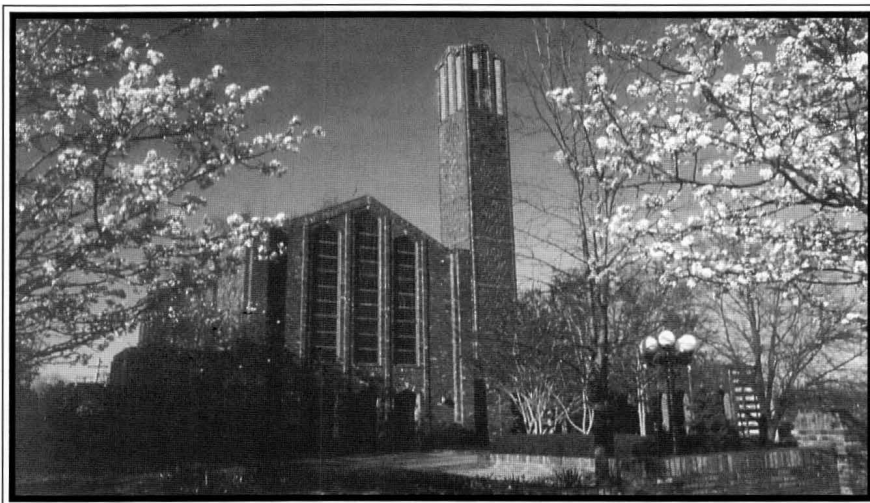


Mississippi State University



Chapel of Memories, constructed from bricks salvaged from original MSU men's dormitory that burned down in 1959.

REBECCA K. TOGHIANI

Mississippi State University • Mississippi State, MS 39762-9595

Mississippi State University (MSU), established in 1878 as the Mississippi Agricultural and Mechanical College, is located just east of Starkville, Mississippi. MSU is the largest of eight institutions of higher learning in the state of Mississippi and is the land-grant institution in Mississippi. Home to the Bulldogs (or “Dawgs,” as they are more affectionately known around campus), MSU attracts quality students from Mississippi as well as from the surrounding states. It has grown from 334 men in 1878 to 14,862 undergraduate and graduate students with 828 teaching faculty for the 1997-98 academic year.

MSU has long been synonymous with engineering education in Mississippi and in the Southeast. The School of Engineering was established in 1892 by MSU's first president, Stephen D. Lee. In 1895, the first eight undergraduates pursuing the curriculum titled “General Engineering” were awarded degrees. Women were first admitted to the University in 1934, but could not live on campus as there were no women's housing facilities available. Alumni from the early

years at MSU fondly remember “Old Main,” which was the largest men's dormitory in the U.S. during its time. Old Main burned in 1959, and the bricks salvaged from its remains were used to construct the Chapel of Memories on campus.

The College of Engineering enrollment today stands at 2233 undergraduates and 268 graduate students, with 303 BS degrees, 116 MS degrees, and 18 PhD degrees having been conferred for the 1996-97 academic year. Enrollment of underrepresented groups in the College has grown at a rapid pace over the past two decades, and in 1990 the College of Engineering at MSU was recognized as one of the top thirteen producers nationwide of BS-level engineers of African-American descent.

The College of Engineering is also home to the National Science Foundation Center for Computational Fluid Simulation, the Diagnostic Instrumentation and Analysis Laboratory (DIAL), and the Raspet Flight Research Laboratory. The NSF Center is one of twenty-five engineering research

centers across the United States with research efforts directed at enhancing global competitiveness of U.S. industry and agencies by reducing the time and cost for performing complex field simulations for engineering analysis and design. DIAL is funded through the Office of Environmental Management in the U.S. Department of Energy and has the mission of developing modern diagnostic techniques to monitor, control, and optimize environmental remediation processes. DIAL has recently moved into a new 54,000 ft² laboratory and educational facility located at the Mississippi Research and Technology Park adjacent to the MSU campus. The Raspet facility is the largest and best-equipped university flight research facility in the U.S. and is located at Bryan Field, just on the west side of Starkville. Faculty across the college and university engage in interdisciplinary research efforts through these research centers.

The College of Engineering enrollment today stands at 2233 undergraduates and 268 graduate students, with 303 BS degrees, 116 MS degrees, and 18 PhD degrees having been conferred for the 1996-97 academic year.

