

ENVIRONMENTAL MEASUREMENTS LABORATORY



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Fiscal Year 1998 **OSTI**
Accomplishments And Technical Activities



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Mitchell D. Erickson

MASTER

January, 1999

**FISCAL YEAR 1998
ACCOMPLISHMENTS AND TECHNICAL ACTIVITIES**

Mitchell D. Erickson, Director

**Environmental Measurements Laboratory
U.S. Department of Energy
201 Varick Street, 5th Floor
New York, NY 10014-4811**

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ABSTRACT

The Environmental Measurements Laboratory (EML) is government-owned, government-operated, and programmatically under the DOE Office of Environmental Management. The Laboratory is administered by the Chicago Operations Office. EML provides program management, technical assistance and data quality assurance for measurements of radiation and radioactivity relating to environmental restoration, global nuclear nonproliferation, and other priority issues for the Department of Energy, as well as for other government, national, and international organizations. This report presents the technical activities and accomplishments of EML for Fiscal Year 1998.

EXECUTIVE SUMMARY

The Environmental Measurements Laboratory (EML), with its core strengths in monitoring, radiological measurements, and measurement technology innovations, provides value-added mission support to the Department of Energy (DOE) and several other federal agencies in a wide variety of programs, both nationally and internationally. Many of these activities serve to better position the U.S. as a world leader in areas ranging from characterization and sensor technology to measurement quality assurance to subsurface/vadose zone contaminant characterization.

This report presents, by customer, the technical activities and accomplishments of EML for Fiscal Year (FY) 1998. EML's FY 1998 DOE customers included the Office of Environmental Management (EM-40, EM-50, EM-70), the Office of Science (SC), the Office of Nonproliferation and National Security (NN), and the Office of Environment, Health and Safety (EH). EML's FY 1998 Work for Others (WFO) customers included the U. S. Air Force (AF), the U. S. Nuclear Regulatory Commission (NRC), and the U. S. National Aeronautics and Space Administration (NASA).

Paths to Closure. EML's main mission is to support EM's site closure and cleanup completions through its: (1) activities in development and deployment of radiological field characterization and monitoring technologies, and (2) performance testing programs which provide external oversight of the quality of data used in the DOE cleanup activities. Highlights for FY 1998 were the development and demonstration of PASS, a portable aerosol sampling system; the demonstration and deployment of *in situ* gamma-ray spectrometry; and the continued activities of the EML Field Survey Team as a critical technical interface between DOE site personnel and the contractors engaged in site surveys. EML site survey activities will lead to a regulatory agency approved protocol that will significantly reduce remedial costs and accelerate schedules. For example, EML's real-time measurements at Fernald are projected to save over 30 million dollars in measurement costs and will allow the 2006 Closure Schedule to proceed without delays due to analytical overload.

Performance testing highlights include EML's designation as a DOE reference laboratory, sponsored by the National Analytical Management Program (NAMP), under the implementation of the ANSI Standard 42.23, and EML's continued administration of the biannual Quality Assessment Program (QAP) with more than 150 laboratories participating. The EML QAP supported paths to closure at DOE sites performing characterization or monitoring activities (e.g., Fernald, Brookhaven, Savannah River, and Oak Ridge). Also, EML performed a pilot test of ANSI Draft Standard N13.29, "Environmental Dosimetry Performance - Criteria Testing," which covers performance testing of environmental dosimetry providers. Quality assurance and standards development insure that the vast multitude of sample analyses and field measurements that are performed to support DOE site closures are legally and scientifically defensible and will not lead to costly remediation failures during close-out radiological surveys.

National Security and Science. As a federal facility, EML supports DOE's National Security mission through its detection and deterrence technologies for the Comprehensive Test Ban Treaty (CTBT) and the Nonproliferation Treaty (NPT) activities. In FY 1998, the next generation of the EML-designed AUTORAMP was designed and demonstrated. A Tagged Aerosol Generator (TAG) was in the first stages of development. A portable gamma radiation measurement system, RAMPSCAN, was designed and deployed by the AF. EML continued its management of the Office of Biology and Environmental Research (OBER) Human Subjects Research Database in compliance with federal policy to protect the rights and welfare of human research subjects. FY 1998 also saw the deployment of an EML atmospheric radon monitor at the Global Atmospheric Watch (GAW) Pallas station by the Finnish Meteorological Institute (FMI).

Performance Measures. One of EML's performance measures assesses the results of EML's activities in the areas of technology development. Shown in the table below are the FY 1998 metrics, utilizing the Office of Science and Technology (OST) breakdown of development, demonstration and deployment. Also shown is the number of reports published during the fiscal year, which is another metric applied to projects in research and performance testing.

	Number of Technologies			Number of Publications
	Developed	Demonstrated	Deployed	
DOE EM	1	2	1	9
Other DOE	1	0	0	10
WFO	2	2	2	8
TOTAL	4	4	3	27

FY 1999. In FY 1999, EML will continue its activities under the Accelerated Site Technology Deployment Program (ASTD) program with the Fernald Environmental Management Project (FEMP) and will begin activities with Brookhaven National Laboratory under a new ASTD proposal: "Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites." EML anticipates being designated the "U.S. Radionuclide Laboratory" for the CTBT in FY 1999. In the area of technology development, the PASS will be deployed at Fernald and the TAG will move into the beta testing and demonstration stages. As a DOE-designated reference laboratory, EML will continue its activities with NIST to develop criteria and performance testing protocols for the reference laboratories as specified in the ANSI Standard 42.23. Currently, EML has a total of 16 publications that have been submitted, accepted for publication or published for FY 1999.

Mitchell D. Erickson,
Director

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PART I. SUPPORTING EM's PATHS TO CLOSURE

SUMMARY OF FY 1998 ACCOMPLISHMENTS

Office of Science and Technology (EM-50)

- **CMST-CP** – EML provides management support to CMST-CP as the Focus Area Liaison for Deactivation and Decommissioning and as Project Facilitators. These activities promote technology demonstrations and deployments (Section 1.1.1).
- **CMST-CP** – As federal technical experts, EML provides independent reviews of technology programs and proposals (e.g., Kabis groundwater samplers and *in situ* tritium monitors) (Section 1.1.1).
- **CMST-CP** – EML is the Federal Review Group for the Chemical Analysis Automation (CAA) Program (Section 1.1.1).
- **SCFA Vadose Zone** – EML is the lead organization for collaborative Russian/American studies of contaminant migration in groundwater. This effort supports the SCFA high-priority needs for characterizing and modeling groundwater plumes, and for corroboration and verification of Hanford vadose zone modeling efforts (Section 1.1.2).
- **International Program - Former Soviet Union (FSU)** – EML represents EM as the Technical Program Manager for the Site Characterization and Contaminant Transport Focus Area of the Joint Coordinating Committee on Environmental Management (JCCEM). The Focus Area is collaboratively studying, with Russian and American scientists, contaminant migration in groundwater (Section 1.2.1).

DOE Field Office Closure Activities

- **ASTD** – EML partnered with the Fernald Environmental Management Project (FEMP) and Brookhaven National Laboratory (BNL) on two ASTD proposals (Section 1.3.1A).
- **FEMP - Soil Contamination** – EML is part of the Real Time Measurement Work Group at Operable Unit (OU) V of the FEMP. The Work Group's mission is to gain regulatory acceptance of *in situ* gamma-ray spectrometry for final certification (Section 1.3.1B).
- **FEMP - *In Situ* Spectrometry** – EML Field Survey Team activities, are providing the technical basis that has resulted in the deployment of *in situ* spectrometry and has established a model for its acceptance by regulators at other DOE sites (Section 1.3.1B).
- **FEMP - Ambient Aerosol Characterization** – EML is demonstrating specially-designed aerosol sampling equipment next to an existing high volume sampler used by the FEMP for compliance purposes. After a 6-month testing and intercomparison period, EML's equipment will be deployed by FEMP for characterizing the uranium air concentration at remote sites (Section 1.3.1B).
- **FEMP - Groundwater Transport Modeling** – EML provides technical assistance and Quality Assurance (QA) on fate and transport modeling to support the FEMP groundwater cleanup program. These activities support the accelerated cleanup of a sole source drinking water aquifer. Enhancements in the current model will allow for remediation employing the minimum number of conventional extraction wells (Section 1.3.1B).
- **FEMP - Analytical Services** – EML has prepared and validated large volume soil materials to be used in radioanalytical QA processes (Section 1.3.1B).
- **Rocky Flats** – EML is providing consultation to Rocky Flats Environmental Technology Site (RFETS) on *in situ* and laboratory-based measurements for remediation (Section 1.3.1C).
- **BNL - OU IV** – EML is providing guidance on the characterization and radiation monitoring plans for the final remedial design of Building 650 Sump Outfall Area of OU IV at BNL. Cleanup costs will be reduced through better decision making during excavation (Section 1.3.1B).

- **BNL - Peconic River** – EML is consulting with the Chicago Operations Office Brookhaven Group (CH/BHG) and BNL on the highly sensitive issue of radionuclide contamination of the Peconic River (Section 1.3.1D).
- **BNL** – EML reviewed DOE Report, “Assessment of Tritium Analytical Data at Brookhaven National Laboratory/Analytical Services Laboratory.”
- **Ames** – EML is providing consultation to Ames on radiological survey planning for characterization and decontamination (Section 1.3.1E).
- **FUSRAP** – EML provided consultation and performed intercomparison measurements for radiological surveys with DOE contractors at the Luckey, OH Formerly Utilized Sites Remedial Action Program (FUSRAP) site during DOE project transition to the Corps of Engineers (Section 1.3.1F).

National Programs/Centers of Excellence

- **NAMP** – EML provides a semi-annual external, independent performance evaluation program, the QAP, designed to test the quality of environmental radiological measurements reported by DOE contractor and subcontractor laboratories. Participation in QAP is an element of the site’s integrated QA management program to provide quality data “the first time” thereby reducing cost of repeat analyses (Section 1.4.1A).
- **NAMP** – EML is a designated “reference laboratory” under the specifications of American National Standards Institute (ANSI) Standard 42.23 and will provide a traceable lineage to the National Institute of Standards and Technology (NIST) for analytical measurements. The establishment of traceability together with QAP provides assurance of data quality that the DOE analytical complex requires for critical project decision making (Section 1.4.1A).
- **NAMP** – EML is participating in intergovernmental work groups which are leading a federal effort to respond to recent Inspector General (IG) reports on lack of data quality and project planning. The interagency guidance developed will provide more consistent approaches to facilitate implementation of the Federal Facility Compliance Act (Section 1.4.1B).

- **NAMP** – EML supports NAMP activities to develop an EM policy on accreditation of DOE laboratories through participation in the National Environmental Laboratory Accreditation Conference (NELAC) activities to develop standards for a national accreditation program for testing laboratories (Section 1.4.1C).
- **NAMP** – EML, through its activities with national and international standards organizations, supports DOE's effort to implement Public Law 104-113, The National Technology Transfer and Advancement Act of 1995, which calls for federal participation in the development and use of voluntary standards (Section 1.4.1C).
- **NETO** – EML, after providing a lead technical role in FY 1996-97 in the development of Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), is now part of the joint DOE-EPA training team. This radiation site survey and investigation process will be used to demonstrate compliance by DOE, NRC and EPA, and will have a major impact on the Deactivation and Decommissioning (D&D) of nuclear facilities (Section 1.4.2).

SUMMARY OF FY 1998 ACTIVITIES

1.0 OFFICE OF ENVIRONMENTAL MANAGEMENT

FY 1998 Funding: 5.150 M Program Direction Funding
0.400 M Program Support Funding

1.1 OST/Office of Technology Systems (EM-53)

1.1.1 Characterization, Monitoring, and Sensor Technology - Crosscutting Program (CMST-CP)

1.1.1.1 FY 1998 Accomplishments and Activities

- During FY 1998 EML completed the integration of technical support to CMST-CP. EML held functional responsibilities as field technical manager, focus area liaison and project facilitators. EML also directly responded to the CMST-CP Headquarters Manager's requests for technical reviews and assistance.
- The D&D Focus Area (DDFA) Liaison and the EML CMST-CP Point of Contact participated in the CMST-CP retreat to delineate mission, vision, goals, roles and responsibilities for the program.

