

OKLAHOMA DOE EPSCoR TRAINEES

Final Report

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Robert C. Knox

**University of Oklahoma
Norman, OK 73109**

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MP Dvorscak

11-27-00

Mark P. Dvorscak

Date

(630) 252-2393

E-mail: mark.dvorscak@ch.doe.gov

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Final Report

ABSTRACT

This report presents the results of the State of Oklahoma DOE EPSCoR Traineeship program. The program was carried out at the three major research universities in the state: the University of Oklahoma, Oklahoma State University, and the University of Tulsa. Each of the three universities selected a central thrust area for the DOE EPSCoR traineeships that was in keeping with research strengths of the institution. These thrust areas are related closely enough to be mutually supportive, but are sufficiently distinct to minimize duplication of effort among the institutions. The University of Tulsa emphasized its programs in petroleum exploration, development and processing. The University of Oklahoma is emphasized research related to the supply and applications of natural gas and environmental concerns. Oklahoma State University focused on advanced materials and manufacturing, particularly as they relate to the oil and gas industries.

1. Summary of Overall Progress of the Traineeship Awards
 - a. Participating Departments

This report presents the results of the State of Oklahoma DOE EPSCoR Traineeship program that was carried out at the three major research universities in the state: the University of Oklahoma, Oklahoma State University, and the University of Tulsa. Each of the three universities selected a central thrust area for the DOE EPSCoR traineeships that was in keeping with research strengths of the institution. These thrust areas are related closely enough to be mutually supportive, but are sufficiently distinct to minimize duplication of effort among the institutions. Table 1 lists the key departments at each university that were selected to participate in the DOE EPSCoR traineeship program.

Table 1. DOE EPSCoR Traineeship Program Participant Departments

Institution	Department
University of Oklahoma	Petroleum Engineering Geology and Geophysics Chemical Engineering Botany and Microbiology
University of Tulsa	Petroleum Engineering Geosciences Chemical Engineering
Oklahoma State University	Mechanical Engineering Chemical Engineering Chemistry Physics

- b. Recruiting methods/efforts utilized

To obtain the strongest possible candidates for the DOE-EPSCoR traineeship program, each university recruited nationally. Special attention was paid to colleges and universities with a traditionally large enrollment of Hispanics, American Indians, and/or Blacks and to the four-year colleges. Applications were sought from qualified minority women, who constitute an especially under-represented group in this field. Because of the Alliance for Minority Participation, we had a cadre of minority undergraduates in science and engineering fields from which we could draw excellent graduate students.

Candidates for the DOE Traineeships completed an application that provides personal data, names of references, transcripts and an essay describing the candidate's career goal and research interests. Selection was made on the basis of the academic record and references, and on the goodness of fit between the candidate's expressed interests and the institution research program. Only candidates who met the citizenship requirements established by DoE were considered. Preference was shown to candidates who were women minorities or handicapped people. The screening process on each campus was performed by the Associate Project Director for that campus and a representative of each key department. Each participant department was asked to provide a prioritized list of the nominated trainee candidates. The final selection was made by the selection committee composed of the Associate Project Directors from the three participating universities.

c. Trainee Research Topics

Specific thesis topics for the DOE EPSCoR trainees were selected by mutual agreements between each trainee and participant faculty. The topics that have been decided by the trainees are listed in Table 2.

Every DOE EPSCoR trainee was expected to participate in a practicum program during the period of the traineeship. Trainees were provided opportunities for practicum experience at both Federally funded and privately funded research laboratories. These practicum opportunities were developed through faculty contacts with industry and the national laboratories to complement the research interests of the individual trainees. Table 3 lists the practicum arrangements of the DOE EPSCoR trainees.

d. Faculty Involvement

Faculty involvement with the Oklahoma DOE Trainees is depicted in Table 4. The faculty listed include a mix of established senior personnel and junior faculty. The senior faculty provide mentorship to the junior faculty members in addition to providing guidance to the research endeavors of the Trainees.

e. Professional Development Activities

The DOE EPSCoR trainees were encouraged to pursue opportunities for enhancing their understanding of important energy-related issues and the unique opportunities the DOE EPSCoR traineeships afford. An important aspect of the DOE EPSCoR Traineeship program was

professional development activities. Each trainee was encouraged to utilize the traineeship to attend and/or participate in selected technical conferences or other symposia. Listed in Table 5 are the professional development activities for each trainee. It is important to note that the Oklahoma DOE Trainees tended to participate in the professional development activities by presenting papers and/or posters. This is also a reflection of the level of faculty involvement with the Trainees.

