Road Transportable Analytical Laboratory (RTAL) System

**Quarterly Report
August - October 1995**

November 1995

Work Performed Under Contract No.: DE-AC21-92MC29109

U.S. Department of Energy
Office of Environmental Management
Office of Technology Development
Washington, DC

For

U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia

By
Engineering Computer Optecnomics, Inc.
Annapolis, Maryland

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CONTRACT OBJECTIVE

The goal of the Road Transportable Analytical Laboratory (RTAL) Project is the development and demonstration of a system to meet the unique needs of the DOE for rapid, accurate analysis of a wide variety of hazardous and radioactive contaminants in soil, groundwater, and surface waters. This laboratory system has been designed to provide the field and laboratory analytical equipment necessary to detect and quantify radionuclides, organics, heavy metals and other inorganics. The laboratory system consists of a set of individual laboratory modules deployable independently or as an interconnected group to meet each DOE site's specific needs.

After evaluating the needs of the DOE field activities and investigating alternative system designs, the modules included in the RTAL are:

- Radioanalytical Laboratory
- Organic Chemical Analysis Laboratory
- Inorganic Chemical Analysis Laboratory
- Aquatic Biomonitoring Laboratory
- Field Analytical Laboratory
- Robotics Base Station
- Decontamination/Sample Screening Module
- Operations Control Center
- Protected Living Quarters

Each module provides full protection for operators and equipment against radioactive particulates and conventional environmental contaminants. This is especially important in areas where radioactive particulates from environmental matrices, e.g. soils, are aerosolized by wind or volatile chemicals are present. These contaminants can adversely affect sensitive chemical and radiochemical analyses as well as potentially being harmful to personnel.

The goal of the integrated laboratory system is a sample throughput of 20 samples per day, providing a full range of analyses on each sample within 16 hours (after sample preparation) with high accuracy and high quality assurance. The RTAL will provide the DOE with very significant savings in terms of both cost and time. This will accelerate and improve the efficiency of clean-up and remediation operations throughout the DOE complex. At the same time, the system will provide full protection for operating personnel and sensitive analytical equipment against the environmental extremes and hazards encountered at DOE sites.

INTRODUCTION

U.S. Department of Energy (DOE) facilities around the country have, over the years, become contaminated with radionuclides and a range of organic and inorganic wastes. The major types of contamination found at the various sites have been summarized in the "Environmental Restoration and Management Five Year Plan" and, except for radionuclides (at most locations) and high explosives (at a few locations), are representative of the types of wastes found at many industrial facilities.

The DOE faces additional unique challenges in cleaning up this contamination. Many of the DOE sites encompass large land areas and were originally sited in relatively unpopulated regions of the country to minimize risk to surrounding populations. In addition, many times wastes were stored underground at the sites in 55-gallon drums, wood boxes or other containers until final disposal methods could be determined. Over the years, these containers have deteriorated, releasing contaminants into the surrounding environment. This contamination has spread, in some cases polluting extensive areas.

Remediation of these sites requires extensive sampling to determine the extent of the contamination, to monitor cleanup and remediation progress, and for post-closure monitoring of facilities. The U.S. Environmental Protection Agency (EPA) has found that shipping samples to a central laboratory for analysis is a slow and expensive process. The EPA is emphasizing the use of field instrumentation and transportable laboratories to provide critical analytical data (which form the basis for remediation decisions) faster and at lower cost. The use of field systems can cut several weeks to months off the turnaround time for analytical information.

The DOE's problems in getting samples analyzed is further compounded by the almost universal presence of radionuclides in the samples. The DOE's samples require wipe tests for surface contamination before shipment and after receipt, specialized transportation containers and procedures (depending on the level of radioactivity present in the sample), and a substantial amount of additional paperwork. It can be very difficult and time-consuming to ship samples off-site from DOE facilities because of requirements established to ensure against inadvertent release of radioactive materials. The occasional improper shipment of radioactive materials from DOE facilities has also led to periodic curtailment of all shipments to ensure that proper shipping procedures are followed. Such curtailments can cause havoc to projects where accurate sample analytical data is critical to decision-making and also because environmental samples degrade over time.

Thus, the DOE would benefit greatly if it had reliable road transportable, fully independent laboratory systems that could perform on-site the full range of analyses required. Such systems could accelerate clean-up and remediation efforts by providing critical analytical data more rapidly, and save money by eliminating handling, transportation and manpower costs associated with sample shipments.