A. *Field Technical Manager* (through June 1998).

- Attended the FY 1998 Kickoff Meeting to discuss the CMST-CP Multi-Year Program Plan and other strategic planning issues.
- Attended the OST/Field Workshop which addressed operational issues relevant to the Focus Areas and Cross Cutting Programs.
- Worked with the Focus Area Liaisons to organize the CMST-CP Annual Program Review. Presented the welcoming address and an overview of the technical program.

- Held a 2-day planning meeting with the Focus Area Liaisons to develop the Technology Needs and Gap Analysis Report.
- Developed input for the FY 2000 Internal Review Budget (IRB).
- Worked with the CRE to organize the American Society of Mechanical Engineers (ASME) peer review schedule for CMST-CP, and provided the Review Criteria for the technologies applicable to characterization and monitoring of dense, nonaqueous phase liquids (DNAPLs).
- Attended the SCFA Midyear Program Review.
- Worked with the CMST-CP Headquarters Program Manager to plan the FY 1999 Technical Portfolio.
- Attended the CMST-CP Organization Development Retreat.

B. DDFA Liaison.

- EML serves as the DDFA Liaison (Product Line Manager) for the CMST-CP.
- Presented an overview of the CMST-CP at the DDFA midyear review.
- Member of the Hanford Canyon Disposition Initiative (CDI) Technology Working Group that reviews, assesses and recommends technology demonstrations and deployments for the characterization phase of the project.
- Member of the DOE/Utilities Consortium which seeks to identify, demonstrate and deploy D&D technical solutions for the nuclear utility and DOE sites. Attended a working group meeting held at Florida International University (FIU).
- Presented an overview of the CMST-CP Program and its support of D&D activities at the DDFA Mid-Year Review.
- Participated in the evaluation of basic science projects at the EM Science Program (EMSP) Workshop that may address the more applied needs of CMST-CP and the DDFA.
- With coordination of the DDFA, wrote D&D sections of CMST-CP Gap Analysis, FY99 Annual Performance Plan and Multi-Year Program Plan.

C. CMST Project Facilitators.

- Seven EML staff serve as CMST-CP project facilitators for projects supporting the SCFA.

- Completed the annual facilitator on-site reviews and reports.
- Attended and served as breakout session moderators during the FY 1998 CMST Program Review. The CMST projects undergo an annual independent review to ensure that the CMST-CP program is consistent with and supports EM closure strategies as well as end user needs.
- Worked with 3M Corporation to develop an Innovative Technology Summary Report (ITSR).
- Visited FIU to meet with the manager of the Analytical Laboratory at the Hemispheric Center for Environmental Technology (HCET).
- Attended the demonstration of the Cone Permeameter Technology developed by Science and Engineering Associates.
- Visited the Integrated Demonstration Site in Savannah River Site to observe the operation of the DOE Site Characterization and Analysis Penetrometer System (SCAPS) truck.
- Reviewed the Alternative Landfill Cover Demonstration Gate 4 Report.

D. Federal Technical Experts.

- EML reviewed the technology of Kabis groundwater samplers (Sibak Industries Limited, Inc.) and provided guidance concerning its deployment at the Hanford site.
- EML attended the Tritium Monitoring Workshop at the Desert Research Institute, Las Vegas. The workshop discussed ground and surface water tritium issues in the DOE complex and resource opportunities.
- EML reviewed various technical proposals, including: "A Real-Time Personnel Monitor for Alpha Contamination" and "Real-time *In Situ* Detection of Tritium in Water."
- EML served as an external technical reviewer at the CMST-CP Annual Program Review for the following projects: "Demonstration of Emerging Continuous Emissions Monitoring Technologies," "DOE Laboratory/Industry Performance Demonstration," "Portable X-ray K-edge Heavy Metal Contaminant Detector," "SCAPS Logistics" and "Technology Applications for Field Sampling Systems."
- EML attended a 3-Dimensional Integrated Characterization and Archiving System (3D-ICAS) briefing and demonstration at ORNL. The 3D-ICAS technology combines sensors for

radionuclides, organics, asbestos and base materials with a 3-D mapper for surface contamination characterization.

- EML attended the 6th International On-Site Analysis Conference where sessions were held to discuss technology transfer and verification.
- EML attended the Site Characterization and Monitoring Technology Pilot Environmental Technology Verification (ETV) Program Stakeholders Workshop. Current and future activities of ETV and EPA policy developments were discussed.

E. Federal Review Group for CAA.

- EML, at the request of headquarters, is the lead federal review group for the CAA Program.
- EML attended the DOE-sponsored CAA Technology Workshop and prepared a reviewed of the technical specifications for the PCB module. EML also reviewed the module for computerization of data validation.

1.1.1.2 Planned FY 1999 Activities

- EML will continue at the present level of management and technical expert support for CMST-CP.
- EML will attend a meeting to review the draft Project Plan for CAA. The CAA objectives and proposed cost and needs studies will be reviewed. Options for paths forward will be developed and a response to project plan deliverables outlined. A Business Review meeting for the CAA Project is planned where the major principal investigators will present an update and status for their FY 1999 tasks.
- EML will provide technology verification oversight for the CAA.
- EML will provide technical reviews and assistance as requested.
- EML will present several technologies at the Technoventions Conference: "Environmental Technologies-from Laboratories into the Hands of Users," which will showcase innovative environmental technologies, particularly those applicable to environmental characterization, monitoring and surveillance. Technical interactive sessions will be provided for:

- AUTORAMP: An automatic environmental aerosol monitoring, analysis and reporting system;
- RADOMETER: A portable survey instrument for real time measurements of ^{222}Rn and ^{220}Rn , and the RADGRABBER: A real time aircraft instrument for atmospheric radon measurements;
- DATA VISUALIZATION: Three dimension software applied to subsurface radionuclide transport;
- PASS: A long-term fuel and solar cell powered aerosol sampling system for NESHAP Compliance;
- ISD97: Deconvolution Methodology for *In Situ* Gamma-Ray Spectrometric Measurements.

1.1.1.3 Background and Objectives

EML provides technical program management and expert technical support for CMST-CP activities. EML contributes its technical expertise by assessing proposals, monitoring project progress, evaluating project products, and assessing technology requirements, capabilities and limitations.

1.1.1.4 Impact

These activities promote innovative deployments that will provide faster, better, cheaper, and safer clean-up activities across the DOE complex, thus fulfilling the objectives of the 2006 Plan.

1.1.2 Subsurface Contaminants Focus Area (SCFA)

1.1.2.1 FY 1998 Accomplishments and Activities

- During FY 1998, EML, as lead of the international Russian/American program studying subsurface contaminant migration, focused program efforts to help solve SCFA needs at DOE sites, especially related to the Hanford vadose zone.

A. Technical Program Manager for Russian/American Subsurface Studies (see also Section 1.2 on JCCEM activities)

- Represents EM-50's JCCEM Russian/American Contaminant Migration Program at "The State of the Knowledge of the Vadose Zone Book Project" workshops.
 - ▶ The First Workshop addressed developing a vadose zone clean up program (Chapter 2) and characterizing and monitoring the vadose zone (Chapter 3).
 - ▶ The Second Workshop addressed fate and transport issues (Chapter 4).
- Coordinated and edited the Russian submission of "Case Study" for "The State of the Knowledge of the Vadose Zone Book Project" concerning strontium migration at the Tomsk site.
- Coordinated Russian participation in the Fourth International Symposium and Exhibition on Environmental Contamination in Central and Eastern Europe (Warsaw '98) session on the vadose zone.
- Wrote abstracts for presentation at Warsaw '98 by Russian participants concerning JCCEM efforts to apply studies to Hanford vadose zone modeling calibration, verification, and validation.
- Edited and submitted two papers from the JCCEM program for Warsaw '98 Proceedings.

1.1.2.2 Planned FY 1999 Activities

- Continue to represent EM-50's JCCEM Contaminant Transport Focus Area efforts at SCFA initiatives.
- Continue to work with the Site Technology Coordinating Groups (STCG) at Nevada and Idaho to integrate Russian/American JCCEM studies to help solve subsurface modeling needs by the utilization of historic Russian contaminant plume data.

1.1.2.3 Background and Objectives

The Vadose Zone Book will be a comprehensive text book addressing not only the current understanding of vadose zone characterization and contaminant fate and transport, but also will include case studies, comparisons of technologies and analyzes of key topics that need additional investigation. EML is the lead organization for subsurface contaminant migration studies of the JCCEM, thus providing the SCFA coordination and integration with Russian expertise, data, and instrumentation that can be used to help EM remediation efforts at DOE sites with unique characterization and modeling capabilities.

1.1.2.4 Impact

These activities promote international participation on SCFA initiatives to advance the state of knowledge of the vadose zone within the DOE complex. Additionally, international participation supports EM's advancement of the "state of the art" for the best technical solutions to the complex problems of contaminant transport.

1.1.2.5 Publications

- Drozhko, E., M. Glinsky, L. Samsonova, N. Vasilkova, A. Zinin, G. Zinina, M. Foley, A. R. Hutter. "Aspects of JCCEM Russian/American Studies of Contaminant Transport and 'Solute/Rock' Interaction," Proceedings of the Fourth International Symposium and Exhibition on Environmental Contamination in Central and Eastern Europe - Warsaw98, Warsaw, Poland, September 15-19, 1998, accepted for publication.
- Drozhko, E., M. Glinsky, A. V. Glagolev, A. Alexahkin, I. A. Ivanov, A. A. Poshokov, B.B. Looney, R. L. Nichols, A. R. Hutter. "Russian/American subsurface contaminant transport studies around Lake Karachai," Proceedings of the Fourth International Symposium and Exhibition on Environmental Contamination in Central and Eastern Europe - Warsaw98, Warsaw, Poland, September 15-19, 1998, accepted for publication.

1.2 OST/Office of Technology Integration (EM-54)

International Program: FSU

1.2.1 FY 1998 Accomplishments and Activities

- Served as the technical lead on joint Russian/American studies of subsurface contamination migration at various FSU sites. Field studies for hydrogeologic characterization and model development of contaminant migration at the Mayak Production Association (Chelyabinsk-65) will provide the world's best source of calibration and verification data models for use at many DOE sites.
- Presented the accomplishments and future plans of the Site Characterization and Contaminant Transport Focus Area of the JCCEM at the CMST-CP Annual Program Review. These Focus Area studies on contaminant migration in ground waters are sponsored by EM-53/CMST-CP.
- Participated in European Commission-sponsored workshops conducted in the FSU as a member of the Expert Panel for international collaborative efforts at the Mayak site.
- Organized and lead the Contaminant Transport Focus Area Annual Workshop to develop and finalize statements of work, technical tasks, and contracts for FY 1998.
- Co-presented with the Russian coauthors a paper, "Experience of the Joint Russian/American Studies Conducted in 1994-1998," and coauthored another presented paper entitled "Results of Russian/American Field Studies Around Lake Karachai" at Spectrum '98 - An International Conference on Decommissioning and Decontamination and Nuclear and Hazardous Waste Management.
- Lead the planning group workshop during the Spectrum '98 Conference to initiate FY 1999 activities.

1.2.2 Planned FY 1999 Activities

- Collaborated on a jointly developed 3-dimensional hydrogeological model of the Mayak site by using Russian historical contaminant plume monitoring data. These efforts will result in data that can be used to verify and validate models currently in use at many DOE sites.
- Continue and start, respectively, the development of historical contaminant plume databases into usable forms for calibration and verification of contaminant transport models in use at DOE sites.
- Coordinate and direct the results of this JCCEM Focus Area to address issues for the Hanford Vadose Zone Initiative and other high-priority soils and groundwater needs at the Idaho National Engineering and Environment Laboratory (INEEL) and the Nevada Test Site (NTS).

1.2.3 Background and Objectives

EML represents EM as the Technical Program Manager for the Site Characterization and Contaminant Transport Focus Area of the JCCEM cooperative projects. The JCCEM is the managing body of a Memorandum of Cooperation between DOE/EM-50 and the Russian Ministry of Atomic Energy (MINATOM). The JCCEM Russian and American scientists collaboratively study contaminant migration in groundwater.

