DOE/ID/12735--T36

MSE-14

PROJECTS AT THE WESTERN ENVIRONMENTAL TECHNOLOGY OFFICE

Quarterly Technical Progress Report
April 1 - June 30, 1995

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Prepared for

U.S. Department of Energy
Under Contract DE-AC22-88ID12735

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CONTENTS

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 (COCs) 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 COCs.

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

The field tests of cadmium and zinc hyperaccumulators at the Silver Bow Creek Comprehensive Environmental Response, Compensation, and Liability Act site were initiated. Identified test species were started in a local greenhouse in May, the soil test plots were prepared, and the plants were then transferred to the Silver Bow Creek site in late June.

The work plan for cesium and strontium plant uptake field studies at the Idaho National Engineering Laboratory (INEL) was approved, and the project is proceeding. Plants were started in a greenhouse for later transplantation at the test site.

A contract was signed with Phytotech, Inc., in early May for bench- and pilot-scale testing of rhizofiltration technology. Initial efforts are focused on the cleanup of water contaminated with uranium and technetium.

MSE approved the draft report by Harbor Branch Oceanographic Institute/Microbial Processing, Inc., on their comprehensive aquatic plant screening metals absorption studies.

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 are being incorporated into the field tests at these sites.

Testing Accomplishments

Testing of the rhizofiltration technology is in progress at a DOE site in Ashtabula, Ohio.

Major Events

A paper on phytoremediation was presented at the 3rd International Conference on In Situ and On-Site Bioremediation held in San Diego, California, in late April.

Plans/Projected Activities

Biomass Remediation Project activities planned for the fourth quarter of FY95 include:

- completing (or almost completing, depending on the length of the growing season) the field portion of metals and radionuclide uptake studies at the Silver Bow Creek site and at the INEL test site;
- completing the first phase of field testing of the rhizofiltration technology at the Ashtabula, Ohio, site; and
- publishing reports summarizing the findings of the screening 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 Development of an Air Sparging Optimization Model Project began in FY95. A subcontract was put into place with Parson Engineering Science (ES) in early March, and a work plan was then developed by ES. MSE developed the project plan, and work on the project was initiated in the latter part of March.

The first task of the project was to review literature and models for applicable information to the project; this effort was completed, and a draft document was developed by ES outlining the work that was accomplished. A project meeting was held in June to initiate development of the conceptual decision tool.

Plans/Projected Activities

Development of an Air Sparging Optimization Model Project activities planned for the fourth quarter of FY95 include:

- receiving the final version of the document from ES outlining the work they completed regarding the literature and model review; and
- receiving a document outlining the work that was accomplished to initiate development of the conceptual decision tool, along with example templates and scenarios for the 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.

Technical Accomplishments

The Evaluation of Soil Saw Project began at WETO in FY95. The scope of work definition was finalized in April 1995, and project work was initiated immediately.

Information regarding the testing of the horizontal emplacement tools and the vertical soil saw has been difficult to obtain. Because of horizontal tool failures and the suspension of the vertical tool testing, no actual operations can be observed. Contacts have been made with Brown and Root, the developer of both tools, to obtain information; however, minimal information has been received.

Plans/Projected Activities

Evaluation of Soil Saw Project activities planned for the fourth quarter of FY95 include:

- following the contacts presently in place and using DOE contacts to obtain the required information; and
- assessing the consultant/subcontracting option to aid in the information flow to support this effort.

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 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 (UNR) MacKay School of Mines.

The initial surrogate test phase was conducted in Butte, Montana, at the Mineral Research Center, which is owned by Montana Tech and operated by Hydro Processing and Mining, Montana, Inc. 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 (NAREL) 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 (ASH); Advanced Processing Technologies, Inc. (APT)
Campbell centrifugal jig (CCJ); Trans Mar, Inc.
SEPOR air classifier; U.S. Naval Academy
high-gradient magnetic separator (HGMS); LANL

All technology demonstrations will be performed at the UNR with the exception of the HGMS, which will be conducted at LANL. The UNR is to send soil samples to LANL for testing through the HGMS system.

All testing was completed by October 31, 1994.

