

New Mexico Tech

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- **New Mexico Tech ranks in the top ten for three consecutive years...**

From the Chairman...

On behalf of the Department of Petroleum and Chemical Engineering, I would like to introduce myself and welcome you to the first Petroleum Engineering Newsletter. I am Dr. Thomas W. Engler, Assistant Professor and Program Chair. The objective is to keep in touch with you, the alumni, to inform you of our success both in academic and research circles, and to obtain feedback from you of concerns or advice of the future of our department.



Let me first start by providing a few statistics of where the department is today. Current enrollment is approximately twenty undergraduates and forty graduate students; from all over the world. The department consists of five full-time faculty positions; Dr. Bill Lyons and Dr. Robert Bretz are halftime with the department and halftime with mechanical and chemical engineering, respectively. The remaining faculty are: Dr. Her-Yuan Chen, Dr. Larry Teufel, and myself. With the recent departure of Dr. Hareland to bigger and better things, we are currently searching to fill the position. We wish Geir success in his new adventure. Our goal for students over the next five years is to double the undergraduate student enrollment to 40 students, and remain constant the number of graduate students.

Leading research by Petroleum Research and Recovery Center, lead by Dr. Robert Lee and by the department continue this trend of excellence in research. Collaborations with New Mexico Bureau of Mines and Mineral Resources, with Sandia Labs, and with industry complement our research endeavors.

Throughout the next several pages are various articles about our program. I hope you find these informative and interesting. Our intentions are to provide two newsletters a year, a Spring issue and a Fall issue. If you prefer email copy versus hard copy let us know and we will include you on the email list, or visit our website at www.nmt.edu~petro for the latest information.

My research interests include: Formation Evaluation/Petrophysics, Naturally Fractured Reservoirs, and Unconventional Gas Recovery.

Current research projects that I am involved with are the DOE Gas Project headed by Dr. Lawrence W. Teufel involving fractured simulation in tight-gas reservoirs and the Bureau of Land Management project on reasonable foreseeable development plans in the San Juan Basin.

Petroleum Engineering Faculty



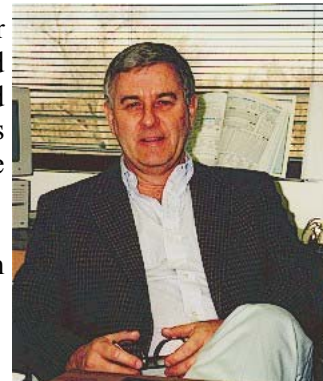
Lawrence W. Teufel is the Langdon Taylor Professor of Petroleum Engineering. Dr. Teufel has been at New Mexico Tech for seven years. He earned his B. S. in Geology from Syracuse University in 1973, his M. S. in Geology in 1976 as well as his Ph. D. in Geology in 1979 from Texas A&M University.

His research interest are Rock Mechanics and Fractured Reservoirs and is currently committed to the DOE Gas Project involving fractured simulation in tight-gas reservoirs.

If you need to contact Dr. Teufel, feel free to contact him at teufel@nmt.edu or by telephone by calling (505) 835-5483.

Bill Lyons is Professor of Petroleum and Mechanical Engineering. His expertise is in air and gas drilling and completion and Production Practices. This includes aerated fluid and stable foam drilling operations. He has a particular interest in the design of drilling and completion programs for low pore pressure gas wells and work over operations. He has written several books on these topics, which have contributed to the fundamental literature on the subject.

He earned his B. S. in Geological Engineering from The University of Kansas in 1961, his M. S. in Engineering Mechanics, Minor-Mathematics from the University of Kansas in 1962 as well as his Ph. D. in Engineering Mechanics, Minor-Mathematics from the University of Kansas in 1965. You may contact him by blyons@mailhost.nmt.edu or at (505) 835-5318.



Bob Bretz, Associate Professor of Petroleum and Chemical Engineering, received his B. S. in Chemical Engineering in 1963, M. S. Interdisciplinary Engineering in 1975, and his Ph. D. in Bio-engineering in 1977 from Texas A&M. Dr. Bretz researches Transport Phenomena, Porous Media, and Environmental. You can email him at bretz@nmt.edu or contact by phone at (505) 835-5436.