1.2.4 Impact

These efforts are directed, in part, to helping modeling calibration and verification issues for the Hanford Vadose Zone Initiative. Other DOE applications for the program include solutions to the STCG identified needs at NTS and INEEL. Models and protocols may be applicable at many other sites.

1.2.5 Publications

- Nichols, R. L., B. B. Looney, A. R. Hutter, E. G. Drozhko, Y. V. Glagolenko, S. I. Rovny, Y. G. Mokrov, I. A. Ivanov, A. V. Glagolev and V. N. Golotchak. "Summary of the Installation and Initial Sampling of StrataSamplers in the Mishelyak River Valley, Ozyorsk, Russia (U)," Westinghouse Savannah River Company Report WSTC-TR-98-00206, June 1998.
- Glagolev, A. V., S. A. Ter-Saakian, I. A. Ivanov, A. A. Poshokov, B. B. Looney, R. L. Nichols, A. R. Hutter. "Russian/American Field Studies Around Lake Karachai," Proceedings of the Spectrum '98 Conference, American Nuclear Society, La Grange Park, IL, pp. 927-931, September 13-18, 1998.
- Kudryavstev, E. G., E. Drozhko, M. Glinsky, Yu. Tatarchuk, A. R. Hutter. "Experience of Joint Russian/American Studies Conducted in 1994-1998," Proceedings of the Spectrum '98 Conference, American Nuclear Society, La Grange Park, IL, pp. 932-935 September 13-18, 1998.

1.3 Supporting EM Activities at DOE Field Offices

EML supports EM closure activities through technology development and deployment, acting as a federal technical lead, providing performance testing and supporting radiological field surveys. There is a high return on investment (ROI) for the DOE field programs.

1.3.1 FY 1998 Accomplishments and Activities

A. Accelerated Site Technology Deployment (ASTD).

- EML continued ASTD activities with FEMP on the proposal “Deployment of an Integrated Technology Suite for Cost-Effectively Delineating Contamination in Soils in Support of Soil Remedial Actions,” at the Ohio Field Office which supports the deployment of *in situ* spectrometry. *In situ* spectrometry is currently deployed at FEMP for characterization, excavation control and precertification activities. EML’s work at FEMP has established a model for the acceptance of *in situ* spectrometry by the regulators.
- EML partnered with BNL on an ASTD proposal supporting the EM-50 DDFA. The proposal, “Deployment of Innovative Characterization Technologies and Implementation of the MARSSIM Process at Radiologically Contaminated Sites” has been approved.

B. EM Activities for the Fernald Environmental Management Project (FEMP).

PBS: OHFN0530

Contaminated Soils

- EML serves as the technical team lead for the “Real-time Measurements Work Group” at OU V dealing with the Soil Characterization and Excavation Project. This Work Group is addressing regulatory acceptance of *in situ* gamma-ray spectrometry for final certification.
- EML provided *in situ* spectrometry for comparability measurements and testing of contaminated soils using predetermined waste acceptance criteria at Fernald. This activity supports the on-site disposal facility operational plan.

- EML provided on-site support in the areas of thoron and radon detection instrument calibration at Fernald.
- EML prepared sections of the "Users Guide" for deployment of *in situ* spectrometry at the FEMP.
- EML has developed the technical basis to extend the application of *in situ* spectrometry to nonflat terrain areas at the FEMP.
- EML has provided data interpretation and consultation in the development of methodology to correct for ^{226}Ra disequilibrium conditions for the soils measurements program at the FEMP.

Aerosol Characterization

- EML completed a 1-year study to characterize the size distribution of ambient aerosol radioactivity downwind at the site fence line. The first 6 months of data show that the major fraction of uranium aerosol is in the nonrespirable range of the size distribution.
- In response to customer needs, and through its on-site involvement, EML initiated the development of portable, light weight, low air flow, low d.c. power, automated equipment for the characterization of uranium bearing ambient aerosol at the Fernald site. This equipment was designed as a portable aerosol sampling system (PASS) for remote sampling.
- EML's aerosol equipment is currently co-located with existing FEMP aerosol samplers to demonstrate the equivalence of collection methods. After a 6-month testing and intercomparison period, EML's equipment will be available to FEMP for use in characterizing uranium air concentrations due to remedial activities.

Groundwater

- Provided consultation and technical assistance in transport modeling to support the groundwater cleanup program at FEMP. As a QA effort, EML's model will provide additional information to FEMP for comparison with information from the contractor's model. EML reviews will improve the current FEMP groundwater model so that it will have a more robust numerical code for predicting groundwater flow and the fate of uranium contamination in the groundwater.

- Presented a paper "Modeling Studies of the Characterization of Subsurface Uranium Contamination at Fernald, Ohio, USA," coauthored with Los Alamos National Laboratory and Flour-Daniel Fernald at Warsaw '98.

Analytical Quality Assurance

- Prepared and validated a large, bulk site specific (South Field) Quality Control (QC) soil sample. Use of site specific soil is critical to FEMP needs. Recent analyses of soils collected for Area 1 Phase 1 certification by different contractor laboratories have revealed problems in comparability of the results. EML's expertise and experience provided a level of confidence needed to support the use of onsite soils in the construction of the 1000 yr disposal facility. Cost avoidance related to the purchase and transport of soils from offsite, approximately 800k yd³, is significant.
- Prepared a homogenized soil sample to be used for treatability studies on fixing uranium to soil related to long-term storage issues at Fernald.

C. EM Activities for the Rocky Flats Environmental Technology Site (RFETS).

PBS: RFRT0375

- Provided consultation to contractors at RFETS on *in situ* and laboratory-based spectrometric measurements to support the radiological survey work for the remediation of Trench 1 and for the characterization of the area surrounding 903 Pad.

D. EM Activities for CH/BHG.

PBS: CHBN0006

Sump Outfall Area

- EML is providing support and guidance in the development of plans for the characterization and radiation monitoring of the Area of Concern (AOC) 6 - Building 650 Sump Outfall Area of OU IV at BNL. This activity is in support of the final remedial design for this OU.
- EML provided radiation monitoring and field and laboratory measurements of radionuclides in surface and sub-surface soils of the Building 650 Sump Outfall Area at BNL.

- EML provided quarterly thermoluminescence dosimetry (TLD) environmental radiation monitoring at AOC 6 as part of the interim remedy while BNL upgrades their in-house environmental monitoring program.

Peconic River Investigation

- With its unique experience in measuring radionuclides in lake sediments, EML has been requested by the CH/BHG to provide consultation on background concentrations, sampling, analysis, and QA related to the highly sensitive issue of plutonium and other radionuclide levels in sediments along the Peconic River, downstream (off site) from BNL.

Operable Unit V

- Assisted BNL with an oversight review of the data usability guidance for OU V Wetlands Area Remedial Investigation (RI) to determine if it would meet NY State Department of Health requirements and provided recommendations for further action.
- Provided a reviewed of the contractors' data validation reports for the OU V RI.

Environmental Monitoring

- EML provided measurement support for the assessment of radiation doses in public areas (Science Museum, RHIC Visitors Center) from BNL operations.

E. EM Activities for CH/Ames Group.

PBS: CHAM0025

- EML provided expert consultation to CH/Ames Group and Ames Laboratory on radiological survey planning for the characterization and decontamination of the Harley A. Wilhelm Hall at Iowa State University, a site where research on ^{232}Th was formerly performed.

F. EM Activities for the FUSRAP Luckey, OH Site.

- EML provided consultation and performed intercomparison measurements with DOE contractors for radiological surveys at the Luckey, OH FUSRAP site during DOE project transition to the Corps of Engineers.

G. Princeton Plasma Physics Laboratory

- EML is assisting the Princeton Plasma Physics Laboratory (PPPL) by providing quality oversight and analysis for a shipment of tritium waste from PPPL to the Hanford Site for disposal.

H. Technical Development and Application of *In Situ* Spectrometry.

- Demonstrated *in situ* gamma spectrometry at the International Atomic Energy Agency (IAEA)/U.S. EPA Workshop on Environmental Radiation Measurements Using Spectrometric Techniques.
- Developed a computer program for hot spot identification that analyzes nuclide specific data from a series of *in situ* measurements on a grid and provides a quantitative record of the magnitude and location of potential hot spots that might be 'hidden' in the data.
- Participated in the Institute of Electrical and Electronic Engineers (IEEE) standards committee N42.RM which is developing a performance standard for *in situ* measurements.
- Provides, free of charge and without prejudice, a "RADIATION & RADIOACTIVITY MEASUREMENT HOTLINE" on an ad hoc basis by which advice and consultation are provided to DOE and contractor personnel and other agencies (see EML's Web Site for more information, <http://www.eml.doe.gov>). Those assisted in FY 1998 included:
 - ▶ DOE: Argonne National Laboratory, Bechtel Hanford, BNL
 - ▶ Other Government: EPA, North Carolina Division of Radiation Protection, Ohio EPA, the NRC, U. S. Army
 - ▶ Utilities: Duke Engineering Services, Trojan Nuclear Power Plant, Big Rook Point Nuclear Power Plant
 - ▶ Commercial: Nuclear Fuel Services, Technical Measurements, Constellation Technology, Porter Consultants.

I. Performance Testing.

- Staged an intercomparison of *in situ* gamma-ray spectrometers for radionuclide measurements involving manufacturers, regulators and users.

- EML has developed specialized equipment and computer software for the accurate calibration of high purity germanium detectors for *in situ* spectrometry. EML provides a calibration facility which features translational and rotational capabilities for the precise positioning of detectors, radiation sources and shielding.

J. Supporting Radiological Field Surveys: MARSSIM Activities.

(see also Section 1.4.2, NETO activities)

- Presented a lecture, "An Application of *In Situ* Survey Techniques Using the Proposed MARSSIM Methodology" at Spectrum '98 - An International Conference on Decommissioning and Decontamination and Nuclear and Hazardous Waste Management.
- Presented a Professional Enrichment Program course on the statistical aspects of MARSSIM final status survey design and data analysis at the Health Physics Society Annual Meeting.
- Presented an invited paper on the applications of MARSSIM in cases where the dose limit is only a fraction of the variability in the background at the Health Physics Society Annual Meeting.
- EML participated in the development and presentation of a MARSSIM training course produced by the Oak Ridge Institute for Science and Education (ORISE) Professional Training Program. This course is required for NRC inspectors. During FY 1998 the course was given at Mare Island Naval Shipyard, CA and NRC Headquarters, MD.

1.3.2 Planned FY 1999 Activities

- Continue direct support to DOE and contractor staff at sites undergoing cleanup. This includes survey design, instrumentation and methods development, and QA.
- The ORISE MARSSIM training course will be presented at NRC Region I, PA.
- EML will continue to provide quarterly TLD monitoring at BNL AOC 6 until the transition to a BNL operated program is complete. Thereafter, EML will provide QC to the BNL program.
- Continued consultation on the BNL Peconic River investigation.
- Demonstration of PASS will be completed and deployed at FEMP.

1.3.3 Background and Objectives

- The EML Field Survey Team, without contract negotiation or delay, provides support to DOE Field EM Offices and their contractor staff in planning and conducting surveys to characterize radioactive contamination and to certify that release criteria have been met. As a non-contractor DOE Laboratory, EML serves as an important technical interface between DOE site personnel and the contractors who are engaged in survey programs.
- The scope of environmental cleanup taking place within the DOE complex necessitates rapid measurement techniques of radioactive contaminants during site characterization work as well as certification of areas following remediation. *In situ* gamma-ray spectrometry is a technique that provides information on the concentration for specific radionuclides that are present in soil and building materials. As the leading developer of this technique, EML is active in promoting its use through consultation, training, demonstrations and intercalibration exercises.

1.3.4 Impact

- Efforts of the EML Field Survey Team help to ensure that radiological surveys are conducted with a high degree of quality in a cost-effective manner.
- *In situ* spectrometry can provide a measure of several tons of soil in just a few minutes, thus providing savings in time and expense.
- At Fernald, EML's work will result in the major accomplishment of EPA approval for the use of real-time instrumentation for certification purposes. This has significant cost and schedule implications and is precedent setting for other DOE sites. Real-time measurements are projected to save over 30 million dollars in measurement costs and will allow the 2006 Closure Schedule to proceed without delays due to analytical overload.
- At Fernald, EML's work will improve the current FEMP groundwater model for achieving capture and cleanup of the FEMP's groundwater plumes by employing the minimum number of conventional extraction wells necessary within a reasonable time frame for restoring the

aquifer. This activity supports the accelerated groundwater cleanup of a sole source drinking water aquifer.