Technical Accomplishments

With the completion of all testing, technology reports for testing were initiated. The final report on ASH testing was received from APT, Inc., and the final report for CCJ testing was received from TransMar, Inc. The UNR reports for the automated flotation, tall column flotation, and Knelson centrifugal concentrator were received in mid-May. Final report activity was initiated by MSE at the end of May.

Major Events

Project closeout continues. Department of Energy equipment was inventoried by UNR, and appropriate forms were submitted to MSE; disposition of the equipment is pending. The UNR contract performance period was completed; however, the contract was not closed due to outstanding items with UNR.

Plans/Projected Activities

Heavy Metals-Contaminated Soil Project activities planned for the fourth quarter of FY95 include:

- completing the rollup report; and
- completing project closeout activities.

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 (FMS) and development and demonstration of a technology to treat chromatic and other acidic wastestreams.

The eight 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 FMS 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 FMS; 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 FMS; and 4) selection and installation of two to three reverse osmosis units at other machining facilities at WVA.

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 involved 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.

Technical Accomplishments

Project 1—Manufacturing Operation Oil Waste

Phase 1—The Sanborn Technology Pioneer system, which was selected to recycle coolant at the FMS, is scheduled to arrive at WVA on June 16, 1995. Installation of the system is scheduled for mid-July.

Phase 2—Megametrics Corporation's reverse osmosis unit was installed on June 2. The reject water discharge line from the reverse osmosis unit was installed per instructions from WVA personnel.

Phase 3—A Request for Proposal was prepared for procurement of an oil-water separation technology. The purchase of this technology is an attempt by WVA to minimize the amount of oil waste each manufacturing facility generates during a coolant replacement cycle. MSE and WVA personnel will select the technology; procurement and installation of the oil-water separation technology will depend on the performance of the Sanborn Pioneer system. The selection process will be similar to the selection process used in Phase 1. The selection process for Phase 3 is scheduled to be completed by July 21, 1995.

Phase 4—No work has been scheduled to start selection and procurement of the reverse osmosis units.

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

Laboratory equipment was purchased. A fume hood needed to conduct the experiment was installed in the Biomass Remediation System laboratory trailer. Sulfate-reducing bacteria were grown in serum bottles. A test reactor was set up to indicate the kinetics of the reaction; this reactor contains sulfate-reducing bacteria, growth media, and approximately 30 parts per million of chromium VI. The reactor is kept anaerobic by the use of an argon blanket, and in addition, the reactor is continually stirred through the use of a gyratory shaker table. Work on the laboratory test plan continued.

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

MSE, CERL, and WVA agreed on a final scope of work, and the detailed design review was completed.

Procurement of equipment began and is on-going.

Project 4—Chrome-Plating Facility Environmental Technology

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

Rinse Water Recycle Demonstration—Contact with the two technology vendors was established, and the equipment was installed in the 120-millimeter (mm) chrome-plating facility at WVA. Startup tests were completed, and process tests are underway. If the two systems prove effective, it will provide WVA with clean rinse water and reduce wastewater disposal. Hexavalent chrome will also be recovered and could be returned to the plating bath.

Chrome-Plating Bath Purification—An electrolytic process developed by the U.S. Bureau of Mines at the Rolla Research Center will be used to remove contaminants from the plating bath. An agreement was sent to the U.S. Bureau of Mines to outline the scope of work and to formalize tasks for the Bureau's $100,000 in-kind contribution; however, the Bureau has moved its Rolla Research Center to the Twin Cities Research Center, which has delayed their participation. The Bureau will begin fabricating the unit in July.

Project 5—Waste Acid Detoxification and Reclamation

Engineering design and bid specifications were developed for installing the Waste Acid Detoxification and Reclamation system adjacent to an electropolish acid tank in the 120-mm gun tube chrome-plating facility at WVA. WVA has purchased the system from Pacific National Laboratory and anticipates delivery in late July.

Project 6—Heavy Metals in Soils and Plume

Funding for this project has not yet been received.

Project 7—Hazardous Air Pollution Demonstration

MSE received funding to perform this technology evaluation. A tentative demonstration site was identified at WVA, and discussions with the vendor were initiated. Castle Hone and Lap, Inc., will be contracted to obtain access to their patented fume elimination technology, and the effectiveness of the technology in controlling chrome fumes from chrome electroplating baths will be evaluated.