In addition to attending research conferences, the Oklahoma DOE Trainees also procured significant amounts of equipment to aid them in their research efforts. The research tools listed in Table 5 include computers, software, and analytical instruments.

Table 2: Trainee Research Topics

Institution	Department/Trainee	Research Topic
University of Oklahoma	Petroleum Engineering	Effectiveness of Artificial Permeability Barriers in Controlling Water Coning and Cresting Problems in Water Drive Gas Reservoirs
	Petroleum Engineering	Pulse Testing in Horizontal Wells, Effect of nonlinear horizontal wellbore on pressure response
	Geology	Factors that Control Propagation of Pre-existing Faults in Sedimentary Rocks Using Finite Element Modeling Techniques and Detailed Field Mapping Techniques
	Chemical Engineering	Surfactant Modification of Activated Carbon for Enhanced Methane Storage
	Botany and Microbiology	Microbial degradation of ethylcyclopentane under sulfate reducing conditions
	Chemical Engineering	Mutual Solubilities of Water-Cumene, Water-Propylbenzene, and Water-Triethylbenzene Systems
	Chemistry	Preparational Characterization of II-IV Semiconductor Quantum Dot-doped Glasses
	Physics	Optical Characterization of MBE Semiconductor Samples
Oklahoma State University	Physics	Mr. Arthur Fischer
	Physics	Jeffrey S. McCullough

Institution	Department/Trainee	Research Topic
	Physics Mark O'Steen	MBE Growth and Characterization of Wide Gap Semiconductors
	Physics Jeromy Rezac	Studies of Microsphere Whispering Gallery Modes
Tulsa University	Chemical Engineering Mr. Lawrence Crynes	Development of a Novel Monolith Froth Reactor for Three-Phase Catalytic Reactions
	Geochemisty Mr. David Mitchellree	Geochemisty, overpressuring and thermal history of a portion of the Anadarko Basin, Oklahoma
	Geosciences Sheila McGinty	Tensleep Sandstone at Zeisman Dome, Big Horn County, Wyoming
	Chemical Engineering Ricky Yeates	Sublette Characterization, Mobility, and Remediation of Recent & Historic Spills of Oilfield Brine in the Tallgrass Prairie Preserve, Oklahoma
	Chemical Engineering Alec Klinghoffer	Catalytic Wet Oxidation of Acetic Acid as a Waste Treatment Technology
	Mechanical Engineering Radovan Rolovic	Tipton Coiled Tubing Mechanics Research Project
	Mechanical Engineering Jeremy Edwards	Development of a Procedure and Code for Prediction of Solid Particle Erosion in an Arbitrary 3-Demensional Geometry
	Mechanical Engineering Matthew Hackworth	Puncture & Fracture Reistance in Ultra-thin Aluminum Pressure Vessels

Institution	Department/Trainee	Research Topic
	Mechanical Engineering Matthew Hackworth	Puncture & Fracture Resistance in Ultra-thin Aluminum Pressure Vessels

