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# DECONTAMINATION SYSTEMS INFORMATION AND RESEARCH PROGRAM


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# P8 Decontamination Systems Information and Research Program

## CONTRACT INFORMATION

**Cooperative Agreement Number** DE-FC21-92MC29467

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Alfred Stiller, Chemical Engineering
John Zondlo, Chemical Engineering

Terry Baker, Pennsylvania State University
Victor Mansour, MTCI
James Hooper, Marshall University
Harry R. Johnson, BDM Federal, Inc.

**METC Project Manager** Rodney A. Geisbrecht

**Period of Performance** October 1, 1992 to September 30, 1997

## OBJECTIVES

The Program seeks to facilitate expedited development and implementation of solutions to the nation's hazardous waste clean-up efforts. By a unique combination of university research and private technology development efforts, new paths toward implementing technology and speeding clean-ups are achievable. Mechanisms include aggressive industrial tie-ins to academic development programs, expedited support of small business technology development efforts, enhanced linkages to existing DOE programs, and facilitated access to hazardous waste sites.

## BACKGROUND INFORMATION

The Decontamination Systems Information and Research Program at West Virginia University consists of research and development associated with hazardous waste remediation problems at the Department of Energy complex and elsewhere. The program topically falls into an information component, which includes knowledge acquisition, technology evaluation and outreach activities and an R&D component, which develops and implements new and improved technologies. Projects began in February 1993 due to initiation of a Cooperative Agreement between West Virginia University and the Department of Energy.

Research has been conducted in most of WVU's colleges on a diversity of topics which have utilized the strengths of the WVU researchers. Thirteen projects have been supported over the nearly two years of funding. The project topics have ranged from bioremediation to innovative technology economics. The WVU research program has coalesced into three emphasis areas; In Situ Remediation Processes, Innovative Technology Implementation, and Information, Public Policy, Community Outreach and Economics.

## PROJECT DESCRIPTIONS

### Introduction

The university research program has provided incubation funding for the development of new concepts or information programs. The technology development researchers are expected to develop industrial cooperation and support, focussing development towards field tests and large scale demonstration. Normally, each project would last for two years before industrial involvement were required.

### In Situ Remediation Technologies

Site Remediation Technologies: Drain-Enhanced Soil Flushing/M. A. Gabr

Use of prefabricated vertical drains in remediation efforts. This project has demonstrated improvement of low permeability soils in laboratory tests. Fine grained soils can be fully cleaned by judicious drain placement, a cost-effective process. The project has the cooperation of a manufacturer and will next move into field testing.

Site Remediation Technologies: In Situ Bio-remediation of Organic Contaminants/W. Sack, A. K. Shiemke, P. Carriere

This project is attempting to implement coupled aerobic and anaerobic (methanogenic and methanotrophic) bioremediation for chlorinated organic compounds. The project is in the feasibility study stage; the concept is being demonstrated in columns.

Microbial Enrichment for Enhancing Biodegradation of Hazardous Organic Wastes in Soil/A. J. Sexstone & C. M. Atkinson

This project seeks to develop protocols to evaluate the viability of commercial cultures for

bioremediation. The project is particularly interested in deep soil applications where natural populations are small and should be augmented.

Development of Standard Test Protocols and Barrier Design Models for *In Situ* Formed Barriers/ Echol E. Cook, Harry Johnson (BDM)

This project will utilize building B-17 at METC to develop subsurface *in situ* barrier evaluation methods and new methods to from subsurface *in situ* barriers.

Advanced Technology

Development of Organic Sensors: Monolayer and Multilayer Self-Assembled Films for Chemicals Sensors/H. O. Finklea

This project seeks to develop dependable coatings for surface acoustic wave sensors. A number of chemistries have been tried. Attempts to chemically attach the coatings are often hindered by attacks of the aluminum resonators. Current work centers on use of clathrates.

Chemical Destruction of Polychlorinated Biphenyls/K. K. Wang

This project has investigated use of non-regulated reagents to replace naphthalene in existing processes, and development of recoverable polymeric reagents for liquid phase treatment. Recent discovery of a low cost reductive dechlorination method will shortly be tested on soil. This new method reduces polychlorinated species to dichlorinated species, which are then amenable to bioremediation.