EXCITING TIMES AT MSU

The past decade has been one of tremendous growth and change at MSU. Improvements in facilities either recently completed or just underway include: the NSF Engineering Research Center, the DIAL Laboratory, a \$15-million expansion and renovation of the Mitchell Memorial Library, the Joe Frank Sanderson Center (a recreational sports complex), renovation of the Hand Chemical Laboratory, the T.K. Martin Center for Technology and Disability, and the Dave C. Swalm Chemical Engineering Building.

Dean A. Wayne Bennett was named Dean of the College of Engineering in 1996 and through his leadership the framework has been laid for significant enhancements to the undergraduate and graduate programs in the College of Engineering with a \$4.6-million grant from the Hearin Foundation. College faculty are excited about the change and opportunities that our undergraduate and graduate programs will undergo in the areas of global awareness, entrepreneurship, interdisciplinary activities, computation skills, and communications skills over the next five years.

The University's 16th president was named this past fall. Dr. Malcolm Portera began his tenure as President of MSU on January 1, 1998. The coming decades offer much excitement and continued growth for the Chemical Engineering Department.

HISTORY OF THE DEPARTMENT

Chemical engineering at MSU made its debut in 1935 as a curriculum offering through the Department of Chemistry. The first program lacked many of the features present in modern-day chemical engineering programs and, as was common in those days, encompassed the field of industrial chemistry. In 1936, courses in unit processes, industrial sto-

ichiometry, and chemical plant design were added to the curriculum, and in 1939, a state-of-the-art course, "Slide Rule," offered by the Physics Department, was added to the chemical engineering curriculum. The catalog curriculum description for chemical engineering noted that "those who wish to make careers in this field will naturally look forward eventually to opportunities for graduate study."! Obviously, the opportunities for chemical engineers in industry have grown since that time.

Harold E. Graves, Associate Professor of Chemical Engineering, was the only faculty member in the Chemistry Department who taught ChE courses (all seven of them!) in those early years. It wasn't until 1942 that the Department of Chemistry became the Department of Chemistry and Chemical Engineering. The first six graduates to complete the chemical engineering curriculum matriculated in 1938, and among them was Robert Lamar Pigford, who graduated with "Special Honors."

Throughout the forties and fifties, chemical engineering was staffed by one, at most two, faculty members who taught all of the required courses. Graves left the university in 1939 and Laddie F. Dobry took his place as the sole chemical engineering faculty member. In 1940, Dillon Evers joined Dobry, but he soon went on leave and remained on leave through 1943. Michael G. Pelipetz came in 1942 and stayed until 1946. In 1945, Mahlon P. Etheredge joined the faculty, and the next year, Pelipetz departed and was replaced by Henry V. Allen Jr. Allen remained on the faculty for only two years. During these early years, the curriculum underwent significant modifications with courses commonly found in present-day ChE curriculums being added. In 1948, Etheredge was named Head of Chemical Engineering. The two-member chemical engineering faculty tradition continued with William A. Reinhardt arriving in 1949 to replace Allen.

In 1952 there was a significant event that continues to impact chemical engineering even today. The state legislature approved funding for a building of 35,602 ft² to house chemical engineering. The building, dedicated in 1956 in honor of Etheredge, continues to be the home of the chemical engineering department today. The faculty grew during the next few years, with Arnold J. Gully joining as Associate Professor in 1953, and Ernest E. Bailey, Everard G. Baker, and Dennis Brown coming in as Acting Instructors.

In 1956, chemical engineering was established as a separate department and Charles W. Selheimer took the helm as the second department head. Gully and Baker remained on the faculty with Selheimer. Then in 1959 the department was transferred from the College of Arts and Science to the

School of Engineering, joining the nine established engineering departments. Earl C. Oden joined the department as Associate Professor and Royce B. Luker joined as Assistant Professor in 1960.

John L. Weeks, Jr., was named head of the department in 1962, and David Cornell joined the faculty in that same year. The faculty, consisting of Weeks, Cornell, Oden, Luker, and Baker, was responsible for the department's successful accreditation in 1964 by the EPCD. Luker left in 1967. Undergraduate enrollment during those early years grew at a steady pace from the first six graduates in 1938 to approximately 15 to 20 graduates per year during the 1960s.

C. Hai Kuo joined the faculty in 1971, and in 1973 Allen G. Wehr, H.A. Koelling, and William B. Hall came to chemical engineering from the newly dissolved Ceramic and Metallurgical Engineering program, bringing considerable expertise in the materials area to chemical engineering. George Lightsey, a '65 alumnus, returned to the department to teach in 1976.

