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ON-SITE LABORATORY SUPPORT OF OAK RIDGE NATIONAL LABORATORY ENVIRONMENTAL RESTORATION FIELD ACTIVITIES

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to be presented at the
Eleventh Annual Waste Testing and Quality Assurance Symposium
Washington, DC
July 23 - 28, 1995

Environmental Restoration Division

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Prepared by the
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American Chemical Society

1155 SIXTEENTH STREET, N.W.
WASHINGTON, D.C. 20036

March 27, 1995

Mr. James L.E. Burn
Scientist
Bechtel Environmental
151 Lafayette Drive
Oak Ridge, TN 37830

Dear Mr. Burn:

On behalf of the American Chemical Society and the Environmental Protection Agency, we are pleased to accept your paper entitled *On-Site Laboratory Support of Oak Ridge National Laboratory Environmental Restoration Field Activities* to be presented at the Eleventh Annual Waste Testing and Quality Assurance Symposium, July 23-28, 1995, at the Washington Hilton & Towers, Washington, DC. Your paper will be included in the Sampling and Field 1 Session on Tuesday AM, July 25, 1991. You will have a total of one-half hour for your oral presentation; 20 minutes for presentation and a 10-minute question period.

Please find the materials you will need to prepare the manuscript of your paper. All authors, both paper and poster, are requested to send their manuscript to the American Chemical Society no later than May 12, 1995 in order to assure the timely review and printing of the Symposium proceedings that will be distributed to all meeting attendees. **Suggestions for Effective Slide Presentations** is also enclosed for your review.

The final program with registration and housing materials is scheduled to be mailed in late April. The deadline for returning the registration form to the American Chemical Society is June 26, 1995. Please note that the registration fee is waived only for the primary author presenting the paper. If you wish to make reservations at the Washington Hilton & Towers, 1919 Connecticut Ave., NW, Washington, DC 20009, before the final program is mailed, please contact the hotel reservations department at (202) 483-3000. Be sure to identify your affiliation with the ACS/EPA Symposium in order to take advantage of the conference rate of $100/single or $120/double.

We look forward to welcoming you to the Symposium. In the meantime, should you have any questions, please feel free to contact our office at (202) 872-4608.

Sincerely,

Nicole Rodgers
Meeting Planner
Conference Management

Enclosures

cc: Gail Hansen, US EPA, Office of Solid Waste
David Friedman, US EPA, Office of Research & Development
Larry Keith, Radian Corp.

Mr. A.S Will, III
Oak Ridge National Laboratory
Building 7078, MS 6402
Oak Ridge, TN 37830

Subject: Bechtel Job No. 19118, RI/FS Project
Martin Marietta Energy Systems, Inc.
Subcontract No. 12B-99053C
TRANSMITTAL OF A PAPER ENTITLED "ON-SITE LABORATORY SUPPORT OF OAK RIDGE NATIONAL LABORATORY ENVIRONMENTAL RESTORATION FIELD ACTIVITIES"

Dear Mr. Will:

We are pleased to submit for your review a paper entitled "On-Site Laboratory Support of Oak Ridge National Laboratory Environmental Restoration Field Activities", by Jack Burn. This paper is to be presented at the Eleventh Annual Waste Testing and Quality Assurance Symposium on July 25, 1995 and published in the conference proceedings.

Should you have any questions, please contact Jack Burn at 576-1782.

Sincerely,

John W. Coleman
Acting Program Manager

Enclosure: Paper

cc: ER Document Management Center
Jerry Kuhaida

ON-SITE LABORATORY SUPPORT OF OAK RIDGE NATIONAL LABORATORY ENVIRONMENTAL RESTORATION FIELD ACTIVITIES

James L. E. Burn, Ph.D., Sr. Scientist, Bechtel Environmental, Inc., Oak Ridge, Tennessee 37831-0350

