Projected Activities

Resource Recovery Project activities planned for the first quarter of FY96 include:

- issuing the EDA final report;
- continuing demonstration testing of the E-Rem demonstration;
- completing the first round of Request for Information response evaluations and issuing Request for Proposals;
- beginning bench-scale tests and assembling equipment for the CCI demonstration;
- obtaining approval of the FY96 Technical Task Plan; and
- completing contract negotiations with additional technology providers as budget allows.

SPRAY CASTING PROJECT

The objective of the Spray Casting Project is to perform research and development on the pressure-controlled atomization process (PCAP) as a means of replacing electroplated chromium on United States Air Force aviation parts. The process will also be applied to near-net shape fabrication of DOE-OTD special nuclear materials as a means of waste minimization. After the spray casting process has been Air Force qualified as a replacement for electroplated chromium, pilot-scale equipment will be designed and fabricated, and the process will be tested on aviation parts.

Technical Accomplishments

Demonstration and Validation of Spray Casting

The Survey of Air Force Air Logistics Centers was completed, and representative parts that would be candidates for coating with PCAP were documented.

The test plan for the Optimization of Performance Parameters task was completed and submitted to Concurrent Technologies Corporation (CTC) for review and approval and was transmitted to the Air Force. The analysis of performance parameters, which is also part of the Optimization of Performance of Parameters task, was also completed and sent to CTC for review and approval.

The design of the Engineering Demonstration Unit was initiated. The subsystem design tasks are:

- nozzle/tundish/heater;
- systems control;
- gas heater;
- electrical power distribution;
- materials feed and water distribution;
- process flows; and
- chambers, overspray collection, and part manipulation.

DOE-OTD

Fabrication of the nickel cylinder was completed. Based on experience gained from spraying the nickel, it was decided that spraying of the surrogate cylinder would not take place until a suitable nozzle could be obtained.

MSE supported the efforts of Lockheed Martin Energy Systems to develop a conceptual design for Intermediate and Production Spray Facilities at the Y-12 Plant in Oak Ridge, Tennessee. MSE provided the functional design requirements, initial test plans, and initial conceptual designs for the facilities, which would sprayform depleted uranium into casks for the transportation and long-term storage of high-level radioactive waste materials.

Air Force

The Air Force Wear and Corrosion Integrated Test Series Report was completed.

Plans/Projected Activities

Spray Casting Project activities planned for the first quarter of FY96 include:

- continuing the preliminary design of the engineering demonstration unit;
- initiating the adhesion improvement test series;
- publishing the Air Force Final Report; and
- publishing the DOE-OTD final report.

SUBSURFACE BARRIERS PROJECT

This project addresses issues relative to subsurface barrier monitoring/verification, performance, emplacement, and applications so that subsurface barrier technologies are advanced to implementation and deployment at DOE sites. The following three tasks are associated with the project.

Task 1: Verification of Barriers—This task includes reviewing barrier monitoring and verification technologies to identify and classify technologies that require some improvements or require field testing or those that are ready for implementation. As a result, requirements for barrier monitoring will be defined so that appropriate technologies may be advanced to meet end-user needs.

Task 2: Performance Standards—This task involves providing input to a January 1997 decision on whether subsurface barriers are applicable as a remedial alternative at DOE sites. A review of the on-going activities at EPA, specific state regulatory agencies, and DOE sites will be accomplished to determine their requirements regarding barriers and barrier applications. This should lead to a summary of the functional requirements and performance standards that would be applicable to subsurface barriers.

Task 3: Field Testing of Barriers—Field testing of subsurface barrier systems is required to collect installation and operational cost data and evaluate the performance of the barrier under actual field conditions. This task will include project development, identification of the field testing site, evaluation of site characterization data, integration of the functional requirements, coordination with the site personnel, site preparation activities, field testing, and evaluation of the results. This task will target the evaluation and/or demonstration of four technologies: flowable grouts, viscous liquids, polymer grouts, and the horizontal soil saw.

Technical Accomplishments

Task 1—Verification of Barriers

Efforts were initiated with database searches and contacts being made to determine the state of technologies capable of verifying and monitoring subsurface barriers. Efforts began with a search of the U.S. Geologic Survey bibliographic database *Water Resources Abstracts* for articles identifying applicable technologies.

A Request for Information was placed in the *Commerce Business Daily* to identify technologies being developed to meet these needs. Questionnaires are being sent to responders and others identified as having knowledge about suitable technologies.

Task 2—Performance Standards

Efforts were initiated with database searches and contacts being made. The goal was to determine any documented performance standards adopted for subsurface barriers. Contacts within DOE and with private industry and review of regulatory requirements were initiated and are in progress.