Project 8—Underground Storage Tank Monitoring Upgrade

The four additional interface boxes were fabricated for future installation by WVA. This project is now closed out.

Plans/Projected Activities

Industrial Wastestream Pollution Prevention Project activities planned for the fourth quarter of FY95 include the tasks given below.

Project 1—Manufacturing Operation Oil Waste

- completing final design for Sanborn Technology's Pioneer system;
- preparing subcontract specifications for installation of the Pioneer system;
- installing the Pioneer system;
- selecting an oil-water separation technology; and
- preparing subcontract and bid specifications for installation of the oil-water separation technology.

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 experiment; and
- setting up the actual experiment that includes 12 reactors.

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

- starting construction of the control panels;
- ordering all necessary equipment;
- starting the subcontract documents; and
- preparing a checkout procedure for the control panels.

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 rest 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 the design package for installation of the Waste Acid Detoxification and Reclamation system; and
- installing, operating, and evaluating the Waste Acid Detoxification and Reclamation system.

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.

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 restarted at 5 gallons per minute (gpm) with the installation of the floating pump. Progress has been slow due to excessive moisture, which has continued to add to the water level in the open pond.

The MHD system preventative maintenance activities, as identified in the MHD Program Shutdown Plan, continued on their regular and scheduled cycles during April and May. Project task funds were depleted at the end of May, and this activity was closed at that time.

Materials from the various decontamination and decommissioning removal activities were evaluated and placed adjacent to the fenced scrap sale area in anticipation of future scrap sales. Removal of scrap material that had been intermixed with component suppliers test hardware was removed from the Port of Butte and also placed in the scrap sale area. Additionally, combustor and slag rejector test hardware located in the outside warehouse lockup was sorted and placed in one area. Project task funds were depleted at the end of May, and this activity was closed at that time.

Removal and cleanup of the liquid seed system and ancillary equipment in Building 50 was completed; the structural steel and floor grating still needs to be repaired.

The as-built drawings for the removal of the coal-handling compressor, air dryer, and facility interfaces were completed, and the task was closed out. The compressor is stored on the coal pad awaiting final excess property disposition.

The as-built drawings on the decontamination and decommissioning of the slag removal system in the pit area of Building 60 were completed, and the task was closed out.

Repair was completed on the concrete floor in Building 50 where the combustion air valve hydraulic power unit was located. The as-built drawings were then finalized for task closeout.

Efforts were finalized for removing the primary cooling water instrumentation that had remained after previous removal efforts of MHD components. The as-built drawings are in the process of being completed.

The coal unloading and stockpiling system was removed and stored on the coal pad awaiting final excess property disposition. Field work remains on removing services to that railroad unloading system.

Removal of extraneous structural steel in the nitrogen tank farm area was started. This activity will clean up that area where unused structures remained after 14 of the 16 oxygen tanks were removed in the 1980s.

The secondary cooling water piping and valves that were blocking access to the new open area in Building 50 were removed; some minor field changes still need to be done.

Cleanup was initiated in the ditches and south of Building 20 that had coal and therminol contamination. This item was identified in the June 1994 Argonne National Laboratory Property Assessment Report.

Technical Accomplishments

Landfarming of the 40 yards of contaminated soil was started; the odor of the contaminated soil has decreased upon exposure to the atmosphere. 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 in October 1995 for final determination and closure action.

The bid was awarded and construction was completed for installation of the monitoring well that is downgradient from the two coal basins. This well installation resulted from the characterization of the groundwater flow regime and vadose aquifer zone adjacent to the south coal basin that had previously been requested by the Argonne National Laboratory Property Assessment Report. The Water Quality Division of the MDHES concurred with this approach. The as-built drawings were completed, and this task was closed out.

Draft copies of the MHD Program Summary Report were transmitted to the program coordinator and the WETO site representatives for their review. The list of spares associated with the MHD program was revised, and as systems are being removed in the facility, the appropriate spares from the warehouse are also being excessed.

Site Environmental Compliance Activities

Regulatory Compliance

The annual Site Environmental Report was completed and submitted as required by DOE Order 5400.1.