ABSTRACT

A remedial investigation/feasibility study has been undertaken at Oak Ridge National Laboratory (ORNL). Bechtel National, Inc. and partners CH2M Hill, Ogden Environmental and Energy Services, and PEER Consultants are contracted to Lockheed Martin Energy Systems, performing this work for ORNL's Environmental Restoration (ER) Program. An on-site Close Support Laboratory (CSL) established at the ER Field Operations Facility has evolved into a laboratory where quality analytical screening results can be provided rapidly (e.g., within 24 hours of sampling). CSL capabilities include three basic areas: radiochemistry, chromatography, and wet chemistry. Radiochemical analyses include gamma spectroscopy, tritium and carbon-14 screens using liquid scintillation analysis, and gross alpha and beta counting. Cerenkov counting and crown-ether-based separation are the two rapid methods used for radiostrontium determination in water samples. By extending count times where appropriate, method detection limits can match those achieved by off-site contract laboratories. Volatile organic compounds are detected by means of gas chromatography using either headspace or purge and trap sample introduction (based on EPA 601/602). Ionic content of water samples is determined using ion chromatography and alkalinity measurement. Ion chromatography is used to quantify both anions (based on EPA 300) and cations. Wet chemistry procedures performed at the CSL include alkalinity, pH (water and soil), soil resistivity, and dissolved/suspended solids. Besides environmental samples, the CSL routinely screens health and safety and waste management samples. The cost savings of the CSL are both direct and indirect. Direct cost savings are estimated based on comparable off-site quick-turnaround analytical costs. Indirect cost savings are estimated based on: reduction of costs and liability associated with shipping for off-site analyses, preparation for sampling, assistance to Health & Safety staff, and sampling crew downtime. Lessons learned are discussed.

INTRODUCTION

A remedial investigation/feasibility study (RI/FS) began at Oak Ridge National Laboratory (ORNL) in 1987 for ORNL's Environmental Restoration (ER) Program. Bechtel National, Inc. and partners CH2M Hill, Ogden Environmental and Energy Services, and PEER Consultants are the RI/FS subcontract team. In 1989 the project established the Close Support Laboratory (CSL) to provide rapid radiological ($\alpha/\beta/\gamma$) and volatile organics screens on samples to determine DOT classifications before shipment to the off-site CLP laboratory. The advent of the *Observational Approach* and *SAFER*

led the RI/FS team to shift the main use of the CSL from preshipment screening to screening to help in technical decisions (e.g., further sampling, new analytical requests). Basic wet chemistry techniques were added to assist in rapid and cost-effective sample characterization. CSL scope is now changing further to support other groups performing environmental restoration/waste management activities for ORNL ER.

TECHNICAL SUPPORT

CSL staff assist RI/FS project geologists with planning, interpretation, and application of sampling and analysis plans and associated support documents. Also, the staff currently supports ER field efforts with analytical planning, cost estimating, and data interpretation.

We interact with various ER project staff to provide pre- and post-field-support activities including preparation of sampling kits, sample screening for DOT transportation/packaging and radioactivity checks, analytical planning and coordination with off-site confirmatory-level laboratories, receiving excess sample from off-site labs, and archiving or disposing of sample remnants (thus closing the chain-of-custody).

*Im*mobile laboratory trailers at the ORNL ER Field Operations Facility (FOF) house the CSL. This location is convenient for sampling teams to pick up sample kits or to deliver samples since the FOF is the starting and stopping point for most ER field activities. We routinely screen environmental, health and safety, low-level decontamination and decommissioning and waste management samples. Our sample screening results are used by off-site labs to guard against instrument contamination and detector saturation.

ANALYTICAL TECHNIQUES

The analytical scope of the CSL covers basic radiological and volatile organics screening, and basic wet chemistry. Analyses can be performed rapidly, and results from complementary techniques are reviewed to provide a fuller technical understanding. Radiochemical analyses include gamma spectroscopy, tritium and carbon-14 screens using liquid scintillation analysis, and gross alpha and beta counting. Cerenkov counting and crown-ether-based separation are the two rapid methods used for determination of radiostrontium in water samples.

Gamma spectroscopy is performed via an intrinsic germanium detector with a computer-based multichannel analyzer. Due to the lack of an autosampler and the long count times often required, the gamma detector system is a bottleneck in sample throughput. A second detector will soon be on-line to increase our capacity.

Liquid scintillation is used to perform ^{3}H and screening ^{14}C analyses. Samples are not distilled; instead, soils are DI water extracted (1:1 w/v) and instrumentation software

corrects for quenching effects in all samples. Carbon-14 can be excluded based on negative screening results but cannot be confirmed based on positive results (other weak or quenched β particles may cause 'false' positives).

Gross α and β are measured using proportional counters. Low-activity samples are analyzed on a low-background gas-flow proportional counter. Higher-activity samples are analyzed on scalers because higher-activity samples might contaminate the low - background counter, and the ZnS solid scintillator probe is immune to the β->α cross-talk observed in the α signal from the gas-flow proportional counter.

The CSL analyzes ^{90}Sr in water samples using one of two methods. Strontium may be separated from unfiltered or filtered samples using SrSpec columns (EiChrom), then immediately counted for ^{90}Sr as gross β before substantial ^{90}Y ingrowth. Alternatively, after a two-week ^{90}Y ingrowth, ^{90}Sr Cerenkov counting may be performed on filtered samples using the liquid scintillation counter (and *no* scintillation cocktail). Strontium-90 Cerenkov counting also requires gamma spectroscopy to provide $^{137}Cs/^{60}Co$ correction to the Cerenkov-determined activity.