The FY95 Interim Report for the project was completed.

Task 3—Field Testing of Barriers

Demonstration 1—This task addresses flowable grout as a subsurface barrier material. Specifically, the effort includes evaluating single bore-hole injections of Montan Wax using permeation grouting emplacement. The injections were accomplished previously at a site at the Richland, Washington, landfill. A subcontract was placed with Golder and Associates to accomplish the field work to support the evaluation.

Another task includes evaluating radiation on Montan Wax. This work will be accomplished by Brookhaven National Laboratory (BNL) and will assess the breakdown of the properties of the Montan Wax when exposed to radiation. A draft Field Work Proposal (FWP) was submitted by BNL, and funding is being transferred.

Demonstration 2—This task addresses viscous liquids as a subsurface barrier material. Single bore-hole injection tests were previously completed and evaluated; based on that successful work, a demonstration was deemed appropriate. Specifically, this effort includes the requirements to complete the reporting for the previous level of testing and to accomplish the demonstration. The project is being accomplished in conjunction with Lawrence Berkeley Laboratory (LBL) under an FWP agreement. The scope of work in the FWP was approved, and work was initiated. The site selection criteria was developed by MSE, and the process of selecting the site was initiated. The report for the previous level of testing is being finalized.

Demonstration 3—This task involves a polymer grout lining added to a concrete subsurface barrier. The site selection for this demonstration was previously selected to be the 400 Area at the Hanford site. Sandia National Laboratory (SNL) previously completed the design work for the concrete barrier, and BNL has led the polymer material specification along with the perflorocarbon tracer verification and monitoring field planning. An FWP was developed by BNL for the tracer work, and the scope of work definition was completed. The FWP was finalized to provide funding to BNL for the perflorocarbon tracer work, and the funding transfer is in progress. The Demonstration Test Plan was finalized. The polymer purchase to support the project was completed by MSE. The concrete barrier was placed at the Hanford site in August.

Demonstration 4—This task was to address the horizontal soil saw emplacement demonstration to be completed at Fernald. The demonstration has since been cancelled.

Major Events

Representatives from the project participated in the International Containment Technology Workshop in Baltimore, Maryland, on August 29-31, 1995.

Plans/Projected Activities

Subsurface Barriers Project activities planned for the first quarter of FY96 include the tasks given below.

Task 1—Verification of Barriers

- identifying selected technologies that are ready for the next phase of proof/testing; and
- developing a report to identify and recommend technologies for advancement.

Task 2—Performance Standards

- continuing regulatory interviewing regarding subsurface barrier performance standard development;
- identifying performance standards for existing subsurface barriers; and
- initiating documentation of the performance standards.

Task 3—Field Testing of Barriers

Demonstration 1

- completing the Montan Wax field data evaluation.

Demonstration 2

- finalizing the site selection process for the viscous liquids demonstration; and
- initiating the demonstration design for the viscous liquids demonstration.

Demonstration 3

- completing the subsurface barrier concrete and polymer emplacement;
- completing the perflorocarbon tracer work on the barriers; and
- initiating the evaluation and reporting effort for the project.

THERMAL PROJECTS

The Plasma Centrifugal Furnace (PCF) Development Program began in August 1988 with initiation of the Plasma Arc Furnace Experiment (PAFE) Project at WETO. The original scope of the PAFE Project was to provide a location within an EPA Superfund site to demonstrate the Retech, Inc., PCF under the EPA Superfund Innovative Technology Evaluation (SITE) Program.

In 1988, DOE contract personnel from the INEL worked with the EPA in an attempt to have the PCF demonstrated at a Superfund site on INEL property east of Idaho Falls, Idaho. This attempt was unsuccessful; therefore, MSE personnel approached the State of Montana with the proposition that the PCF technology be demonstrated at WETO under the auspices of the SITE Program. The State of Montana agreed, and the project was initiated under an Interagency Agreement (IAG) between EPA and DOE.

The PCF was installed at WETO in 1989. Commissioning and startup of the PCF began with the first plasma torch ignition on October 20, 1989, after which EPA and DOE Shakedown testing was performed. Results of the EPA and DOE Shakedown test series proved the applicability of the technology to totally destroy organic waste and provide a nonleachable solid product in which the waste volume is reduced by at least two-thirds. During the DOE portion of the SITE test, three Radioactive Waste Management Complex (RWMC) tests were successfully completed before the end of the fiscal year.