Air Quality

The quarterly Excess Emissions Report was completed and submitted to the Air Quality Division of the MDHES as required by the facility air quality permit.

Waste Management

Approximately 3,000 gallons of waste scrubber water from the Plasma Arc Centrifugal Treatment System failed the EPA's Toxicity Characteristic Leaching Procedure for lead; consequently, this water will be disposed as hazardous waste.

The search continues for a potential user of the potassium formate solution left over from the MHD program.

Coal fines continue to be removed from the soil surrounding the coal pad and Area 20. This soil is nonhazardous and is being disposed at the local sanitary landfill.

Nonhazardous wastewater from the east evaporation pond is being discharged to the sanitary sewer. The flowrate of 5 gpm is continually monitored and reported to the publicly owned treatment works on a monthly basis.

Plans/Projected Activities

MHD Shutdown activities planned for the fourth quarter of FY95 include:

- receiving review comments from DOE on the MHD Program Summary Report and incorporating those comments for final report issuance to Pittsburgh Energy Technology Center;
- completing removal of the liquid seed system in Building 20 and finalizing as-built drawings;
- completing removal of underground services to the coal unloader and stockpiler;
- completing a punch list of items on relocation of secondary cooling water piping and finalizing as-built drawings;
- completing removal of excess structural steel in the nitrogen tank farm area and finalizing as-built drawings;
- completing as-built drawings on primary cooling water instrumentation removal;
- completing cleanup of the railroad ballast adjacent to the coal pad where coal dust has accumulated;
- completing cleanup of residual material in the east evaporation pond;
- continuing landfarming fuel oil-contaminated soil; and
- dependant on project funding, initiating field work packages for removal of the instrumentation and control components in Building 50 associated with the vitiated and metallic air heaters.

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 a Pyrite volume continued. The Pyrite volume will detail 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. A data base to contain the data from the field activities for the project was initiated. Corrective and preventive maintenance was conducted on the system.

Activity III, Project 2—Clay-Based Grouting Demonstration

Analysis of data generated during the first phase of grout injection continued during the reporting period. Activities leading to a second phase of grout injection were undertaken; these activities included contract and specification development and procurements.

Activity III, Project 3—Sulfate-Reducing Bacteria Demonstration

Work on the sulfate-reducing bacteria laboratory report continued 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. A data base to contain the data from the field activities for the project was initiated. Monitoring of the field portion of the project will be on-going for 3 years.

Activity III, Project 4—Nitrate Removal Demonstration

The site access agreement was signed, and subcontracts were initiated with vendors to supply field-scale equipment. Work on a final design was initiated for the field-scale demonstration device.

Activity III, Project 5—Biocyanide Demonstration

Activities during the reporting period consisted of developing a field site and laboratory work to determine values for working parameters that will be applied to the field reactor.

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 was performed 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.

Activity IV, Project 4—Neutral Chelating Polymers

A number of experiments were conducted to quantify literature-determined methodologies. A new software system that models the energy involved in different polymeric configurations was used to develop a number of models of possible 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.

Activity VI—Education

A number of mineral waste emphasis graduate students completed their course work and graduated from the program. Some of these students have begun experimental work on projects sponsored by the MWTP.

Plans/Projected Activities

Mine Waste Technology Program activities planned for the fourth quarter of FY95 include the tasks given below.

Activity I—Screening Criteria

Development of a Pyrite volume will continue.

Activity III, Project 1—Crystal Mine Treatment

Monitoring of the project will continue throughout the next quarter.

Activity III, Project 2—Grouting

A second phase of grout injection will be undertaken during July or August, and the 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.

Activity III, Project 4—Nitrates

Project activities will continue. A field demonstration is scheduled for the July - August 1995 timeframe.

Activity III, Project 5—Biocyanide Remediation

Project activities will continue. A field demonstration is scheduled for the July - August 1995 timeframe.

Activity III, Development Projects

The projects Photo-Oxidation of Arsenic and 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

Laboratory activities for the project will be extended during the next quarter, and long-term storage samples will be stored for future analysis through a no-cost extension of the project. Final reporting on the project will begin.