- At Fernald, the aerosol characterization project will contribute to an understanding of what size aerosols are contributing to the radionuclide population dose. The data could also be used for compliance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP)
- At Brookhaven, cleanup and soil disposal costs will be reduced through better decision making during excavation.

1.3.5 Publications

- Reginatto, M., P. Shebell and K. M. Miller. "ISD97, a Computer Program to Analyze Data from a Series of *In Situ* Measurements on a Grid and Identify Potential Localized Areas of Elevated Activity," U. S. DOE Report EML-590, October 1997
- Reginatto, M., P. Shebell and K. M. Miller. "An Alternative Approach to Hot Spot Identification Using *In Situ* Gamma Spectrometry Measurements on a Grid," *Health Physics* 74: 481-485, 1998.
- Reginatto, M. "A New Approach to Hot Spot Identification Using *In Situ* Gamma-Ray Spectrometry," *Proceedings of X-change '97: The Global D&D Marketplace*, pp. 356-361, August, 1998.
- Miller, K. M., P. Shebell, M. A. Monetti, G. A. Klemic, R. Venkataraman, E. Fisher, D. G. Scoggins, S. H. Faller, B. Moore, R. Reiman, D. G. Keifer and B. Gilmartin. "An Intercomparison of *In Situ* Gamma-Ray Spectrometers," *Radiation and Radioactivity*, in press.
- Miller, K. M. "Fluence Evaluations for Applications of *In Situ* Gamma-Ray Spectrometry in Non-Flat Terrain," U. S. DOE Report, in press.
- Monetti, M. A., A. Berne, K. M. Decker, H.-R. C. Jaw, G. A. Klemic, K. M. Miller, M. Reginatto, P. Shebell. "Monitoring of Ambient Radiation and Measurements of the

Radioactivity in Soil at the Brookhaven National Laboratory Building 650 Sump Outfall Area," U. S. DOE Report, in press.

- Lee, H. N., B. J. Travis, R. D. White. "Modeling Studies of the Characterization of Subsurface Uranium Contamination at Fernald, Ohio, USA," Proceedings of the Fourth International Symposium and Exhibition on Environmental Contamination in Central and Eastern Europe - Warsaw98, Warsaw, Poland, September 15-19, 1998, accepted for publication.
- Shebell, P., M. Reginatto. "An Application of *In Situ* Survey Techniques Using MARSSIM Methodology," Proceedings of Spectrum '98, American Nuclear Society, La Grange Park, IL, pp. 847-853, September 1998.

1.4 EM NATIONAL PROGRAMS/CENTERS OF EXCELLENCE

1.4.1 National Analytical Management Program (NAMP)/EM-70

EML supports NAMP through participation on the NAMP Internal Steering Committee and through project activities in the NAMP core program areas highlighted below.

1.4.1.1 FY 1998 Accomplishments and Activities

- EML presented five lectures at the annual NAMP Conference - NAMP'98: Addressing Analytical Needs into the 21st Century entitled: "The Role of EML and NAMP," "Analytical Laboratory Research and Development in the 21st Century," "Quality Assurance," "Radiological Data Validation," and "EML's Quality Assessment Program."

A. Quality Assurance Program Area.

- EML maintains and operates the Quality Assessment Program (QAP) for environmental radiological analysis for DOE, in which 154 DOE laboratories currently participate. A

summary of the evaluation of over 3300 reported results, issued in January and July, is available to the participants 48 hours after the reporting deadline via an Internet connection to the EML computer. This rapid access to the data results is a unique feature of the EML QAP.

- ▶ Issued the latest QAP results as EML Report QAP9803 (the 48th distribution of samples) in July 1998. It is currently available (along with the 1996 and 1997 reports) in PDF format through the QAP Home Page (<http://www.eml.doe.gov/QAP>).
- ▶ Presented a talk, "QAP: Performance Evaluation for Environmental Radiation Protection," at the annual meeting of the Council on Ionizing Radiation Measurements (CIRMS).
- ▶ Held the QAP Workshop at the 43rd Annual Conference on Bioassay, Analytical and Environmental Radiochemistry. The purpose of the workshop was to present an update of QAP procedures and to obtain user feedback for program improvement.
- As a DOE designated reference laboratory, under the implementation of the national standard ANSI 42.23 "American National Standard Measurement and Associated Instrument Quality Assurance for Radioassay Laboratories," EML has initiated activities with NIST to develop criteria and performance testing protocols for the reference laboratories as specified in the standard. EML participates on the NIST National Radioassay Traceability (NNRT) Steering Committee.
- EML administers the EML Gamma Spectrometry Data Evaluation Program. This is a voluntary program that allows participating laboratories to assess the ability of the spectroscopist and the gamma spectrometry software data reduction systems to accurately identify and quantify nuclides in both routine and more complicated analyses. The results of the 1997 distribution in which 26 laboratories participated are available on the QAP Home Page (<http://www.eml.doe.gov/QAP>).

B. Technical Development Program.

- EML provides Internet access to the *HASL-300 Procedures Manual* through the EML Home Page (<http://www.eml.doe.gov>). New methods developed by EML are added as they become available. The U. S. EPA has approved the radiological method applicable to drinking water (40 Code of Federal Regulations (CFR) 141.25).

- EML presented a lecture at the Oak Ridge National Laboratory (ORNL)-DOE Conference on Analytical Chemistry in Energy Technology entitled "Determination of Pu and Am in Coral Samples and Soils Samples with Very High Calcium Content."
- EML attended the 1998 Conference on Plasma Spectrochemistry.
- EML participates in the activities of several standards organizations concerned with laboratory data quality or verification of new laboratory methods.
 - ▶ EML is a member of the American Society for Testing Materials (ASTM) D19.04 Committee Method for Radiochemical Analysis for Water which addresses low-level radiochemical methodologies.
 - ▶ One of EML's scientists was awarded the ASTM committee's highest honor, the "Max Hecht Award" for outstanding service and leadership as the Chair of Subcommittee D19.04.
 - ▶ EML is a member of the ASTM C26 Nuclear Fuel Cycle Committee which is discussing new methods for microwave dissolution of environmental matrices and measurement of nuclear materials by alpha and gamma-ray spectrometry and inductively coupled plasma atomic emissions spectroscopy (ICP-AES) and inductively coupled plasma mass spectroscopy (ICP-MS).
 - ▶ EML is a member of the ANSI 41.5 Committee on Verification and Validation of Environmental Radiological Measurements.
- EML is a member of the DOE Analytical Managers (DAM) Group whose mission is to facilitate improvements in the analytical chemistry operations with the DOE complex.

C. Interagency Cooperation Program

- EML continued its significant participation in the Multi-Agency Radiation Laboratory Analytical Protocols (MARLAP) Manual Work Group activities. MARLAP is an interagency group with representatives from Department of Defense (DoD), DOE, EPA, U. S. Food and Drug Administration (FDA), NIST, NRC and U. S. Geological Survey (USGS) who are developing a joint federal guidance manual for planning, implementation and assessment phases of projects which require radioanalytical analysis.

- ▶ EML currently chairs four of the MARLAP work groups and is responsible for the manual's chapters on "Nuclear Counting Instrumentation," "Project Planning Process," "Project Plan Documents," and "Radiochemical Data Validation."
- ▶ EML is also involved with other MARLAP activities: Measurement Statistics and QA/QC Chapter Work Groups; MARLAP Integration Work Group; and Data Quality Objectives (DQO) Example Work Group.
- EML participates in the NELAC, a voluntary association sponsored by the U. S. EPA to foster the development of national standards for accreditation of environmental testing laboratories. The National Environmental Laboratory Accreditation Program (NELAP) is to be implemented by state and federal accrediting authorities.
 - ▶ NELAC meetings are attended by EML staff representing QAP, a performance testing provider.
 - ▶ The NELAC Federal Partners Committee is composed of members from EPA, the Department of Agriculture, the Department of Commerce, DoD, DOE, Department of Interior and NRC. This group facilitates and encourage the adoption of the NELAC standards by federal agencies. EML participates in Federal Partners meetings, representing DOE/EM through NAMP.
- EML is a member of the Planning and Implementation Subgroup of the Intergovernmental Data Quality Task Force (IDQTF). The IDQTF is an EPA Federal Facilities sponsored workgroup that is responding to the IG report on environmental data quality issues for EPA's oversight of Federal Facilities. The task force included QA representatives from EPA Federal Facilities, EPA HQ, EPA, EPA regions, DoD and DOE. The goals for the task force include: developing a written agreement between federal agencies on what constitutes an adequate QA program to ensure environmental data quality; developing guidance that outlines the roles and responsibilities of the EPA and the Federal Facilities with regard to QA/QC oversight; and developing guidance for the implementation of Federal Agency-wide requirements and procedures regarding data quality.

1.4.1.2 Planned FY 1999 Activities

- Semiannual distribution and evaluation of the QAP will be continue.
- Completion of the provisional draft of the MARLAP Manual to be submitted for intra-agency review.
- Continuation of standards and interagency task force activities.

1.4.1.3 Background and Objectives

- EML's QAP is an external, independent performance evaluation program designed to test the quality of environmental radiological measurements reported by DOE contractor and subcontractor laboratories. There are over 150 national and international participants. Participation of EM contractors is required through DOE Memorandum.
- EML's activities with national standards organizations support NAMP's activities in response to recent IG reports on lack of data quality and project planning at federal Superfund Sites.

1.4.1.4 Impact

- The EML QAP program provides EM with complex-wide comparability of environmental radiological analysis for characterization, site survey and monitoring activities.
- Development of national standards and intergovernmental consensus guidance supports the policies initiated under Public Law 104-113 and will provide more consistent approaches to facilitate implementation of the Federal Facility Compliance Act.

1.4.1.5 Publications

- Greenlaw, P. "Semi-Annual Report of the Department of Energy, Office Of Environmental Management, Quality Assessment Program," U. S. DOE Report EML-594, January 1998.
- Greenlaw, P. "Semi-Annual Report of the Department of Energy, Office Of Environmental Management, Quality Assessment Program," U. S. DOE Report EML-596, July 1998.
- Scarpitta, S. C. "Preparation and Validation of Gross Alpha/Beta Samples Used in EML's Quality Assessment Program," U.S. DOE Report EML-592, October 1997.

1.4.2 National Environmental Training Office (NETO)/EM-13

Joint Agency Activities on Implementation of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)

FY 1998 Funding: 0.040 M Program Support Funding from U. S. EPA

1.4.2.1 FY 1998 Accomplishments and Activities

- EML developed the training manual and participated as an instructor for a training course on MARSSIM (NUREG-1575 and EPA 402-R-97-016, December 1997) for the professional staff from DOE field sites, EPA's Regional Offices, and state regulatory agencies. Approximately 30 radiation protection professionals attended each course. In these training courses EML teaches three modules: Statistics, Survey Planning and Design, and Final Status Survey Data Analysis. During FY 1998 the course was given in:
 - ▶ Washington, D.C. June 29-July 2 (HQ)
 - ▶ Denver, CO July 28-30 (Rocky Flats)
 - ▶ Richland, WA September 14-16 (Hanford)

1.4.2.2 Planned FY 1999 Activities

EML has an agreement with NETO/EPA to provide additional courses in FY 1999. The course is scheduled for Albany, NY (October), Chicago, IL (November), Oak Ridge, TN (December), BNL, NY (December), Aiken, SC (January), Sacramento, CA (February), Albuquerque, NM (February), Idaho Falls, ID (March), Annapolis, MD (April), FEMP, OH (May), and Boston, MA (June).

1.4.2.3 Background and Objectives

EML, after providing a lead technical role in the development of MARSSIM (see Section 5.3 NRC), is now participating in training courses on MARSSIM, including final status survey design, data analysis, data quality assessment, and statistical methodology. The training was developed jointly by the U. S. EPA Office of Radiation and Indoor Air (ORIA) and the DOE EM NETO.