The current effort addresses the unique requirements of the DOE for a Road Transportable Analytical Laboratory (RTAL) system capable of analyzing for a wide variety of hazardous and radioactive contaminants in soil, groundwater, and surface waters. This effort is based on the earlier laboratories and operations control centers developed by Engineering Computer Optecnomics (ECO), Inc. for the U.S. Environmental Protection Agency, and the U.S. Departments of Defense and State. These include counter-terrorist systems for use in areas contaminated with chemical or biological warfare agents. The advances achieved in the development of these earlier systems have been incorporated into the development of the RTAL.

The RTAL has been designed to provide for the efficient and effective operation of the field and laboratory analytical equipment necessary to detect and quantify radionuclides, organics, heavy metals and other inorganics. The integrated RTAL system will be able to provide a full range of accurate analyses on-site. At the same time, the RTAL system will provide full protection for the operating personnel and the sensitive analytical equipment against the environmental extremes and the hazards encountered at DOE sites.

APPROACH

The development of the Road Transportable Analytical Laboratory system is being conducted in two phases. Phase I, encompassing work at Maturity Level 4, Major Sub-systems, was for the development and optimization of the RTAL system design to most effectively meet the needs of the DOE. This phase incorporated development of detailed performance requirements (based on documented data and meetings with potential DOE users of the RTAL system), development and evaluation of alternative system configurations, and optimization of the final design. The work required under Phase I was completed on schedule and within budget.

Phase II of this project represents a transition to Maturity Level 5, Full-Scale Demonstration. A full-scale partial prototype of the RTAL system is being constructed. This partial prototype consists of the following three modules:

- Radioanalytical Laboratory
- Organic Chemical Analysis Laboratory
- Operations Control Center

The Operations Control Center will be capable of accepting data from robotic site contaminant mapping equipment. In addition, the DOE and the U.S. Army have agreed in principle to augment the demonstration of the prototype RTAL with the following two Superfund TERMMTM laboratory modules, also designed and constructed by ECO, to be loaned by the Army:

- Inorganic Chemical Analysis Laboratory
- Aquatic Biomonitoring Laboratory

This five-module prototype system will be tested at an appropriate DOE site to demonstrate the performance of the system and to quantify the cost and time savings it provides.

Upon completion of Phase II, ECO, Inc. will enter into commercial production of the Road Transportable Analytical Laboratory system, providing full warranties and guarantees for the product. The RTAL system will be integrated into ECO's existing line of TERMMTM and Superfund TERMMTM modular transportable analytical laboratory and operational control systems.

PROGRESS DURING QUARTER

This report documents the progress achieved on the development of the RTAL system during the fifth quarterly period of the Phase II development, from August 1, 1995 through October 31, 1995. The Phase II effort under this contract is divided into five tasks:

- Task 1 - NEPA Documentation
- Task 2 - Drawings
- Task 3 - Prototype System Construction
- Task 4 - On-Site Prototype Demonstration
- Task 5 - Final Report

Task 1 was completed earlier, resulting in the granting of a Categorical Exclusion. Task 2, Drawings, was also completed during prior work quarters. During this quarter, work was completed on Task 3 and continued on Task 4. Task 5 has not yet been initiated in accordance with the project schedule. The progress achieved on Tasks 3 and 4 is discussed below.

The Radioanalytical Laboratory was delivered to Fernald Environmental Management Project (FEMP) on August 24, after Canberra completed equipment debugging. A problem with the

Germanium Detector Automatic Sample Changers was correcteded by Canberra prior to delivery. A complete Operating Manual for this RTAL module was included with the delivery. Mr. R. Heath of Fernald Environmental Restoration Management Co. (FERMCO) did an excellent job of preparing for the receipt of the unit. It was initially placed near the OU-1 Waste Pits pending movement into final position. FERMCO representatives inspected the Laboratory upon delivery and were delighted with the quality, design, automation features, and analytical instrumentation in this module.

The analytical instrumentation for the Organic Chemical Analysis Laboratory was installed and acceptance testing successfully completed on August 1. The Organic Chemical Analysis Laboratory was delivered to FEMP on September 21. A complete Operating Manual for this RTAL module was included with the delivery. The unit was initially held in the FEMP receiving area and then moved into final position near the OU-1 Waste Pits.

Installation of the wireless Local Area Network (LAN) hardware in the Operations Control Center was completed and the system successfully demonstrated. Debugging of the system software, specifically integration with the Hewlett-Packard computer system software, was also completed. This unit was delivered to FEMP on October 12. A complete Operating Manual for this module was included with the delivery. This completed the construction and delivery of the prototype RTAL system. The unit was initially held in the FEMP receiving area along with the Organic Chemical Analysis Laboratory. The Organic Chemical Analysis and Operations Control modules were moved to the OU-1 Waste Pit area during the week of October 30 but will not be placed in their final locations at the waste pit site until early November.