Activity IV, Montana Tech Research Project 3—Photoassisted Reactions

Improvements in the oxidation of cyanide are expected during the next reporting period. Activities should also accelerate on the second portion of the project—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.

Activity V—Reporting, Technology Transfer, and Documentation

The annual report will be published.

The fourth annual Mine Waste Conference will be held.

Activity VI—Education

Summer field activities for K-12 students and teachers will be held.

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 2—General Support

No activity took place under this task during the reporting period.

Task 3—Technology Selection

The *Commerce Business Daily* (*CBD*) announcement and Request for Proposal were finalized. In March, the DOE Headquarters Project Manager and the WETO Technical Project Manager postponed the Technical Task Plan milestone that called for issuance of these documents.

Task 4—Technology Demonstration

Vail Research and Technology Corporation—The final report for the Vail Research and Technology Corporation demonstration was completed and is available through MSE.

Electrochemical Design Associates—Phase I testing was completed by Electrochemical Design Associates (EDA) and its subcontractor AEA Technology at AEA/Harwell, Didcot, United Kingdom, on March 13 and 14, 1995. A short test synopsis was received from EDA on April 4, 1995, and a draft test report was received on April 14, 1995. Following comment by MSE to increase the amount of technical detail presented, a final test report was received from EDA on May 25, 1995. The EDA subcontract was terminated for the convenience of MSE and the Government on May 31, 1995, due to increased costs and the immaturity of the technology, as evidenced by the continuing increase in system complexity. A final report is being written by MSE and will include the final report by EDA as an appendix.

E-REM—Contract negotiations were concluded with E-REM, and a copy of the completed contract was sent for signature. Work on this demonstration is expected to begin in early to mid-July.

IBC Advanced Technologies Inc.—IBC Advanced Technologies, Inc. (IBC) completed equipment fabrication and shipped the equipment to WETO in late May; MSE completed facility preparations for the demonstration. IBC personnel completed on-site assembly of their system, including hardware/software checkouts and hookups to MSE equipment (electricity, compressed air, plant service water, support tankage), and the startup phase of the demonstration began on June 22. During the startup phase, IBC will optimize the operation of the system, which should take several weeks. Following that, the monitoring phase, in which IBC's proprietary SuperLig® material will be monitored for a maximum of 3 months for degradation in capacity and selectivity, will begin. 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—Negotiations for a revised demonstration approach, including media durability testing and enhanced bench testing in exchange for less hardware (thereby incurring no added cost), were completed with ChromatoChem (CCI). This subcontract will require DOE approval.

Task 5—Water Acquisition

No 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 will be used to perform an operational checkout of the system when installation is complete.

Task 7—Technology Transfer

Information generated by the Resource Recovery Fellowship Program-Mineral Economics graduate student has been helpful for the economic evaluation of the EDA demonstration. This student is currently working on the evaluation of potential value-added processes for products from the IBC demonstration.

Work continued on the water economics effort. The Resource Recovery Fellowship Program-Water Economics graduate student is scheduled to make a presentation at the Universities Council on Water Resources Annual Meeting in Portland, Maine, this August. At the present time, an evaluation of the recreational economics of recovered Berkeley Pit water released for instream flows is underway. An attempt is being made to reach an arrangement with the Montana Department of Natural Resources for the use of an economic modeling program; this recreational demand model was developed as part of the Upper Clark Fork Damage Assessment, and the State is carefully evaluating any potential conflicts that could result from MSE's use of the model.

Work began on the program and agenda for a conference entitled *Resources Through Technology Conference '95—Solutions to Remediation,* to be held in September 1995.

Plans/Projected Activities

Resource Recovery Project activities planned for the fourth quarter of FY95 include:

- beginning demonstration testing of E-Rem and CCI demonstrations;
- developing 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

MSE received a contract with Concurrent Technologies Corporation of Johnstown, Pennsylvania, to design, fabricate, and install an engineering demonstration PCAP unit at the National Defense Center for Environmental Excellence. Work on that contract has begun, and the project team has been formed. Initial tasks include surveying several Air Force Air Logistics Service Centers to evaluate candidate parts for spraying, developing a test plan to improve coating adhesion, and initiating design of the new unit.