1.4.2.4 Impact

The MARSSIM provides an enhanced, cost effective process for gathering information on planning, conducting, evaluating, and documenting environmental radiological surveys of surface soil and building surfaces at nuclear sites undergoing D&D. This information will be used for demonstrating compliance with regulations across three federal agencies (DOE, NRC and EPA) and for developing D&D implementation plans. This process, accepted by the EPA and the NRC, will have a major impact on the D&D of nuclear facilities. Several commercial nuclear power utilities are evaluating implementation at their sites.

1.4.3 Center for Risk Excellence (CRE)/EM-52

1.4.3.1 FY 1998 Accomplishments and Activities

- EML attended the Support Team meeting of the CRE which reviewed the current programs and explored future directions and projects.
- EML attended the CRE Strategic Planning Meeting.

1.4.3.2 Planned FY 1999 Activities

- EML plans to work on integrating the uncertainty in dose modeling into the process of evaluating the risks of site release decision error rates following final status remediation surveys.
- EML will investigate the impact of dose or risk-based decontamination criteria on existing concentration-based guidance within DOE.
- EML will participate in a CRE meeting in Hanford, WA on the CRE's contribution to the Groundwater/Vadose Zone Integration Project.
- EML will contribute to the CRE report on the Groundwater/Vadose Zone Integration Project.

1.4.3.3 Background and Objectives

The CRE works with the DOE laboratories to manage and solve national environmental problems and promote environmental stewardship with a risk conscious focus.

1.4.3.4 Impact

The overall goal of the risk program is to develop and implement policy, practices, guidance, tools, support, and training that result in credible risk-based environmental decisions, which protect human health and the environment and involve meaningful stakeholder participation.

PART II: SUPPORTING DOE's NATIONAL SECURITY AND SCIENCE MISSIONS

SUMMARY OF FY 1998 ACCOMPLISHMENTS

Other DOE Offices

- **SC/HSRD** – Update, maintain and ensure the quality of the Human Subjects Research Database (HSRD) of all research on human subjects currently funded by DOE in compliance with federal policy to protect the rights and welfare of human subjects (Section 2.1).
- **SC/Health Effects** – Reanalyzed the 1973 mine experiments to characterize the risks to human health from exposures to low levels of radiation and chemicals (Section 2.2).
- **SC/SERDP** – SERDP-developed technologies accelerate cost-effective cleanup of contaminated defense sites and mission readiness in the areas of cleanup, pollution prevention, compliance and conservation (Section 2.3).
- **NN/Global Network** – EML operates a global sampling worldwide network for monitoring compliance and early warning system for nuclear releases (Section 3.1).
- **NN/Sample Database** – EML has available an archive of environmental samples collected during the period of atmospheric nuclear weapons testing (Section 3.1).
- **NN/Tagged Aerosol Generator** – EML is developing an instrument for *in situ* calibration of air sampling instrumentation -TAG (Section 3.1).
- **NN/CTBT** – EML contributes to the development of U.S. policy on the analysis of environmental radioactivity for nonproliferation treaty monitoring (Section 3.2).
- **EH** – EML performed a pilot test of the ANSI Draft Standard N13.29, "Environmental Dosimetry Performance - Criteria for Testing," which covers performance testing of environmental dosimetry providers (Section 4.3).

Work for Others

- AF – EML received a *Certificate of Excellence* from the Director, Materials Technology, Air Force Technical Applications Center (AFTAC). The Laboratory was recognized for “its technical expertise and innovation which contributed substantially to the production of world-class technical data for national-level policy makers and effected dramatic enhancements to the nation’s capabilities to monitor compliance with treaties curbing the spread of weapons of mass destruction” (Section 5.1).
- AF – AUTORAMP was successfully demonstrated for six months at McClellan AF Base and has been deployed at Patrick AF Base, FL since November 1996 to monitor atmospheric radioactivity. AUTORAMP is a fully automated and completely unattended gamma-ray analysis system. The second generation AUTORAMP II was developed for the Remote Atmospheric Measurements Program (Section 5.1).
- AF – EML developed a portable gamma radiation measurement and analysis system, RAMPSCAN, to rapidly measure standard aircraft filters for fission products. RAMPSCAN is deployed at Patrick AF Base (Section 5.1).
- NASA – Collected unique cosmic-ray data using an instrumentation package that includes a neutron spectrometer during several high altitude flights of NASA’s ER-2 aircraft (Section 5.2).
- NRC – Developed new radiological survey designs and measurement methods for residual radioactivity that will be used to meet rulemaking decommissioning criteria (Section 5.3).
- EPA – EML provided instruction/training for the joint EPA - DOE NETO training course on MARSSIM to personnel from DOE field sites, EPA's Regional Offices, and state regulatory agencies (Section 1.4.2).

SUMMARY OF FY 1998 ACTIVITIES

2.0 OFFICE OF SCIENCE (SC) (formerly Energy Research, ER)

FY 1998 Funding: 0.375 M

2.1 OBER/Protecting Human Subjects Program (SC-72)

2.1.1 FY 1998 Accomplishments and Activities

- Continued maintenance and QC of the HSRD. The HSRD provides the public with easy access to information on all active human subject research projects funded by DOE, conducted in DOE facilities, or conducted by DOE personnel.
- Published the FY 1997 HSRD on the World Wide Web in March (<http://www.eml.doe.gov/HSRD/HSR.HTM>). The FY 1997 database profiles 253 research projects at 31 research facilities.

2.1.2 Planned FY 1999 Activities

- EML will prepare the data for the FY 1998 HSRD and release the information on the Internet.
- EML is currently developing new and innovative software for improved Internet access to the database.
- EML will attend the Human Subject Work Group meetings and the Public Responsibility in Medicine and Research Conference.

2.1.3 Background and Objectives

The HSRD documents all research involving the use of human subjects that is currently supported by DOE or occurs at DOE facilities in compliance with Federal Policy for Protection of Human

Subjects (10 CFR 745). The HSRD was initiated in response to the Secretary of Energy's Openness Initiative (1994). EML performs the administrative and technical tasks associated with managing the HSRD. EML is responsible for creating, annually updating, maintaining and ensuring the quality of the database. EML also provides software development and participates in the Human Subjects Working Group.

2.1.4 Impact

The DOE Protecting Human Subjects Program is responsible for assuring that the rights and welfare of human research subjects are protected and that the information is readily available to the public.

2.2 OBER/HEALTH EFFECTS RESEARCH PROGRAM

2.2.1 FY 1998 Accomplishments and Activities

- Reanalyzed and published the activity size distribution of particulate data from 1973 mine experiments.
- Presented the activity size distribution data results at the Cincinnati Meeting of the American Association for Aerosol Research.
- Presented the talk "Activity Weighted Size Distribution Measurements in a Diesel Powered Uranium Mine" at the 5th International Aerosol Conference, Edinburgh, Scotland. The research concluded that miner lung dose is much higher than expected due to the small particle size of the diesel aerosol as well as the high level of ultra-fine aerosol.

2.2.2 Planned FY 1999 Activities

- If funded, will evaluate general aerosol characteristics of mines used in the epidemiology studies for the BEIR6 Report.

2.2.3 Background and Objectives

The Health Effects Research Program focuses on understanding and characterizing the risks to human health from exposures to low levels of radiation and chemicals. The increased risk of lung cancer from exposure to radon is determined from long-term epidemiology studies of lung cancer in uranium and hardrock mines. The aim of these investigations is to understand how risk coefficients derived in mines can be applied to exposure in homes.

2.2.4 Impact

As part of the SC's Health Effects Research Program, EML's radon risk projects develop fundamental biological information and advance technologies for use in research on the health effects of energy-related agents and processes.

2.2.5 Publications

- Cavallo, A. J. "Reanalysis of 1973 Activity Weighted Particle Size Distribution Measurements in Active Uranium Mines," *J. Aerosol Sci. And Tech.*, 29:31-38 (1998).
- Cavallo, A. J., A. R. Hutter and P. Shebell. "Radon Progeny Unattached Fraction in an Atmosphere Far from Radioactive Equilibrium," accepted for publication in *Health Physics*.

2.3 Strategic Environmental Research and Development Program (SERDP)

2.3.1 FY 1998 Accomplishments and Activities

- Coordinated all Departmental activities for the DOE Offices (SC, EM, DP, EH, FE, PO) and the National Laboratories with the DOD, EPA and other federal agencies partnering with SERDP. These activities included: developing the statements of needs related to DOE/DoD mission for projects to be funded by SERDP, providing guidance for the fiscal year program, reviewing and selecting proposals, reviewing SERDP new-start and continuing research projects.
- Attended all SERDP Scientific Advisory Board meetings.
- Organized DOE's participation in the annual SERDP Symposium: "Partners in Environmental Technology '98."

2.3.2 Planned FY 1999 Activities

- Ongoing DOE technical co-ordinations and briefing activities.
- Represented SERDP at the EM-50 sponsored Technoventions Conference.

2.3.3 Background and Objectives

In November 1990, Public Law 101-510 was enacted establishing SERDP as a multi-agency program funded through the Department of Defense (DoD). The Program identifies, develops, and transitions environmental technologies that relate directly to defense mission accomplishments. SERDP responds to the environmental requirements of DoD and those requirements that DoD shares with the DOE. EML, as DOE Technical Coordinator, has managed the day-to-day operation of SERDP for DOE since 1996.

2.3.4 Impact

SERDP has funded development of new and innovative technologies that enhance mission readiness by accelerating the cost-effective cleanup of contaminated defense sites; facilitating full compliance with environmental laws and regulations; enhancing training, testing, and operational readiness through prudent conservation measures; and eliminating or reducing defense industrial waste streams through aggressive pollution prevention.

2.4 Interagency Arctic Research Policy Committee (IARPC)

2.4.1 FY 1998 Accomplishments and Activities

- Prepared and reported to IARPC the DOE arctic research budgets, priorities and research highlight and summaries for submission through the National Science Foundation (NSF) to the President, Congress and for publication in "The Journal Arctic Research of the United States."
- Attended the annual Strategic Planning Meeting to identify federal mandates and future opportunities for conducting Arctic research and to plan the next-year's activities.
- Coordinated and drafted DOE's portion of the report "Seventh Biennial Report of the Arctic Research Policy Committee to Congress."
- Met with the NSF Office of Polar Programs to discuss upcoming IARPC activities and a draft implementation plan for a possible IARPC sponsored "Assessment of Risk to Environments and People in the Arctic."

2.4.2 Planned FY 1999 Activities

- Continue as the DOE Staff Representative on issues related to Arctic research at the IARPC.

2.4.3 Background and Objectives

It is DOE's goal to encourage and support the important national and international scientific and engineering research programs required to carry out the Departments' policies as described in the U.S. Arctic and Antarctica Research Plans. DOE supports the interagency IARPC, the U.S. Antarctica Program (USAP) and the international Arctic Monitoring Assessment Program (AMAP). The IARPC includes representatives from 13 federal agencies or offices including DOE. EML provides staff representation for the Department at all IARPC meetings to ensure coordination of arctic research activities with other federal agencies.

2.4.4 Impact

The Arctic Research and Policy Act of 1984, Public Law 98-373, July 31, 1984; amended as Public Law 101-609, November 16, 1990, provides for a comprehensive national policy dealing with national research needs and objectives in the Arctic. The ARPA establishes an Arctic Research Commission (ARC) and IARPC to help implement the Act. In conjunction with the ARC, IARPC establishes an integrated national Arctic research policy to guide federal agencies in developing and implementing their research programs in the Arctic.

3.0 OFFICE OF NONPROLIFERATION AND NATIONAL SECURITY (NN)

FY 1998 Funding: 0.408 M

3.1 Office of Research and Development (NN-20)

3.1.1 FY 1998 Accomplishments and Activities

- **RDP** – EML is a member of the Radiation Detection Panel (RDP) to identify research needs, review research proposals and results, respond to technical inquiries, and to make recommendations for present and future research programs.
 - ▶ As a member of the RDP, EML attended the DoD/DOE START III Technology Workshop. Co-sponsored by the Defense Special Weapons Agency and NN, the workshop promoted improved coordination in the development of technology for treaty verification.
- **EML Global Network** – The Laboratory continues to operate and maintain a global sampling network of more than 63 aerosol and deposition sampling sites dispersed throughout the world. Data from remote on-site analysis systems are received via satellite. Samples are received, analyzed and reviewed at EML. EML's Global Network has become a cornerstone in monitoring compliance to treaties and in acting as an early warning system for nuclear releases.
- **EML Sample Archive and Database** – EML is developing a database for its unique archives of environmental samples associated with its research programs, some of which were collected over 40 years ago. Included in these archives are over 893 soil samples from a special study conducted by the Albuquerque Operations Office in support of litigation involving land contaminated by plutonium from the Rocky Flats Plant. Many of these historic samples, collected during the period of atmospheric nuclear weapons testing, have unique isotopic compositions, and, therefore, can be used to test and evaluate instruments developed by the NN-20 community and others. In addition, the samples can be used for geolocation in

forensic nuclear analyses, for identification of environmental signatures of nuclear activities, and to establish current baseline values for selected environmental signatures.