In 1990, the Rocky Flats Compacted Waste Project, which used plasma technology to process simulated waste, was initiated. MSE subcontracts this work to Science Applications International Corporation's (SAIC) Idaho office, which performs the work at Retech's Ukiah, California, facility.

In mid-summer of 1992, the INEL Buried Waste Integrated Demonstration (BWID) Program supplied funding for PCF testing. The BWID tests attempted to establish the partitioning of a plutonium surrogate in the PCF using the RWMC-4 feed specification, which was established during the DOE Shakedown Testing phase, but increasing the surrogate concentration to better establish its fate. One BWID test was performed in FY92. The remaining tests, i.e., cerium balance, oxides of nitrogen (NO_x) reduction, and BWID sludges were completed in FY93 and FY94. Testing successfully determined the fate of cerium in the system, determined the impact on NO_x generated from different torch gases, and proved BWID sludges could be treated in the system.

Two Department of Defense (DOD) funded projects were initiated in 1992. The first, the Pyrotechnic Ordnance Plasma Destruction (POPD) Project tested the ability of the PCF to process smoke grenades, illuminating signals, and similar pyrotechnic devices. The second project (Army II) used the PCF to destroy obsolete classified fuzes. Other incineration processes had previously been tested for fuze destruction; however, they left recognizable components in the residue. The plasma process eliminated this problem.

During the fall of 1993, Pit 9 duration testing was performed on the 6-foot plasma arc centrifugal treatment (PACT-6) system (previously known as the PCF) at WETO. The test objective was to prove the capability of the PACT-6 system by processing approximately 30,000 pounds of material in 100 hours. Additional objectives included proof of remote operation; compliance with all emissions applicable and/or relevant and appropriate requirements; and determination of the fate of cerium, which was used as a plutonium surrogate, in the system. The test was successfully completed November 8, 1993.

Testing under the U.S. Army Corps of Engineers Research Laboratory (CERL) workscope was conducted during the spring/summer of 1994. This testing focused on processing high metals feed with the PACT-6 and verifying the quality of the final wasteform. The CERL tests proved the PACT-6 could successfully process high metals feed.

Activities under CERL continued during the fall of FY94. The focus of these activities was on optimizing the system to support full-scale implementation. The workscope involved upgrading equipment to support system optimization, installing a small-scale plasma furnace (SSPF) for more cost-effective screening tests, developing process and economic models, testing for other services, and developing hybrid torches.

An additional effort is being expended on developing a controlled emissions test bed at WETO in support of the Mixed Waste Focus Area (MWFA). This test bed can be used to support all DOE and DOD thermal programs. The effort for FY95 has focused on identifying and testing candidate technologies that will accomplish what the current technologies accomplished while minimizing inputs to the system or improving control. The technologies chosen for demonstration include a continuous emissions monitoring system (CEMS) monitor, two metals monitors, a flameless oxidizer, and a hot-gas filter.

Starting in January 1995, MSE initiated work for the U.S. Army Research, Development, and Engineering Center (ARDEC). This work capitalizes on the previous plasma effort at WETO with the ultimate goal of implementing a plasma system for the destruction of energetic material at a DOD facility. Previous plasma work for ARDEC focused on screening wastestreams in the plasma furnace to determine if the technology was applicable for demilitarization of these items. The on-going effort will focus on the next phase of development such as long-duration operation, feedrate maximization studies, and system optimization. The final task of the effort will be the actual procurement of some of the systems required for the full-scale system.

In FY95, MSE received funding from DOE-OTD under the Facility Transition/Decontamination and Decommissioning Focus Area to develop practical methods for recycling radioactive scrap steel (RSS) into useful product(s). To achieve this goal, MSE suggested and received DOE approval to proceed with alternate program execution guidance, prepared a Request for Proposal accordingly, and solicited bids from industry and academia to assist in determining the technical and economic feasibility of recycling RSS. The feasibility study was completed in September 1995.

Technical Accomplishments

ARDEC

Proposals for a nontransferred arc torch for installation into the PACT-6 were received and evaluated, and a "best and final" proposal was requested from all bidders. A final selection will be made by the end of October with equipment delivery tentatively scheduled for February 1996. The design package for installation of an ordnance feeder was issued, and delivery of major equipment for the feeder is expected in October.

The slag study was completed. This study predicted ordnance ash compositions and the resulting slag compositions and also identified seven general ash compositions that are outside the composition

envelope with which MSE has experience. Small-scale plasma furnace testing was conducted on these compositions. Problems with the slag passing EPA Toxicity Characteristic Leaching Procedure testing requirements were identified for several compositions; these compositions will be reformulated, and tests are planned following review of slag data.