The initial sprays were completed for the fabrication of the nickel cylinder; this work should be finished early in the next quarter.

Reports for the Air Force Wear and Corrosion Integrated Test Series and the final report for the Air Force portion of the Spray Casting Project were completed. These reports will be available early next quarter.

Major Events

MSE personnel participated in two meetings that were held to develop a conceptual design for a thermal spray unit at the Oak Ridge National Laboratory that would be used to fabricate transportation and storage casks for high level radioactive waste. MSE developed the list of functional requirements for the design.

Plans/Projected Activities

Spray Casting Project activities planned for the fourth quarter of FY95 include:

- continuing the preliminary design of the engineering demonstration unit;
- initiating the adhesion improvement test series;
- distributing the Air Force reports for the Wear and Corrosion Test Series and the final report;
- completing the spraying of a 3-inch-diameter nickel circular cylinder;
- completing the Oak Ridge National Laboratory conceptual design; 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 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 horizontal soil saw.

Technical Accomplishments

The Subsurface Barriers Project began at WETO in FY95. The scope of work definition was finalized in April 1995, and project work was initiated immediately.

All tasks and demonstration efforts were initiated simultaneously, and several of the efforts were inherited in various phases of completion.

Task 1—Verification of Barriers

Efforts were new and 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.

Task 2—Performance Standards

Efforts were new and were also 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.

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 is in the process of being 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 is being finalized so work can begin.

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 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.

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 is being finalized to provide funding to BNL for the perflorocarbon tracer work. The Demonstration Test Plan was drafted before WETO was involved in the project; however, MSE provided to SNL and BNL on the plan, which are now being incorporated. The polymer purchase to support the project is in progress at MSE.

Demonstration 4—This task addresses the horizontal soil saw emplacement demonstration to be completed at Fernald. The demonstration is on hold pending successful completion of an earlier phase of testing in progress at a Haliburton site in Duncan, Oklahoma. Once this field testing has been completed, startup of the demonstration is anticipated.

Plans/Projected Activities

Subsurface barriers project activities planned for the fourth quarter of FY95 include:

Task 1—Verification of Barriers

- completing the database searches for technologies capable of subsurface barrier verification and monitoring;
- reviewing applicable literature for technology status regarding such capabilities; and
- identifying selected technologies that are ready for the next phase of proof/testing.

Task 2—Performance Standards

- completing the database searches for performance standards relating to subsurface barriers;
- completing review of the regulatory issues relating to performance standards for subsurface barriers;
- initiating regulatory interviewing regarding subsurface barrier performance standard development; and
- initiating documentation of the performance standards.

Task 3—Field Testing of Barriers

Demonstration 1

- completing the field data gathering of the Montan Wax single bore-hole injection tests; and
- initiating the Montan Wax field data evaluation.

Demonstration 2

- completing the site selection process for the viscous liquids demonstration; and
- initiating the site preparation for the viscous liquids demonstration.

Demonstration 3

- completing the Demonstration Test Plan for the polymer grout demonstration; and
- completing the subsurface barrier concrete and polymer emplacement.

Demonstration 4

- completing project decisions to either take the project off hold or cancel.

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.

Feedstock for the RSS Recycle Facility will be screened for the metallurgical makeup and radioactivity levels, and only those materials classified as "low-level" radioactive waste will be processed. It is likely that radioactive-contaminated steels and alloy materials may also be contaminated with lead and nonlead based paints, rust, chemical contaminants, and special fixatives to hold radioactive contaminants in place. Special consideration may be needed if scrap proves to be heavily contaminated with oil, grease, and dirt.

Technical Accomplishments

ARDEC

The configuration study conducted recommended: 1) ARDEC use a centrifugal furnace design in the field installation and 2) the PACT-6 furnace at WETO be modified and tested to evaluate various methods of improving overall reliability and applicability to ARDEC's specific needs. The first recommendation was based on technical tradeoffs, availability of operations data, and ARDEC schedule goals. PACT-6 modifications that were included in the second recommendation are installation of a new power supply, installation of a nontransferred arc torch, design and installation of a proof-of-concept ordnance feeder, and design and installation of a scrubber water particulate filtration system. Both recommendations were accepted by the customer.