Her-Yuan Chen is Assistant Professor of Petroleum Engineering. He earned his B. S. in Ocean Engineering at the Institute of Marine Science and Technology, Taiwan in 1979, his M. S. Petroleum Engineering in 1985 and his Ph. D. Petroleum Engineering in 1990 from Texas A&M University.

Dr. Chen researches well testing and coupling of fluid flow and stress models.

Dr. Chen is also the faculty sponsor of the New Mexico Tech Chapter of the Society of Petroleum Engineers and continues to

host the Petroleum and Chemical Engineering Department socials. Dr. Chen is always available at her@nmt.edu or at (505) 835-5743.



...As of September 1, 2000, New Mexico Tech has once again been listed as one of the best engineering schools in the nation in the latest annual rankings published by *U. S. News & World Report*.

The *U. S. News & World Report's* annual rankings of graduate schools also credits the graduate program in petroleum engineering and includes the program in the guidebook's top ten list in that field of study for the third year running.

Petroleum Recovery Research Center

PRRC Research Presented in Fall Meetings

Three meetings hosted by the PRRC this fall highlighted a variety of research accomplishments by both PRRC scientists and international researchers in their continuing efforts to solve the exploration and production problems of oil and gas producers. The relationship of wettability (the way in which surfaces accept fluids) to improved oil recovery, the employment of neural networks to cut the risks of exploration, and a portable desalinator that can be brought to the wellhead were featured in the PRRC's offerings for the fall.

International Wettability Symposium

Experts from 11 countries discussed their most recent research at the Sixth International Symposium on Evaluation of Reservoir Wettability and its Effect on Oil Recovery, September 28–29, 2000, chaired by Senior Scientist Jill Buckley, head of the Petrophysics and Surface Chemistry Group of the PRRC. The Symposium series began here in Socorro at the PRRC in 1990, and has since been held in Scotland, Wyoming, France, and Norway. Participants in the Sixth Symposium represented many different points of view—major oil companies, federal agencies, research institutes and academia. Sessions focused on fluid-fluid-solid interactions, pore-scale modelling, crude oil-brine-rock interactions in cores, heterogeneous wetting, and chemical alteration of wetting.

The International Reservoir Wettability Symposium is organized biennially through the efforts of a community of interested scientists. Wettability—the preference of a surface for one fluid over another—has long been recognized as an important factor in oil recovery. The wettability of oil-bearing rocks has a significant impact on the amount of oil that a reservoir might yield, as well as on the rate at which that oil is produced, so the intricacies of wetting behavior are of more than academic interest. Long-term research efforts by scientists around the world are paying dividends in our increased understanding of this complex but important area.

Modified Reverse Osmosis Kickoff

The PRRC research team, including Project Manager Robert Lee and Principal Investigator Mike Whitworth (formerly of the New Mexico Bureau of Mines and Mineral Resources, now of University of Missouri, Rolla) met with interested producers and government officials in Farmington November 2–3 for the kickoff meeting of the DOE-sponsored project, "Modified Reverse Osmosis System for Treatment of Produced Water."

This project is a three-year, \$1.2 million study that, if successful, would result in considerable economic benefits to the oil and gas producers to New Mexico, and possibly revolutionize the treatment of saline waters worldwide. Currently, high disposal costs mean that many low-volume, marginal wells may not be economical to operate. Furthermore, disposing of produced water in deep injection wells or recycling produced water for waterflood operations may not be possible in many parts of the country. In these areas, produced water, which has a very high saline concentration, needs to be treated prior to disposal so it can meet EPA standards for various uses such as surface disposal, fresh water aquifer recharge, drinking water, irrigation, or release to streams.

Reverse osmosis (RO) is a common treatment method for produced water. Although it is successful in desalination plants around the world, this treatment is still complex, costly, and problematic. Small RO operations, such as those operating at the wellhead, cannot benefit from the economies of scale practiced at huge installations like those used for the desalination of sea water. As an alternative to the conventional RO process, the principal investigators plan to develop a treatment system that can economically desalinate salty waters, produce a solid salt waste, and yield 100% water recovery. The proposed system will be portable, so it can be used at any location where salty water requires treatment.