- Completed a survey of the scientific community to determine the availability of environmental samples collected near former nuclear weapons facilities.
- Participated in the Writer's Workshop for the preparation of the International Monitoring System Operational Manual for Radionuclides.
- *Tagged Aerosol Generator* – EML is developing a prototype instrument system for NN to be used for *in situ* calibration of air sampling instrumentation to be used in CTBT monitoring programs. The design specification was completed and the prototype is being assembled.
- *Quality Assurance* – EML QAP samples were provided to 27 international participants and a report on analytical proficiency was provided.

3.1.2 Planned FY 1999 Activities

- Continue to provide a representative to the RDP.
- Continue to develop and enhance the Internet accessible database of archived samples.
- Continue to provide archived samples and/or routine QC samples at the request of NN-20.
- Deposition samples will continue to be collected and archived. Samples are available should any events warrant their analysis.
- Continue to provide direct support to NN-20 on matters related to nuclear forensics, environmental signatures, and other nonproliferation issues.
- Complete the assembly of the prototype TAG and begin the testing phase.

3.1.3 Background and Objectives

The primary mission of NN-20 is to identify existing or potential nuclear proliferation threats anywhere in the world. EML supports this mission through the development of field and laboratory based advanced analytical instruments and technologies, coupled with current

techniques in sample collection, analysis, and data reduction, to aid in identifying potential signatures of proliferation activities.

3.1.4 Impact

The identification of nuclear proliferation threats throughout the world.

3.2 Office of Arms Control and Nonproliferation (NN-40)

3.2.1 FY 1998 Accomplishments and Activities

- Member of the Informal Radionuclide Workshop of the International Monitoring System Network to provide scientific recommendations to Working Group B of the Comprehensive Test Ban Treaty Preparatory Commission.
 - ▶ Attended the Informal Radionuclide Workshop in Brazil to address the requirements of the certified national radionuclide laboratories of the CTBT network, QA and QC, intercalibration, radionuclide events screening and technical training programs.
 - ▶ Prepared the draft report, "Radionuclide Laboratories - Equipment and Procedures."
 - ▶ Attended the Informal Radionuclide Workshop in France to address requirements for meteorological monitoring, location, backtracking, radionuclide station certification and data authentication.
- Attended the Verification and Monitoring Task Force meeting which discussed the use of isotope ratios for radionuclide event screening at the International Data Center (IDC).
- The 5-month field test of the Pacific Northwest National Laboratory (PNNL) Automated Radioxenon Sampling and Analysis (ARSA) System's ability to sample and analyze xenon isotopes under a wide variety of environmental conditions was completed. The report on the performance test was published. These performance tests were performed in the unique, world-class EML Environmental/Radon Chamber. The performance tests included:

- ▶ calibration check source transfer
- ▶ radon decontamination test
- ▶ the xenon-133 spike recovery test
- ▶ power failure/recovery test.

3.2.2 Planned FY 1999 Activities

- Continue to provide direct support to NN-40 on matters related to nonproliferation issues.

3.2.3 Background and Objectives

EML participates in programs supported by NN related to the CTBT and the NPT.

3.2.4 Impact

Contributes to the development of U.S. policy on the analyzes of environmental radioactivity for nonproliferation treaty monitoring.

3.2.5 Publications

- Lagomarsino, R. J., E. Ku, N. Latner and C. G. Sanderson. "Field Test of the PNNL Automated Radioxenon Sampler/Analyzer (ARSA)," U.S. DOE Report EML-597, July 1998.

4.0 OFFICE OF ENVIRONMENT, HEALTH AND SAFETY (EH)

4.1 Office of Nuclear Safety Policy and Standards (EH-31) Technical Standards Program (TSP)

4.1.1 FY 1998 Accomplishments and Activities

- EML supports the DOE TSP as members of the Interim Steering Committee for Metrology and the Accreditation Committee.

4.1.2 Planned FY 1999 Activities

- TSP is an unfunded activity. EML will continue at the current level of effort.

4.1.3 Background and Objectives

On March 7, 1996, President Clinton signed into law "The National Technology Transfer and Advancement Act of 1995." The new law, referred to as Public Law 104-113, serves to continue the policy changes initiated in the 1980s under Office of Management and Budget Circular A-119, *Federal Participation in the Development and Use of Voluntary Standards*, that are transitioning the Executive branch of the Federal Government from a developer of internal standards to a customer of external standards. The DOE TSP Office is taking actions to fully implement the new law.

4.1.4 Impact

By the year 2000, the culture of the DOE community will be based on standards. Technical standards will be formally integrated as part of all DOE facility, program and project activities. The TSP Office activities enhance DOE's transition to a standards-based culture by providing information, coordinating activities, and by promoting the use of consensus standards, and when needed, the development of DOE technical standards.

4.2 Office of Environmental Policy and Assistance/Air, Water and Radiation Division (EH-412)

4.2.1 FY 1998 Accomplishments and Activities

- DOE laboratories and contractors supporting Site Environmental Surveillance are participants in the EML QAP as required by DOE Order 5400.1 (Section 1.4.1).

4.2.2 Planned FY 1999 Activities

- The EML QAP is provided semi-annually for environmental radiochemical analyses of soil, vegetation, air filters and water samples..

4.2.3 Background and Objectives

The EML QAP is an external, independent performance evaluation program designed to test the quality of environmental radiological measurements reported by DOE contractor and subcontractor laboratories.

4.2.4 Impact

The EML QAP program provides EH with complex-wide comparability of environmental radiological analyzes for site survey and monitoring activities.

4.3 Office of Worker Protection Programs and Hazards Management (EH-52)

FY 1998 Funding: 0.023 M (FY 1997 Carry Over)

4.3.1 FY 1998 Accomplishments and Activities

- EML performed a pilot test of the ANSI Draft Standard N13.29, "Environmental Dosimetry Performance - Criteria for Testing," which covers performance testing of environmental dosimetry providers. The project included both laboratory and environmental tests under extreme temperature and humidity conditions. The pilot test was conducted in collaboration with NIST and BNL.
- Presented an invited talk, "ANSI Draft N13.29 Pilot Test Update," at the industry-sponsored "Meeting the Global Needs of Dosimetry" Conference.
- EML has investigated the properties of a new highly sensitive TLD material (LiF:Mg, Cu, P) for environmental applications.
- Presented an invited lecture, "State-of-the-Art of Environmental Dosimetry" at the 12th International Conference on Solid State Dosimetry, Burgos, Spain.

4.3.2 Planned FY 1999 Activities

- An additional report on the pilot test of ANSI Draft Standard N13.29 on Environmental Dosimetry will be published to reach a wider U. S. audience.

- EML will chair the ANSI Standard N13.37 Committee, "American National Standard for Environmental Thermoluminescent Dosimeters - Environmental Applications."

4.3.3 Background and Objectives

Thermoluminescence dosimeters (TLDs) are the most widely used dosimeters for monitoring environmental radiation. EML provides assessments of state-of-the-art dosimeters and performance evaluations through its International Intercomparison Program. Recognizing the need for a performance standard for environmental dosimetry similar to ANSI N13.11, "Personnel Dosimetry Performance, Criteria for Testing," for personnel dosimeters, EML assisted in the development of the draft ANSI N13.29 Standard.

4.3.4 Impact

Environmental dosimeters are small, inexpensive, and have no power requirements, making them especially useful for long-term measurements over large areas. They are widely used at DOE sites for environmental monitoring around operating facilities, remediation monitoring, and long term monitoring. Despite their widespread use, there are no requirements for testing or accreditation of environmental dosimeters. The development of ANSI 13.29 is the first step toward formalizing performance requirements for environmental dosimetry providers.

4.3.5 Publications

- Klemic, G., J. Shobe, S. Sengupta, P. Lamperti, C. Soares, P. Shebell, M. Monetti and F. Raccah. "Pilot Test of ANSI Draft Standard N13.29 Environmental Dosimetry - Performance Criteria Testing," U. S. DOE Report EML-598, September 1998.
- Klemic, G., J. Shobe, S. Sengupta, P. Shebell, K. M. Miller, P. T. Carolan, G. Holeman, H. Kahnhauser, P. Lamperti, C. Soares, N. Azziz, M. Moscovitch, "State of the Art of

Environmental Dosimetry: 11th International Intercomparison and Proposed Performance Tests," Radiation Protection Dosimetry, accepted for publication.

- Ranogajec-Komor, M., G. Klemic, S. Sengupta, Z. Knezevic, F. Raccah, B. Vekic. "Investigation of the Performance of ⁷LiF:Mg,Cu,P Under Environmental Conditions," Radiation Protection Dosimetry, accepted for publication.

5.0 WORK FOR OTHERS - FEDERAL AGENCIES

EML's long-standing reputation for excellence in environmental measurements has led to its being called upon for assistance and consultation by other federal organizations. The Laboratory fulfills special needs within the scientific community outside of DOE that relate to the assessment of radiation and radioactivity in the environment. Projects of this nature are a natural extension of the staff's collective expertise and are in keeping with a larger role that a specialized laboratory such as EML plays within the DOE family.

5.1 U.S. AIR FORCE

FY 1998 Funding: 0.633 M

5.1.1 FY 1998 Accomplishments and Activities

- EML received a *Certificate of Excellence* from the Director, Materials Technology, AFTAC on May 29, 1998. The Laboratory was recognized for its contributions to the AFTAC Materials Product Team whose efforts led to AFTAC getting the National Defense Meritorious Unit Citation. Specifically, the team produced world-class technical data, enhancing the nation's capabilities to monitor compliance with treaties, thereby curbing the spread of weapons of mass destruction. This information was used by national-level policy makers, up to and including the President.
- The EML-designed AUTORAMP is a fully automated and completely unattended gamma-ray analysis system that collects large volume aerosol samples, measures the sample using a germanium detector and transmits the data to a satellite-telephone link or a land telephone. AUTORAMP was successfully demonstrated for six months at McClellan AF Base and has been deployed at Patrick AF Base, FL since November 1996 to monitor atmospheric radioactivity.

- The second generation AUTORAMP II was developed for the Remote Atmospheric Measurements Program (RAMP). The design encompassed changes in the structural, mechanical, electrical and programming areas. An R&D 100 Award proposal was submitted.
- EML developed a portable gamma radiation measurement and analysis system, RAMPSCAN, to rapidly measure standard aircraft filters for fission products. The assessment can be done in a few minutes on a tarmac by an aircraft crew. RAMPSCAN uses an sodium iodide detector and the program can be customized for specific user requirements. RAMPSCAN is deployed at Patrick AF Base.

5.1.2 Planned FY 1999 Activities

- Activities will focus on applications for non-CTBT users. AUTORAMP will be demonstrated at several conferences, including Technoventions.

5.1.3 Background and Objectives

The AF provides funding to EML for the development of monitoring instrumentation to support verification programs under the CTBT.

5.1.4 Impact

Contributed to the development of U.S. policy on the analyzes of environmental radioactivity for nonproliferation treaty monitoring. These systems provide more effective monitoring capabilities for the detection of airborne radioactivity because of their increased sensitivity and reliable unattended operation.

5.1.5 Publications

- Latner, N., C. G. Sanderson, V. C. Negro, S. Wurms, N. Chu. "An Automatic Unit for Unattended Aerosol Collection, Gamma-Ray Analysis and Data Transmission From Remote Locations," *Radioactivity & Radiochemistry* 8:25-30, 1997.