The FEMP team continued to work diligently to prepare for the demonstration of the prototype RTAL at FEMP. Mr. R. Cohen replaced Mr. R. Heath as leader of the FEMP team.

A meeting was held on August 24 with a number of FEMP representatives dealing with preparations for the demonstration. The FEMP Health and Safety Department requires a fire alarm connected to FEMP's system be installed in each module. Also, installation of electrical power and water supply lines was planned. Planning continued during a subsequent meeting between Dr. S. Finger met and FEMP personnel on October 9. However, during a telephone conversation on October 26, Dr. Finger was informed that FEMP would not be able to provide electrical hook-ups within the timeframe required for the demonstration. The RTAL modules will, therefore, operate using their onboard 100 kVA generators for electricity. The generators will operate continuously once the demonstration period starts. Continuous electrical power is necessary to prevent damage to the analytical

equipment, several of which require that vacuum conditions be maintained (it would take about 3 days to restart the units if they had to be shut down completely). The generators will be backed up by the onboard Uninterruptible Power Supplies (10 kVA in each lab).

The U.S. Army Biomedical R&D Laboratory (USABRDL) was scheduled bring their Chemical Analysis Laboratory, Aquatic Biomonitoring Laboratory and Operations Control Center to FEMP prior to the start of the RTAL demonstration. USABRDL's Chemical Analysis Lab will simulate the RTAL's Inorganic Chemical Analysis Laboratory for RCRA analysis of heavy metal contaminants. USABRDL requires that all samples analyzed in their laboratories be non-radioactive. Therefore, samples prepared with surrogate materials will be analyzed in this module. The Aquatic Biomonitoring Laboratory will be used to demonstrate Integrated Biological Assessment techniques for overall hazard assessment.

The USABRDL laboratories will be located outside the FEMP Process Area since their activities in support of the RTAL demonstration are independent of the prototype RTAL modules. USABRDL requested that the demonstration of their Aquatic Biomonitoring Laboratory at FEMP be postponed until April 1996 to allow them to meet other project commitments. To minimize site preparation requirements and costs, it was agreed by all parties (FERMCO, ECO and USABRDL) that all the USABRDL modules will be demonstrated during April. This will have no effect on the prototype RTAL's Radioanalytical and Organic Chemical Analysis Laboratories, which will be demonstrated in January.

Mr. Cohen provided a letter commenting on the draft analytical procedures to be used in the labs. Appropriate modifications were made to the draft RTAL analytical procedures and a revised procedures document prepared. A letter responding to Mr. Cohen's letter, forwarding the revised procedures, was sent to FEMP and METC. A draft Project Specific Plan (PSP) was prepared by FERMCO. ECO reviewed the document and provided comments which are being incorporated into the final document. ECO also prepared a draft project-specific Chemical Hygiene Plan for inclusion in the PSP.

Training requirements were identified. Requirements include Radworker II, General Employee and other site-specific training. Unfortunately, the earliest training could be scheduled was for the week of November 13.

The demonstration period is now scheduled to start on November 27 and continue through January 1996, although this is dependent on the completion of site preparations and documents. ECO personnel will continue to work closely with the FEMP team to expedite the preparation and review of the necessary documents,

interface with FEMP-supplied services, and resolve other issues that may develop.

PLANS FOR NEXT QUARTER

The Phase IIb effort for the development and demonstration of the prototype RTAL system is on budget, although the schedule is being revised to accommodate site and USABRDL requirements. Completion of FEMP service hook-up's, e.g. water and drain lines and site-connected fire alarms, remain to be completed before the demonstration begins. However, good progress is being made in all areas and further significant delays are unlikely.

The plans for the upcoming quarter, from November 1995 through January 1996, call for a strong focus on Task 4, On-site Prototype Demonstration. Training for demonstration personnel is scheduled for the week of November 13. Hewlett-Packard and Canberra technicians will complete set-up and check-out of their analytical systems during the week of November 27. Assuming fire alarm and water hook-ups are completed, lab set-up and procedure preparation will take place during December. The actual demonstration will start in January 1996. The demonstration of the USABRDL Aquatic Biomonitoring and Chemical Analysis Laboratories will take place in April 1996. This time separation will have no effect on the demonstration of the radiochemical and chemical analytical capabilities of the prototype RTAL.

OVERALL STATUS ASSESSMENT

The Phase IIb effort for the development of the prototype RTAL system is on budget, although the schedule is being revised to accommodate site and USABRDL requirements. All contractual requirements to date have been met. ECO will continue to work closely with the FERMCO team to meet all FEMP requirements and maintain progress on this important project.