Table 3: Trainee Practicum Arrangements

Institution	Department/Trainee	Practicum Arrangement
University of Oklahoma	Petroleum Engineering Mr. Thomas Engler	Working with Formation Evaluation Institute
	Geology Mr. Louis A. Boldt	Attended two week advanced structural geology field course taught by Hal Kienart (retired Phillips Petroleum) and will use techniques for detailed field mapping of two research sites
	Botany and Microbiology Luis A. Rios-Hernandez	Biodegradation and molecular biology summer course at Rutgers University (2 weeks). Visit to Dr. Norman Pace Laboratory in the University of California at Berkeley (2 weeks). Visit to Dr. D. C. White Laboratory in the University of Tennessee at Knoxville
	Chemical Engineering Mr. Jerry Newman	Has done contract research for DOW Chemical Company and presented a short course on advanced material techniques to Phillips Petroleum
Oklahoma State University	Chemical Engineering Ms. Gayla Hamby	Summer internship as development engineer at Hoechst Celanese Corporation Technical Center, Corpus Christi, Texas.
	Chemistry Mr. James Greuel	Pursuing summer position at Sandia National Laboratory
	Physics Mr. Arthur Fischer	Pursuing summer position at Sandia National Laboratory

Institution	Department/Trainee	Practicum Arrangement
Tulsa University	Chemical Engineering Mr. Lawrence Crynes	3 month internship as materials engineer for Purolator Products Company, Tulsa, Oklahoma
	Geology Mr. Richard Erickson	Applied for internship at AMOCO Research Center, Tulsa, Oklahoma
	Geochemisty Mr. David Mitchellree	Pursuing summer internships with USGS or AMOCO Production Research
	Geosciences Sheila McGinty	Wyoming fieldwork in Wyoming associated with research interests of Marathon & Oil & Texaco
	Chemical Engineering Ricky Yeates	with NIPER
	Chemical Engineering Alec Klinghoffer	None, student decided not to pursue the Ph.D. and left the University in May 1997
	Mechanical Engineering Radovan Rolovic	Quality Tubing
	Mechanical Engineering Jeremy Edwards	Erosion/Corrosion Research Center Consortium of 15 petroleum-related companies at TU
	Mechanical Engineering Matthew Hackworth	with ALCOA, or Metal Container Corp.

Table 4: DOE Trainee Faculty Involvement

Institution	Trainee	Faculty Advisor	Committee Members
University of Oklahoma	Elise Striz	Dr. Faruk Civan, Petroleum Engineering	Dr. Roy Knapp, Petroleum Engineering Dr. Michale Wiggins, Petroleum Engineering Dr. Donald Menzie, Petroleum Engineering Dr. Matthias Nollert, Chemical Engineering
	Thomas Engler	Dr. Djebbar Tiab, Petroleum Engineering	Dr. Roy Knapp, Petroleum Engineering Dr. Faruk Civan, Petroleum Engineering Dr. Anuj Gupta, Petroleum Engineering Dr. Luther White, Mathematics
	Louis Boldt	Dr. David Stearns, Geology Dr. Ze'ev Rechtes, Geology	Dr. Judson Ahern, Geology
	Luis A. Rios-Hernandez	Dr. Joseph M. Suflita, Botany and Microbiology Dr. David P. Nagle, Botany and Microbiology Dr. Ralph S. Tanner, Botany and Microbiology Dr. Gary Wellborn, Zoology	Dr. Joseph M. Suflita, Botany and Microbiology Dr. Michael McInerney, Botany and Microbiology Dr. David P. Nagle, Botany and Microbiology Dr. Ralph S. Tanner, Botany and Microbiology Dr. Gary Wellborn, Zoology
	Jerry Newman	Dr. Jeffrey Harwell Dr. Kenneth Starling, Chemical Engineering	Dr. Daniel Resasco, Chemical Engineering Dr. Edgar O'Rear, Chemical Engineering Dr. Sherril Christian, Chemistry Dr. John Scamehorn, Chemical Engineering Dr. Roger Harrison, Chemical Engineering

Institution	Trainee	Faculty Advisor	Committee Members
Oklahoma State University	James Greuel	Dr. E. T. Knobbe, Chemistry	Dr. Corinna Czekaj, Chemistry Dr. Warren T. Ford, Chemistry Dr. Gilbert Mains, Chemistry Dr. Penger Tong, Physics
Tulsa University	Lawrence Crynes	Dr. Ramon Cerro, Chemical Engineering Dr. Martin Abraham, Chemical Engineering	Dr. Thomas Harris, Chemistry Dr. Robert Howard, Chemistry