Remediation of Hazardous Sites with Stream Reforming: I. Study of Feasibility and Development of Instrumentation, II. Pressurized Pulse Combustor Fluidized Bed Studies/Victor Mansour, MTCI, Santa Fe Springs, CA

This project is constructing a pressurized fluidized bed steam reforming unit which will be evaluated for soil remediation. The unit is under construction; tests will be run to determine appropriate soil addition methods and efficiency of surrogate chlorinated compound destruction.

Soil Decontamination with a Packed Flotation Column/E.H. Cho, F. F. Peng, & D. C. Yang

This project is developing the packed flotation column for plutonium separation. Efficient operation indicates superior separation at lower cost over conventional methods. The unit has been tested with surrogate materials. A test at the Desert Research Institute is been developed.

Treatment of Volatile Organic Compounds (VOCs) Using Biofilters/S. D. Mohaghegh & P. E. Carriere

The use of biofilters immobilized on carbon is being evaluated for contaminant removal from air. Organic compound removal has been found to be efficient. This project has benefitted from the cooperation of the microbial enrichment project by Sexstone and Atkinson.

Use of Granular Activated Carbon Columns for the Simultaneous Removal of Organics, Heavy Metals, and Radionuclides/B. E. Reed & P. E. Carriere

Specially prepared granular activated carbon has been shown to effectively remove metals and organic compounds (phenol) from water. This project is directed towards industrial waste stream treatment. The project intends to move to field trials with its corporate partner.

Compact Mercuric Iodide Detector Technology Development/D.W. Lyons & G.C. Nandi

Radioactive detectors suffer from low sensitivity unless cooled, which limits the field utility. The $HgI_2$ detector appears to offer very good sensitivity without cooling. The project developed a method to grow the crystals and will incorporated them into instrument tests.

Evaluation of IR and Mass Spectrometric Techniques for On-Site Monitoring of Volatile Organic Compounds/M. Seehra and F.L. King

An atmospheric sampling mass spectrometer system is being built that will be field tested within the year at a contaminated excavation site to determine if volatile chemicals are being released. The project is being supported by the instrument manufacturer, who is providing technical staff to assist in the development.

Carbon products for Waste Stream Clean-up/T. Baker (Penn State), J. Zondlo, A. Stiller

This project seeks to develop nanotubular carbon forms which can be used for enhanced metals removal from solution. The metal removal will be based on applying an electrical field to these conducting carbons.

**Information, Public Policy, Community Assistance and Economics**

Systematic Assessment of the State of Hazardous Waste Clean-up Technologies/ M.T. Berg

This project evaluated existing DOE data bases and developed methods to choose appropriate remediation technologies given a description of the problem.

Excavation Systems for Hazardous Waste Sites: Dust Control Methods for In-situ Nuclear Waste Handling/S. S. Peng & F. F. Peng

This project evaluated the efficiency and health and safety of excavations. This has led to a listing of excavation options and a computer program which will provide insight into excavation equipment options and dust control options.

Winfield Lock and Dam Remediation/R. J. Lovett

This project interacts with community groups and the U.S. Army Corps of Engineers to assist in the remediation of the Winfield (WV) Lock and Dam site. The project provides technical assistance to the community and assists in choosing remediation options for the Corps.

Improved Socio-Economic Assessment of Alternative Environmental Restoration Techniques/A.M. Isserman, W.N. Trumbull & J. J. Fletcher

This project is directing its study to quantifying external costs at remediation sites. These costs are non-engineering clean up costs such as real estate depreciation and perceived health threat.

Marshall University Center of Excellence in GIS/J. Hooper (Marshall)

This project seeks to develop a capability at Marshall University dealing with computer graphical representation of waste sites. Marshall will implement existing software to assist U.S. Army Corps of Engineers efforts.

**FUTURE WORK**

Future work will involve fewer University research projects and more directed research to meet METC's needs. A greater emphasis will be placed on assisting small businesses in their efforts to contribute to the waste clean-up problem.

Continuing university research will include field testing of the vertical drains, continued development of the bimodal bioremediation method and full implementation of the enrichment program. The mass spectrometer will be laboratory tested then installed at Winfield to determine its field suitability. The chemical dechlorination method will be tested. Funds will continue top be spent on the barrier program, the carbon products program and the Marshall University program.