The Hawthorne Army Depot in Hawthorne, Nevada, was selected as the site for the production-scale plasma ordnance destruction unit. A draft version of the System Requirements Document for this system was issued for review. Hawthorne Army Depot, ARDEC, and MSE personnel will meet in October to discuss and incorporate comments from this review. Process flow sheet development will begin in November following finalization of the System Requirements Document.

Controlled Emissions Demonstration Project

Most of the offgas slipstream hardware was delivered, installation packages were completed, and installation is approximately 50% complete. Commissioning of the slip-loop test bed is expected to begin in mid-November, with the demonstration test beginning shortly thereafter.

The monoethanolamine-membrane gas-separation system estimate was completed and is being reviewed.

CERL

The High Metals Test Report was issued. An SSPF slag correlation test was completed; the test report is in progress and will be issued by mid-November. Work on the PACT-6 process model continues.

Aerotherm was selected to complete detailed design and fabrication of their hybrid torch concept. A subcontract was awarded, and design work was initiated.

Decontamination & Decommissioning

A Feasibility Analysis Report was reviewed and issued by the Radioactive Scrap Steel Project Team. The report conceptually defines an integrated process for recycling radioactive scrap steel that is competitive with burial. Conversion costs for making sheet and plate from radioactive scrap steel through the proposed facility are estimated at $1,130/ton.

Operations Accomplishments

ARDEC

Installation of the PACT-6 power supply is 90% complete. System operating test procedures will be started by the end of October.

Small-scale plasma furnace tests were conducted on simulated ordnance ash compositions, and an average electrode life of 4 to 6 hours over 12 tests was experienced. No significant equipment failures were encountered.

Controlled Emissions Demonstration Project

Tests were conducted on the SSPF for the Caterpillar Corporation and the U.S. Navy. Oil filters were processed during the Caterpillar tests in both reducing and oxidizing modes. Shipboard municipal waste was processed in the Navy tests, again, in both the reducing and oxidizing modes. Data analysis and test reporting is on-going.

CERL

Seven SSPF tests were conducted for CERL, and no equipment failures were encountered.

Decontamination and Decommissioning

Test melts are on-going at Montana Tech of the University of Montana to test different methods of decontaminating, decarburizing, and alloying stainless steel in a vacuum-induction furnace.

Major Events

ARDEC

Funding for detailed design and procurement of the production unit was received. Development of the baseline schedule and budget is on-going.

Controlled Emissions Demonstration Project

The final report was received from SAIC documenting Mississippi State University's Diagnostic Instrumentation Analytical Laboratory and Sandia National Laboratory's offgas CEMS testing.

Decontamination and Decommissioning

A presentation was made outlining the MSE/Manufacturing Sciences Corporation project approach and purpose at the American Chemical Society's conference on *Emerging Technologies in Hazardous Waste Management VII* in Atlanta, Georgia.

Plans/Projected Activities

Thermal Project activities planned for the first quarter of FY96 include:

ARDEC

- completing installation of ARDEC PACT-6 modifications;
- initiating PACT-6 ordnance testing; and
- completing SSPF testing of ordnance ash compositions.

Controlled Emissions Demonstration Project

- completing installation of the slipstream test bed; and
- starting up the slipstream test bed.

CERL

- continuing work on the process model;
- awarding the hybrid torch design/fabrication contract; and
- reporting of tests conducted for the Caterpillar Corporation and the U.S. Navy.

Decontamination and Decommissioning

- performing testing and development work to solidify design concepts.

Stationary Plasma Furnace

The plasma hearth process (PHP), currently being designed for DOE by SAIC and Retech in Ukiah, California, through a subcontract with MSE, uses the energy generated by a plasma arc torch to pyrolize organics and to melt and vitrify inert waste components. The subcontract through MSE involves field-scale unit design only.

This technology feeds waste into a fixed crucible (unlike the rotating tub of the PACT-6) and uses a plasma torch to vitrify the waste material in the crucible. The project was divided into three phases. Phase 1 is a proof-of-principle phase that will evaluate the ability of the PHP to treat several simulated waste matrices. The objective of Phase 2 is to design a fully integrated field-scale plasma treatment process; Phase 2 will consist of advanced testing on a wider range of wastes, optimization of the process, and completion of the design. The objective of Phase 3 will be to construct and demonstrate a prototypic field-scale plasma treatment process.

Plans/Projected Activities

Stationary plasma furnace activities planned for the first quarter of FY96 include:

- monitoring SAIC PHP prototypic design activities; and
- continuing design of the field-scale PHP system.