FEE Tool Conference

The Reservoir Evaluation and Advanced Computational Technologies (REACT) Group at The Petroleum Recovery Research Center of New Mexico Tech held their Second Consortium Meeting November 2, 2000 for their NPTO-funded project, "Reducing Exploration Risk with the Fuzzy Expert Exploration (FEE) Tool," at New Mexico Junior College in Hobbs, New Mexico. This project employs emerging exploration technologies—fuzzy logic and neural networks—and applies them to finding and developing reservoirs.

Results of their first-year research included training of a neural network to predict the product of porosity and oil saturation (bulk volume oil) as reported in whole core analysis, use of fuzzy ranking to prioritize 3D seismic attributes that were then correlated with depth using a neural network, development of a radial basis function neural network for use as a log evaluation tool, and completion of a draft design of the Fuzzy Expert Exploration (FEE) Tool system based on readily available software.

Robert O. Anderson



Robert O. Anderson, a New Mexico oilman since 1941 whose long career has won him many honors, achieved another on Saturday, May 13, 2000 when the New Mexico Institute of Mining and Technology awarded him an honorary doctorate in Petroleum Engineering. This event was the highlight of three days of festivities that started with a reception at Macey Center Friday night hosted by the President of New Mexico Tech. On Saturday afternoon, after commencement exercises, the new Doctor of Petroleum Engineering celebrated at another reception in the courtyard of the PRRC attended by family, friends, and associates. On Monday, he was honored once again at a luncheon in Roswell hosted by Regent Ann Murphy Daily, husband William Daily, and her parents Burt and Martha Murphy, attended by a former governor of Alaska and the Vice-Chairman of Chevron, as well as family, friends, and New Mexico Tech officials.

Robert O. Anderson has been well known to New Mexico Tech since 1987, when he served on the Board of Regents from that date until 1992. In 1994, he was appointed a Distinguished Professor in the Department of Petroleum and Natural Gas Engineering.

Anderson was nominated for the honorary doctorate by Dr. Tom Engler, Chairman of Tech's Petroleum and Chemical Engineering Department. Although he already holds two honorary doctorates—one in Humane Letters from UNM and another in Law from NMSU—Tech is the only school in New Mexico that offers the PhD in Petroleum Engineering. As a result of his distinguished career in petroleum and his long history of service to education and community, his nomination was enthusiastically supported by many individuals in New Mexico industry and government.

The following biography relates the activities of Anderson's career that led to the awarding of this honor.

Robert O. Anderson—A Lifetime of Achievement

Born in Chicago on April 13, 1917, Robert Orville Anderson has earned an impeccable reputation both domestically and internationally as a renowned petroleum executive, rancher, and civic leader who has served the oil and gas industry, academia, and the community in various capacities over the past 40 years.

Mr. Anderson began his career in the oil industry shortly after obtaining his Bachelor of Arts degree from the University of Chicago in 1939. That same year he landed his first full-time job in the oil business with American Mineral Spirits Company, a subsidiary of Pure Oil Company in Chicago. In 1941, after acquiring a substantial interest in a small oil refinery in Artesia, New Mexico, he and his family moved to New Mexico. Over the next 15 years he bought and expanded several refineries and purchased Wilshire Oil Company of California, which was subsequently sold to Gulf Oil Corporation.

Mr. Anderson's long association with the prestigious Atlantic Richfield Company (formerly known as Atlantic Refining Company) has included 17 years of leadership as the company's Chief Executive Officer. He served as Chairman of the Board for 21 years and was a member of the Board of Directors for 23 years. He retired from Atlantic Richfield in 1986 to form Hondo Oil & Gas Company, an independent located in Roswell, New Mexico, of which he was Chairman and Chief Executive Officer from September 1986 to February 1994.

Besides being an active wildcatter for oil and gas exploration, production, refining and marketing, Mr. Anderson's other business interests over the past 55 years have included cattle raising and feeding operations, mining and milling, and general manufacturing. His broad experience in the oil industry, his success as a business man, and his leadership qualities earned him the position of Chairman of the Board of the Federal Reserve Bank of Dallas (1961–1964), and earned him seats on the Board of Directors for Chase Manhattan Bank, New York; Columbia Broadcasting System New York; First National Bank of Chicago; Weyerhaeuser Company, Tacoma, Washington; and Carter Hawley Hale Stores, Inc. of Los Angeles.