5.2 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

FY 1998 Funding: 0.233 M

5.2.1 FY 1998 Accomplishments and Activities

- Began analyzing unique cosmic-ray data collected on several high-altitude flights of NASA's ER-2 aircraft using an instrument package that included a neutron spectrometer.
- Planned measurements of the high-energy response of the EML multisphere neutron spectrometer at the Los Alamos Neutron Science Center (LANSE).
- Helped organize the "First Atmospheric Ionizing Radiation (AIR) Investigators' Workshop: Preliminary Results and Lessons Learned from the June 1997 Flights" held at the NASA Langley Research Center and presented three talks: "Calibration of EML Neutron Spectrometer High-Energy Response at LANSE," "AIR Instrument Array," and "EML Multisphere Neutron Spectrometer, Ion Chamber and Scintillation Counter."
- Presented an invited lecture, "Overview of Aircraft Radiation Exposure and Recent ER-2 Measurements," at the 1998 annual meeting of the National Council on Radiation Protection and Measurements (NCRP).
- Developed a new computer code, MAXED, which employs the principle of maximum entropy to unfold multisphere neutron spectrometer data in a mathematically rigorous and unbiased way. Used MAXED to analyze ER-2 cosmic-ray data.

- Met with Langley Research Center, Japanese Atomic Energy Research Institute and Mitsubishi Research Institute physicists to discuss developments in high-energy radiation transport with applications to radiation protection in aircraft, in space and at accelerators.
- Participated in the annual Environmental Impact Program Review of NASA's High Speed Research Office, which supports the AIR project.
- Attended the International Workshop on Cosmic Radiation, Electromagnetic Fields and Health Among Acrews.

5.2.2 Planned FY 1999 Activities

- Measure high-energy response of the EML multisphere neutron spectrometer at LANSCE.
- Make the MAXED code available to other scientists.
- Publish Proceedings of the First AIR Workshop.
- Calculate more accurate responses for the EML multisphere neutron spectrometer using the new high-energy radiation transport code MCNPX.
- Further analyze ER-2 high-altitude cosmic radiation data.
- Plan the second AIR Workshop.

5.2.3 Background and Objectives

EML is the Principal Investigator for the NASA AIR Measurements Project. The AIR Project is an international collaboration of 12 laboratories that was started by scientists from EML and NASA Langley Research Center to make measurements and calculations of stratospheric radiation due to galactic cosmic rays. This project is aimed at evaluating the risks from cosmic radiation associated with next generation supersonic, high-altitude commercial aircraft.

5.2.4 Impact

This project will provide essential information on the radiation risks to the crew and passengers of the next generation of supersonic commercial aircraft and reduce the uncertainties of exposure estimates for present-day air crews.

5.2.5 Publications

- Reginatto, M., P. Goldhagen. "MAXED, A Computer Code for the Deconvolution of Multisphere Neutron Spectrometer Data Using the Maximum Entropy Method," DOE Report EML-595, June 1998.
- Reginatto, M., P. Goldhagen. "MAXED, A Computer Code for the Deconvolution of Multisphere Neutron Spectrometer Data," *Health Physics*, submitted for publication.
- Goldhagen, P. "Overview of Aircraft Radiation Exposure and Recent ER-2 Measurements," NCRP Proceedings No. 20 Cosmic Radiation Exposure of Airline Crews, Passengers and Astronauts," submitted for publication.

5.3 U.S. NUCLEAR REGULATORY COMMISSION (NRC)

FY 1998 Funding: 0.132 M

5.3.1 FY 1998 Accomplishments and Activities

- Played a major role as technical representatives for the NRC in the development of the MARSSIM (NUREG-1575 and EPA 402-R-97-016, December 1997) which provides guidance for planning, conducting, evaluating and documenting radiological surveys of surface soil and building surfaces for decontamination and decommissioning of nuclear facilities.

5.3.2 Planned FY 1999 Activities

- Participate in a series of workshops to be held at the NRC to discuss implementation of final status surveys to demonstrate compliance with NRC's final dose-based decommissioning rule. These are currently scheduled for March and June 1999.
- Develop additional guidance for conducting final status surveys of subsurface contamination.
- Develop two-stage sequential methods for conducting final status surveys.
- Technical consultation on NRC rulemaking for free release of low-level contaminated materials.

5.3.3 Background and Objectives

Provide the NRC with technical consultation and support in the development of decommissioning guidelines.

5.3.4 Impact

The developed radiological survey designs and measurement methods for residual radioactivity will be used to implement decommissioning rulemaking. MARSSIM will greatly streamline the D&D closure process while providing a standardized process (See Section 1.3 and 1.4.2).

5.4 U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

FY 1998 Funding: 0.040 M

See Section 1.4.2 EM/NETO - Joint Agency Activities on MARSSIM.

6.0 STAFF ACTIVITIES

6.1 Expert Advisory Activities

EML scientists are invited to participate in reviews of programs, proposals, reports and other documents, as well as to provide expert technical advise to other scientific organizations.

- **AMEC** – EML met with members of the Arctic Military Environmental Cooperation Project (AMEC), a joint project of DOE and DoD, to discuss issues associated with radiation dosimetry. EML will participate in training, consultation and field activities.
- **Atmospheric Chemistry Program** - Hsi-Na (Sam) Lee was a member of the Proposal, Review Committee for the DOE Atmospheric Chemistry Program.
- **EPA** – Mitchell D. Erickson serves on the Science Advisory Committee of the EPA-funded Hazardous Substance Research Center for Federal Regions 7 and 8, Kansas State University. He completed his term as Chair in 1998. The Science Advisory Committee plans research direction and proposal calls, reviews proposals and the progress of projects, and also reviews the overall progress of the Center against its mission.
- **FMI** – The FMI has deployed an EML atmospheric radon monitor at the GAW Pallas station in northern Finland. An FMI scientist was trained to operate, install and repair the unit. Data will be used to trace atmospheric transport as part of the GAW mission to monitor regional baseline atmospheric conditions.
- **Health Canada** – Isabel Fisenne is providing QA measurements for Phase Two of the Health Canada study to determine the gastrointestinal uptake factor for polonium in humans.
- **IAEA** – Peter Shebell was invited as an expert consultant to the IAEA Workshop on Industrial and Environmental Applications of Nuclear Analytical Techniques in Vienna. The purpose of the Workshop is to help United Nation Member States to apply their analytical facilities and capabilities toward achieving socio-economic progress and development.

- **IAEA** – Anna Berne was invited to participate as an expert consultant at a meeting on “Establishing Reference Radioanalytical Procedures for the Determination of Low Level Radionuclides in Air Particulates, Soils and Sediments” at the IAEA, Vienna.
- **IAEA** – Anna Berne participated in the first ALMERA (Analytical Laboratories for Measuring Environmental Radioactivity) Workshop in Vienna. The workshop evaluated data from the first ALMERA intercomparison. The participating laboratories were considered for participation in radiological studies of the former nuclear testing sites at Mururoa and Fangataufa Atolls.
- **IAEA** – Thomas Beasley served as reviewer of the Analytical Quality Control Services (AQCS) Program of the Department of Research and Isotopes, IAEA.
- **IAEA** – Harold Beck is a member of Working Group-3 on Source Term of the IAEA “Study of the Radiological Situation at the Atolls of Mururoa and Fangataufa.”
- **IEC** – Harold Beck is the U.S. Delegate to Scientific Committee SC45B (Radiation Protection) of the International Electrotechnical Commission (IEC) and a member of Task Groups 45B-5 and 45B-10.
- **IEEE** – Vincent Negro is a member of the IEEE Committee on Nuclear Instruments and Methods.
- **NAS** – Harold Beck was invited by the National Academy of Sciences (NAS) “Committee on Exposure of the American People to Iodine-131 from the Nevada Atomic Tests: Implications for Public Health” to participate in a review of the National Cancer Institute (NCI) Report on “Estimated Exposure and Thyroid Doses Received by the American People from Iodine-131 in Fallout Following Nevada Atmospheric Nuclear Bomb Tests.” He spoke before the committee on “Estimation of the Activities of Iodine-131 Deposited on the Ground: Historical Monitoring Data Approach.”
- **NAS-NRC** – Harold Beck is a member of the NAS-National Research Council (NRC) Committee on Dosimetry for the Radiation Effects Research Foundation (RERF). The Committee is reviewing the present state of dosimetry estimates for the survivors of the Hiroshima and Nagasaki A-Bombs. These estimates are the basis for most estimates of the risk of exposure to low-level radiation.

- **NCI** – Harold Beck was invited to participate in a dose reconstruction workshop, “Radiation Doses to the Population of Kazakhstan Near the Semipalatinsk Testing Site During the Above-Ground Testing,” organized by the NCI. Twenty dose reconstruction experts from the U.S., Russia and Kazakhstan will develop a methodology to be used by the Kazakhstani scientists conducting epidemiological studies of thyroid doses to the downwind populations from the Semipalatinsk site.
- **NCRP** – Harold Beck was re-elected to another term on the Council of the NCRP. NCRP is a nonprofit organization chartered by Congress to collect, analyze and disseminate information and recommendations about radiation protection and radiation measurements. He will continue to serve as Scientific Vice President for Radiation Measurement. He is also Chair of the Scientific Area Committee on Radiation Measurements.
- **NCRP** – Carl Gogolak is writing two chapters, “Program Planning” and “Data Interpretation” for the NCRP Scientific Committee 64-22, Design of Effective Effluent and Environmental Monitoring Programs.
- **NRC** – Kevin Miller provided information to the NRC regarding expected fallout levels of ^{137}Cs and ^{60}Co in soils. The NRC was gathering information on potential radioactive contamination in the vicinity of the nuclear power station in Haddad Neck, CN.
- **SSD** – Gladys Klemic was selected as a member of the Scientific Advisory Committee for the 12th International Conference on Solid State Dosimetry (SSD).
- **USTUR** – Isabel Fisenne was selected as the DOE Representative to the Advisory Committee of the United States Transuranic and Uranium Registries (USTUR). The mission of the Registries is to study the biokinetics, dosimetry and possible biological effects of the actinide elements.
- **YOTO** – Merrill Heit was the DOE Staff Representative to the Interagency Year of the Ocean (YOTO) Conference Planning Committee. He participated on the Discovery and Education Subcommittee. The Conference was held in June 1998.

6.2 Meetings Organized

- Mitchell D. Erickson and David M. Pranitis – Symposium “Field Environmental Analysis: Status and Future,” 1998 Pittsburgh Conference, New Orleans, Louisiana, March 1998
- Paul Goldhagen – Atmospheric Ionizing Radiation Investigators’ Workshop: Preliminary Results and Lessons Learned from the June 1997 Flights, NASA Langley Research Center, Hampton, Virginia, March 30-31, 1998
- Catherine S. Klusek – Characterization, Monitoring, & Sensor Technology Crosscutting Program (CMST-CP) Mid-Year Technical Review, Gaithersburg, Maryland, April 8-10, 1998

6.3 Seminars and Informal Topical Talks

The seminar program and informal topical talks at EML keep the scientific staff informed of progress in programs both within the Laboratory and in other institutions. Visiting scientists are invited to participate.