Table 5: DOE Trainee Professional Development Activities and Research Tools

Institution	Trainee	Conferences	Publications	Research Tools
University of Oklahoma	Elise Striz	1993 SPE Production Operations Symposium	<p>"Pressure Transient Analysis of Power-Law Fluids in Horizontal Wells", presented at the 1996 SPE Annual Technical Conference and Exhibition, Denver, CO, October 1996.</p> <p>"A Coupled Model for the Prediction of Interformation Flow Through an Abandoned Well", SPE Paper Number 49151, proceedings of 1998 SPE Annual Technical Conference and Exhibition, New Orleans, LA, September 1998.</p> <p>"A Coupled Model for the Prediction of Interformation Flow Through an Abandoned Well", SPE Paper Number 49151, presented at the 1999 SPE/EPA Exploration and Production Environmental Conference and Exhibition, Austin, TX, March 1999.</p>	<p>Laptop computer, petroleum engineering texts and references</p>
	Thomas Engler	1993 SPE Annual Technical Conference	"Mud Invasion Model" submitted to Journal of Petroleum Science	Computer

Institution	Trainee	Conferences	Publications	Research Tools
	Louis Boldt	1992, 1993 GSA National Meetings; 1993 AGU Fall Meeting; 1993 ABAQUS Training Seminar on Contact and Friction Analysis	"Gypsum Plate Enhancement of Cataclastic Flow in Thin Section" presented at GSA '93; "Mechanical Behavior of a High Porosity, Friable Quartz Sandstone" presented at AGU '93; "Gypsum Plate Enhancement of Cataclastic Flow in Thin Section" submitted to <u>Journal of Structural Geology</u> ; "Mechanical Behavior of a High Porosity, Friable Quartz Sandstone" submitted to <u>Journal of Geophysical Research</u>	Computer and associated software
	Luis A. Rios- Hernandez	International Petroleum Environmental Conference	Signature metabolites confirming the importance of anaerobic intrinsic remediation of petroleum hydrocarbons. 2000. Presentation	GC-MS analysis

Institution	Trainee	Conferences	Publications	Research Tools
	Jerry Newman	AIChE National Meeting	<p>Patent applications and publications are in preparation for the following projects:</p> <p>"Methane and nitrogen adsorption on proprietary novel polymer with 23 angstrom pores and high surface area"</p> <p>"Surfactant modified activated carbons as purification membrane for methane from nitrogen"</p> <p>"Evaluation of transition metal aerogels and transition metal doped silical aerogels for use in natural gas storage and as purification membranes for natural gas"</p> <p>"Formation of surfactant templated Zeolites with adjustable pore size"</p> <p>"Effect of pore size on methane adsorption in surfactant templated Zeolites"</p> <p>"Evaluation of C60 form of carbon for methane adsorption"</p> <p>"Method for creating aqueous solutions of C60 and/or C70 for water base chemistry of fullerenes"</p> <p>"Metal oxides aerogels as foundation for "super-acid" catalyst"</p>	<p>High amperage arc power supplies, vacuum pumps, pressure sight glass cells, multiple zone high temperature ovens, high pressure cylinders.</p>

Institution	Trainee	Conferences	Publications	Research Tools
Oklahoma State University	James Greuel	1992 ACS Southwest Regional Meeting; 1993 Conference for Molecular Dynamics; 1994 Materials Research Society Meeting	Poster presentation at 1993 Conference for Molecular Dynamics	Computer and associated software; low temperature cryostat for optical spectroscopy
University of Tulsa	Lawrence Crynes	Fall 1992 AIChE National Convention	Two articles from dissertation have been submitted	none to date
	Richard Erickson	Tulsa Geological Society, Tulsa Geological Study Group, American Chemical Society, Gas Chromatography short course	none to date	oil sampling device, tank gauges
	David Mitcheltree	1992 GRI Deep Basin Conference, 1993 Convention of Geological Society of America	Paper at 1992 GRI Deep Basin Conference: Paper at 1993 Geological Society of America Convention	none to date