The engineering package to install the new power supply was completed, and installation was started. A procurement specification for a nontransferred arc torch was issued; vendor bids are expected in late July. Design of the ordnance feeder and scrubber water particulate filtration systems has started, and conceptual design reviews are scheduled for early July.

The slag study was completed. This study predicted ordnance ash compositions and the resulting slag compositions and also identified seven general ash composition that are outside of the composition envelope with which MSE has experience. These seven compositions were recommended for further evaluation on the SSPF; SSPF testing will be conducted in July.

Controlled Emissions Demonstration Project

Most of the off-gas slipstream hardware procurements were awarded, including the Pall high temperature filter, the Thermatrix flameless oxidizer, a special corrosion-resistant blower, a heat exchanger, and an off-gas CEMS. Installation design work is continuing, and development of the demonstration test plan will begin in July. Commissioning of the slip-loop test bed is expected to be completed in mid-October, with the demonstration test beginning shortly thereafter.

Work on the monoethanolamine-membrane gas-separation system estimate continued.

CERL

The High Metals Test Report was drafted. A small-scale furnace slag correlation test was completed, and the test report is in progress. Test workscope for the Navy was completed and submitted to CERL for approval. Work on the PACT process model continues. Selection of a vendor for the hybrid torch design is nearly complete, and a subcontract will be issued to the selected vendor in early July.

Decontamination & Decommissioning

Based on competitive bids, a subcontract team led by Manufacturing Sciences Corporation (MSC) of Oak Ridge, Tennessee, was selected to assist in determining the feasibility of recycling RSS in a regional facility in the western United States. Subcontract work began on May 1 and is on-going.

Wyoming was added to the list of western states that have indicated preliminary interest in hosting an RSS Recycling Facility; Idaho, Nevada, Washington, and Oregon are the other states that have also indicated a preliminary interest in an RSS Recycling Facility. The State of Montana has not been contacted yet.

Operations Accomplishments

ARDEC

The rotary water seal for the PACT-6 was replaced, and work was started on repairing/replacing the shaft water seal. Particulate loading tests were set up and started.

Controlled Emissions Demonstration Project

Analytical testing of the Mississippi State University's Diagnostic Instrumentation Analytical Laboratory (DIAL) and Sandia National Laboratory's off-gas CEMS was completed. The ADA, Inc., mercury detector-removal system was also tested; test results will be available in early August.

CERL

Small-scale plasma furnace installation and the system operability test procedure were completed.

Major Events

ARDEC

Particulate loading tests were conducted to ensure the current off-gas system is capable of handling the particulate emissions expected during the processing of pyrotechnic ordnance. Particulate loading of approximately 150% of those encountered during previous ARDEC testing were simulated, and no off-gas treatment system operational problems were identified.

Controlled Emissions Demonstration Project

The paper *Status of DOE's Controlled Emissions Off-Gas Demonstration* was presented at the International Incineration Conference in Seattle, Washington, in May.

Decontamination and Decommissioning

An abstract outlining the MSE/MSC project approach and purpose was submitted for presentation at the American Chemical Society's conference on *Emerging Technologies in Hazardous Waste Management VII* that is being held in September.

Project meetings are held monthly with MSC to assess project progress and direction. These meetings are held in strategic locations to accommodate tours of plants that operate equipment of interest; thus far the team has observed vacuum induction furnaces at MSC and dc arc furnaces at Charter Steel in Milwaukee, Wisconsin.

Plans/Projected Activities

Thermal Project activities planned for the fourth quarter of FY95 include:

ARDEC

- completing detailed design and installation of ARDEC PACT-6 modifications;
- completing test planning to support FY96 PACT-6 testing; and
- completing SSPF testing of ordnance ash compositions.

Controlled Emissions Demonstration Project

- receiving equipment and completing installation to support testing; and
- developing the FY96 Project Plan.

CERL

- continuing work on the process model;
- awarding the hybrid torch design/fabrication contract; and
- working with CERL on the test plan for the Caterpillar Corporation.

Decontamination and Decommissioning

- reviewing preliminary engineering reports and observing Barnsteel's new induction furnace in operation.

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 fourth quarter of FY95 include:

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