Mr. Anderson has served on the Board of Directors of the National Petroleum Council since 1951. He is a long-standing member of the National Advisory Board of the University of New Mexico Anderson Schools of Management and he is a former member of the Board of Regents of the New Mexico Institute of Mining and Technology where he served from 1987 to 1992.

In 1994 he was awarded the honor of Distinguished Professor in the Department of Petroleum and Natural Gas Engineering at New Mexico Tech. He is a Life Trustee of the California Institute of Technology, The International Institute for Environment and Development in London, and the University of Chicago.

He has received numerous awards for his tireless efforts in support of public, charitable, and political affairs. For example, he founded the International Institute for Environment and Development in London; he is Chairman of the Lovelace-Anderson Endowment Foundation of Albuquerque, New Mexico; and he has served as New Mexico Committeeman on the Republican National Committee. In 1978 he received the very prestigious honor of being the first recipient of the Charles A. Lindbergh Award for Significant Achievement. A similar honor was bestowed upon him in 1989 as the first recipient of the Dwight D. Eisenhower Medal of Excellence.

In addition to this extraordinary list of service and awards, Mr. Anderson has also been recognized with many other honors, including the American Petroleum Institute Gold Medal Award and the Hearst Energy Award for Lifetime Achievement. He holds two other honorary doctorates from New Mexico schools in addition to that awarded by New Mexico Tech.

Department Research

Optimization of Infill Drilling in Naturally-Fractured Tight Gas Reservoirs

Phase I of a joint DOE/industry sponsored research project to increase gas reserves in tight-gas reservoirs was recently completed. The project focus was on multi-disciplinary reservoir characterization and simulation studies of the Mesaverde and Dakota formations in selected areas of the San Juan Basin. The objectives of the project were to: (1) describe reservoir heterogeneities and natural fracture systems, (2) define the elliptical drainage area and recoverable gas for existing wells, (3) determine the optimal location and number of new in-fill wells to maximize economic recovery, and (4) forecast the increase in total cumulative gas production by in-fill drilling on 80 acres well spacing.

Several significant benefits to the understanding and evaluation of naturally fractured, low-permeability gas reservoirs resulted from this study. The development of curvature analysis from 3-D seismic data has led to a method to predict natural fracture swarms. Furthermore, seismic data was applied to generate spatial distributions of reservoir properties for simulation. Two tools were developed specifically for small operators and independents using commonly acquired data. The *Infill Well Calculator* uses minimal reservoir data to determine the optimum well location in an anisotropic reservoir. *Production decline analysis* evaluates rate – time data for estimation of drainage area and completion efficiency. Finally, the integration of data (seismic, log, production) was accomplished through reservoir simulation; subsequently providing verification of the methodology and a comprehensive understanding of the behavior of these unconventional gas reservoirs.

The success of phase I has led to an expansion to phase II, an application of the methodology and tools developed in the first phase to other areas in the San Juan Basin and to tight gas reservoirs in southeast New Mexico. A tech transfer workshop sponsored by PTTC in May 2000 was extremely successful with the development of an additional study area on the Mesaverde initiated this past summer. Other projects currently in the planning stages include Dakota, Lewis Shale and Mancos in the San Juan Basin and Abo and Morrow in Southeast New Mexico.

Oil and Gas Resource Development for the San Juan Basin, New Mexico

This Bureau of Land Management (BLM) sponsored project is a cooperative effort between industry, the BLM, and New Mexico Tech to investigate the *reasonable foreseeable development* for the next 20 years on federal lands in the New Mexico portion of the San Juan Basin. The project scope is to determine the potential number of locations for all producing horizons supported by geological and engineering evidence, and to estimate the corresponding surface disturbance of these new well locations. This information is vital to the *Environmental Impact Statement* (EIS) being prepared by an outside contractor for the BLM and future development in the area.

From the past...

Do you recognize any of these faces? Are you one of these people? Where are you/they now? We are having a contest to find out if any of you out there can identify all these faces. We will award a prize to the person who can identify all these faces correctly and the most quickly.



We would like your feedback on our publication. Please complete the information below and remit to:
New Mexico Tech Petroleum and Chemical Engineering Department
c/o Newsletter
Tanya Pyke
MSEC 300A
801 Leroy Place
Socorro, N. M. 87801
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Department of Petroleum and Chemical Engineering
MSEC 300A
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