6.3.1 Seminars

- Alfred J. Cavallo, EML – “Radon: Is A Cost Benefit-Based Risk Policy Possible? Implications for Decontamination & Decommissioning,” January 1998
- Paul Goldhagen, EML – “Overview of Aircraft Radiation Exposure and Recent ER-2 Measurements,” March 1998
- Juha Antti Hatakka, Finish Meteorological Institute, Helsinki, Finland – “Radon Studies at the Finnish Meteorological Institute,” May 1998
- Charles F. McBrearty, Jr., USAF, AFTAC – “EML and AFTAC Collaboration,” May 1998
- Andrea Kinney, New Jersey Institute of Technology – “Performance Based Measurements Systems,” June 1998

- Robert Topness, Keith Hoffman, 3M Company – “3M Selective Separation Program,” June 1998
- Claus-Dieter Kohl, Institute of Applied Physics, Justus-Liebig University, Glessen, Germany – “Gas Sensor Elements for New Applications Fields,” July 1998
- Al Young, Center for Risk Excellence, Chicago – “Is Risk Relevant? A Challenge for the Center for Risk Excellence,” August 1998
- Gerald Boyd, DOE EM – “Overview of EM-50,” August 1998
- Ondrej Slavik, Nuclear Power Plant Research Institute, Slovakia – “Techniques Used for a ¹³⁷Cs Contaminated River Bank Site Characterization in Slovakia,” September 1998

6.3.2 Informal Topical Talks

- Anna Berne – “Determination of Pu and Am in Coral Samples and Soil Samples with Very High Calcium Content,” October, 1997
- Adam Hutter – “Russian field Trip ‘97,” October 1997
- Mitchell D. Erickson – “Facility Characterization Approaches and Tools: Status, Issues and Needs,” November 1997
- Andre Bouville, NCI – “Studies of Dose Estimation and Health Effects Around Nuclear Sites in the Former Soviet Union,” November 1997
- Carl V. Gogolak – “MARSSIM,” January 1998
- Gladys A. Klemic – “Pilot Test of the New ANSI Draft Standard on Performance Testing of Environmental Dosimeters,” January 1998
- Catherine S. Klusek – “MARLAP,” February 1998
- Hsi-Na (Sam) Lee – “Modeling Underground Uranium Plume at Fernald Site,” February 1998
- Colin G. Sanderson – “CTBT,” March 1998
- Alfred J. Cavallo – “More on Mines,” April 1998
- Pamela D. Greenlaw – “ANSI N42.23, NIST Traceability and EML,” May 1998

- Hsi-Na (Sam) Lee – “Modeling Underground Uranium Transport at Fernald: Importance of Dispersion and Sorption Processes,” June 1998
- Richard J. Larsen, Camille G. Marinetti, Michael Sims – “Web Applications,” July 1998
- Anna Berne (Tien-jui Liang, Taiwan Power Company) – “Introduction to Taiwan Power Company and Taiwan,” July 1998
- Harold L. Beck – “Hiroshima and Nagasaki Dose Reconstruction,” July 1998
- Alfred J. Cavallo – “Lung Cancer Risk from Radon: Latest Results (BEIR VI),” September 1998
- Mitchell D. Erickson – “Innovative Characterization Tools and Approaches for the 21st Century,” September 1998

6.3.3 Visiting Scientists

Many scientists from the national and international community visit EML, generally for periods of a day or two. The following scientists worked and trained at EML for longer periods.

- Chih-Chung Hsiah – Taiwan Power Company, Taiwan, July 1998
- Tien-jui Liang – Taiwan Power Company, Taiwan, July 1998

7.0 Other Publications

This section presents peer reviewed publications of projects completed during FY 1997.

Projects were funded through the Office of Naval Research, the DOE/SC and the NRC.

- Beasley, T. M., J. M. Kelly, T. C. Maiti, L.A. Bond. “ $^{237}\text{Np}/^{239}\text{Pu}$ Atom Ratios in Integrated Global Fallout: A Reassessment of the Production of Np-237,” *J. Environmental Radioactivity* 38:133-146, 1998.
- Beasley, T. M., L. W. Cooper, J. Grebmeier, K. Aargard, J. M. Kelley, L. R. Lilius. “Neptunium-237/Iodine-129 Atom Ratios in the Arctic Ocean: Has Neptunium-237 from Western Europe and Russian Fuel Reprocessing Facilities Entered the Arctic Ocean?” *J. Environmental Radioactivity* 39:255-277, 1998.
- Beasley, T. M., J. M. Kelley, K. A. Orlandini, L.A. Bond, A. Aarkrog, A. P. Trapenikov, V. N. Pozolotina. “Isotopic Pu, U and Np Signatures in Soil from Semipalatinsk-21, Kazakh Republic and the Southern Urals, Russia,” *J. Environ. Radioactivity* 39:215-230, 1998.
- Berkowitz, C. M., J. D. Fast, S. R. Springston, R. J. Larsen, C. W. Spicer, P. V. Doskey, J. M. Hubbe, R. Plastridge. “Formation Mechanism and Chemical Characteristics of Elevated Photochemical Layers Over the Northeast United States,” *J. Geophys. Res.* 103:10631-647, 1998.
- Cooper, L. W., T. M. Beasley, X.L. Zhao, C. Soto, K. L. Vinogradova and K. H. Dunton. “Iodine-129 and Plutonium in Arctic Kelp as Indicators of the Transport of Nuclear-Fuel Reprocessing Waste from Mid-to-High Latitudes in the Atlantic Ocean,” *Marine Biology* 131:391-399, 1998.
- Cooper, L. W., I. L. Larsen, T. M. Beasley, S. S. Dolvin, J. M. Grebmeier, J. M. Kelley, M. Scott, A. Johnson-Pyrtle. “The Distribution of Radiocesium and Plutonium in Sea Ice-Entrained Arctic Sediments in Relation to Potential Sources and Sinks,” *J. Environ. Radioactivity* 39:279-303, 1998.

- Hutter, A. R., E. O. Knutson. "An International Intercomparison of Soil Gas Radon and Radon Exhalation Measurements," *Health Physics* 74:108-114, 1998.
- Lee, H. N. "Improvement of Surface Flux Calculations in the Atmospheric Surface Layer," *J. Applied Meteorology* 36:1416-1423, 1997.
- Knutson, E.O., A. C. George, K. W. Tu. "The Graded Screen Technique for Measuring the Diffusion Coefficient of Radon Decay Products," *Aerosol Sci. Technology* 27:604-624, 1997.
- Reginatto, M. "Derivation of the Equations of Non-Relativistic Quantum Mechanics Using the Principle of Minimum Fisher Information," *Physical Review A* 58:1775-1778, 1998.
- Scarpitta, S., M. Kadnar. "A Portable Battery-Powered Continuous Airborne Radon-222 Sampler," USDOE Report EML-593, April 1998.
- Shebell, P., A. R. Hutter. "Environmental Radiation and Radioactivity in the Vicinity of the Semipalatinsk Test Site," *J. Radioanal. Chem.* 235:133-138, 1998.
- Shebell, P., K. M. Miler, M. Monetti, M. Reginatto, C.V. Gogolak. "Demonstration of Final Status Surveys in Support of New Decommissioning Criteria at the Cushing Refinery Site," Letter Report to NRC, 1998.
- Zhao, X. L., L. R. Kilius, A. E. Litherland, T. M. Beasley. "AMS Measurement of Environmental U-236: Preliminary Results and Perspectives," *Nuclear Instruments and Methods, Part B*, 126:297-300, 1997.

8.0 Points of Contact

Office of Environmental Management (EM)

CMST-CP	Raymond Bath
Subsurface Contaminant Focus Area - Vadose Zone Initiative	Adam Hutter
JCCEM	Adam Hutter
Field Survey Team	Kevin Miller
NAMP	Catherine Klusek/Pamela Greenlaw
QAP	Pamela Greenlaw
NETO - MARSSIM Training	Carl Gogolak

Office of Science (SC)

Human Subject Research Database (HSRD)	Richard Larsen
Health Effects Research Program/Radon Risk	Alfred Cavallo
Strategic Environmental Research and Development Program (SERDP)	Merrill Heit
Interagency Arctic Research Policy Committee (IARPC)	Merrill Heit
Radon Instrumentation	Vincent Negro

Office of Nonproliferation and National Security (NN)

Office of Arms Control and Nonproliferation (NN-40)	Colin Sanderson
Office of Research and Development (NN-20)	Harold Beck

Office of Environment, Health and Safety (EH)

Technical Standards Program	Isabel Fisenne
Environmental Dosimetry	Gladys Klemic

Work for Others (WFO)

U. S. Air Force	Colin Sanderson
U. S. National Aeronautics and Space Administration (NASA)	Paul Goldhagen
U. S. Nuclear Regulatory Commission (NRC)	Kevin Miller/Carl Gogolak
U. S. Environmental Protection Agency (EPA)	Carl Gogolak

9.0 Acronyms

AF	U. S. Air Force
AFTAC	Air Force Technical Applications Center
AIR	Atmospheric Ionizing Radiation
ALMERA	Analytical Laboratories for Measuring Environmental Radioactivity
AMAP	Arctic Monitoring Assessment Program
AMEC	Arctic Military Environmental Cooperation Project
ANSI	American National Standards Institute
AOC	Area of Concern
AQCS	Analytical Quality Control Services
ARC	Arctic Research Commission
ARSA	Automated Radioxenon Sampling and Analysis
ASME	American Society of Mechanical Engineers
ASTD	Accelerated Site Technology Deployment
ASTM	American Society for Testing Materials
BHG	Brookhaven Group
BNL	Brookhaven National Laboratory
CAA	Chemical Analysis Automation
CDI	Canyon Disposition Initiative
CFR	Code of Federal Regulations
CH	Chicago Operations Office
CIRMS	Council on Ionizing Radiation Measurements
CMST-CP	Characterization, Monitoring, and Sensor Technology - Crosscutting Program
CRE	Center for Risk Excellence
CTBT	Comprehensive Test Ban Treaty
DAM	DOE Analytical Managers

D&D	Deactivation and Decommissioning
DDFA	D&D Focus Area
DoD	Department of Defense
DOE	U. S. Department of Energy
DQO	Data Quality Objectives
EH	Office of Environment, Health and Safety
EM	Office of Environmental Management
EML	Environmental Measurements Laboratory
EMSP	EM Science Program
EPA	U. S. Environmental Protection Agency
ETV	Environmental Technology Verification
FDA	U. S. Food and Drug Administration
FEMP	Fernald Environmental Management Project
FIU	Florida International University
FMI	Finnish Meteorological Institute
FSU	Former Soviet Union
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	Fiscal Year
GAW	Global Atmospheric Watch
HCET	Hemispheric Center for Environmental Technology
HSRD	Human Subjects Research Database
IAEA	International Atomic Energy Agency
IARPC	Interagency Arctic Research Policy Committee
ICAS	Integrated Characterization and Archiving System
ICP-AES	Inductively Coupled Plasma Atomic Emissions Spectroscopy
ICP-MS	Inductively Coupled Plasma Mass Spectroscopy
IDC	International Data Center
IDQTF	Intergovernmental Data Quality Task Force
IEEE	International Electrical and Electronic Engineers

IMS	International Monitoring System
INEEL	Idaho National Engineering and Environment Laboratory
IG	Inspector General
IRB	Internal Review Budget
ITSR	Innovative Technology Summary Report
JCCEM	Joint Coordinating Committee on Environmental Management
LANSE	Los Alamos Neutron Science Center
MARLAP	Multi-Agency Radiation Laboratory Analytical Protocols
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MINATOM	Russian Ministry of Atomic Energy
NAMP	National Analytical Management Program
NAS	National Academy of Sciences
NASA	U. S. National Aeronautics and Space Administration
NCI	National Cancer Institute
NCRP	National Council on Radiation Protection and Measurements
NELAC	National Environmental Laboratory Accreditation Conference
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NELAP	National Environmental Laboratory Accreditation Program
NETO	National Environmental Training Office
NIST	National Institute of Standards and Technology
NN	Office of Nonproliferation and National Security
NPT	Nonproliferation Treaty
NRC	U. S. Nuclear Regulatory Commission
NSF	National Science Foundation
NTS	Nevada Test Site
PASS	Portable Aerosol Sampling System
OBER	Office of Biology and Environmental Research
ORIA	Office of Radiation and Indoor Air
ORISE	Oak Ridge Institute for Science and Education

ORNL	Oak Ridge National Laboratory
OST	Office of Science and Technology
OU	Operable Unit
PNNL	Pacific Northwest National Laboratory
PPPL	Princeton Plasma Physics Laboratory
QA	Quality Assurance
QAP	Quality Assessment Program
QC	Quality Control
RAMP	Remote Atmospheric Measurements Program
RDP	Radiation Detection Panel
REFR	Radiation Effects Research Foundation
RFETS	Rocky Flats Environmental Technology Site
RI	Remedial Investigation
SERDP	Strategic Environmental Research and Development Program
SC	Office of Science
SCAPS	Site Characterization and Analysis Penetrometer System
SCFA	Subsurface Contaminants Focus Area
STCG	Site Technology Coordinating Group
TAG	Tagged Aerosol Generator
TLDs	thermoluminescence dosimeters
TSP	Technical Standards Program
USAP	U.S. Antarctica Program
USGS	U. S. Geological Survey
USTUR	United States Transuranic and Uranium Registries
WFO	Work for Others
YOTO	Year of the Ocean