Volatile organics screens are performed by gas chromatography (GC) using photoionization (10.2 eV) and Hall electrolytic conductivity detectors and a CSL-specific method based on EPA 601 and 602. A sixteen-port purge-and-trap autosampler introduces samples onto the GC column. The primary volatile organic contaminants of concern are fuel-based aromatics and solvent-based chlorinated hydrocarbons.

Basic wet chemistry for environmental waters includes alkalinity, dissolved and suspended solids, ion chromatography (IC), and, (for various matrices) pH and resistivity. IC is used to analyze both cations and anions following a CSL-specific method based on EPA 300. Together, IC and alkalinity provide an ionic profile of water samples.

QUALITY ASSURANCE

The mission of the CSL is to provide rapid screening (EPA level II) for the ORNL ER program. The lab delivers these results, using lab-specific methods, without time-consuming deliverable requirements. Controlled CSL procedures and the laboratory quality assurance plan explain quality requirements for each analysis and general laboratory practices. QA staff from Bechtel, ORNL Oak Ridge Reservation, and DOE Oak Ridge routinely audit the lab's procedural conformance and good lab management practices. The CSL has used commercially prepared performance evaluation (PE) samples to fine tune method accuracy. The radiological PE samples were obtained from Analytics and the chemical from Environmental Resource Associates. Recently, we have begun to take part in EPA-sponsored radiological (EMSL-LV) and chemical water

pollutant (EMSL-Cinci) PE studies. Participation in these studies will verify our accuracy and interlaboratory comparability.

COST EFFECTIVENESS/SAVINGS

The CSL is saving dollars both directly and indirectly. Direct cost savings are based on comparable off-site quick-turnaround analytical costs; premium charges for rapid response from off-site laboratories make the CSL especially cost-effective. The RI/FS team has documented CSL savings estimated to be greater than $1 million for each of the last two fiscal years.

Indirect savings are difficult to quantify. They are based on reduction of costs and liability associated with shipping samples off-site for analysis, preparing for sampling and sample shipping, assisting Health and Safety (H&S) staff, and sampling crew downtime. CSL data provides for proper DOT classification of environmental samples. Sample container procurement, sample kit preparation, and sample chain of custody are all centralized through the CSL for most samples analyzed by the CSL. CSL staff also generally prepares and packages samples for shipment to off-site labs for further analysis. H&S staff uses the CSL to analyze monitoring samples to minimize personnel risk, and field sampling crews are more productive because of the rapid turnaround of data from H&S and sampling based on results of previous sampling.

LESSONS LEARNED

Several lessons learned at the CSL may apply to similar screening laboratories.

- Determine a general prioritization scheme for samples and analyses *before* competing deadlines or customers demand one. This planning should include holding time, data end-use, and lab staffing considerations. Lab customers should be aware of and agree with this scheme.

- Establish appropriate sample selection guidelines to identify possible further analyses (e.g., perform γ spectroscopy only when β activity is greater than x) within the screening lab or at an off-site confirmation lab. Setting up a formalized analytical decision tree will save money by reducing unnecessary analyses and documentation requirements.

- Invest in an expandable data handling system and integrate data handling into the appropriate project data management plan. Data quality can be undermined by a poor or 'make-do' handling system.

- Stagger staffing hours. Varied schedules reduce overtime, improve morale, and serve both the first-of-the-day customers (generally technical staff) and end-of-the-day customers (generally field sampling staff).

FUTURE DIRECTIONS

The mission of the CSL will likely stay the same as the CSL continues under another subcontractor to Energy Systems, although with the recent appointment of a technical interface, Energy Systems will take a more active role in CSL activities. An upgrade to the database is under way to ensure seamless electronic data delivery to CSL customers and the Oak Ridge Environmental Information System. As quick-turnaround screening data are more broadly accepted, the analytical capability and sample capacity of the CSL will likely expand.

SUMMARY

The ORNL RI/FS team established the CSL to provide rapid radiological ($\alpha/\beta/\gamma$) and volatile organics screens for ER. Basic wet chemistry techniques were added to assist in rapid and cost-effective sample characterization. The CSL provides its RI/FS and other ER customers with technical and analytical support, and lessons learned may have potential application for similar sites or labs. ER is expanding the CSL's scope to support general environmental restoration/waste management activities at ORNL.