Weeks retired as department head in 1982 and Donald O. Hill, a member of the civil engineering faculty, was named Head of Chemical Engineering. His diverse background encompassed traditional chemical engineering, environmental engineering, and considerable industrial experience and he significantly impacted the development of external research programs by departmental faculty. In 1983, Clifford E. George joined the department. Hill, George, and Kuo continue to serve on the faculty today and have been joined in recent years by Hossein Toghiani (1989), Rebecca Besselsen Toghiani (1989), Steven D. Gardner (1991), Charles A. Sparrow (1993),



Ground-breaking ceremony for new engineering building, with (left to right) Curt Ulmer, Department Head Don Hill, MSU President Donald Zacharias, Dave C. Swalm, Governor Kirk Fordice, College of Engineering Dean Wayne Bennett, and Architect Richard McNeil.

Rudy Rogers (1993), Nancy S. Losure (1994), and Mark E. Zappi (1996). Table 1 lists the current faculty at MSU along with their research interests.

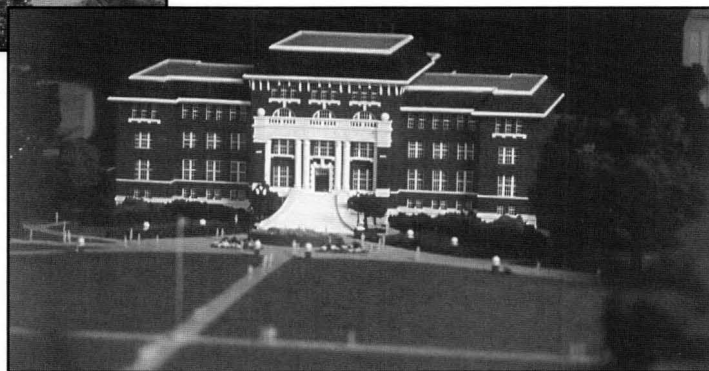
CHE HALL OF FAME

Chemical engineering at MSU has prepared many (1438 BS) graduates who represent the embodiment of success through their careers. In 1989, the Chemical Engineering Hall of Fame was chartered to honor a select group of departmental alumni recognized for their career achievements. Charter members include: David Bradford, '40 (President and CEO of Allied Chemical Corporation; deceased); C. Glendon Bradley, '64 (President of Ciba-Geigy); Gerald W. Cross, '72 (President of Rika-Hercules Chemical Company); Earnest W. Deavenport, '60 (President of Eastman Chemical Company); Hunter W. Henry, '50 (President and CEO of Dow Chemical U.S.; retired); and Dave C. Swalm, '55 (President and CEO of Texas Petrochemicals and Texas Olefins; retired).

In 1992, R.L. Pigford ('38, Professor Emeritus, University of Delaware) was inducted into the Hall of Fame posthumously, and Lawrence A. Adcock ('59, General Manager of the Louisiana Division of Dow Chemical USA, retired) and Norman R. Young ('56, Vice President of Texaco Chemical Company, retired) were also inducted.

THE NEW CHEMICAL ENGINEERING BUILDING

Construction is underway for a new \$18.6-million building, made possible by a generous gift from Dave C. Swalm ('55) combined with support from the State Legislature. The building will face Lee Hall, the historic structure after which it is patterned. The Institutions of Higher Learning Board of Trustees in Mississippi recently approved the new name for the chemical engineering department, henceforth to be known as the "Dave C. Swalm School of Chemical Engineering."



Construction is underway (top photograph) for the new "Dave C. Swalm Chemical Engineering Building," to be completed in 1999, with the architect's rendering of the finished building shown above.

TABLE 1
Current Faculty and Research Interests at MSU

■ **Donald O. Hill** • Professor and Head of Chemical Engineering (PhD, Alabama, '72) Don is a native of Birmingham, Alabama. He worked as a process engineer for the 3M company in Decatur, Alabama, for seven years prior to returning to school to pursue his graduate degrees. His first academic assignment was Professor of Environmental Engineering at MSU. In 1982, Don was named Head of the MSU's Department of Chemical Engineering. His primary teaching and research interests center on the environment and the application of chemical engineering principles to solve environmental engineering problems. His current research efforts focus on industrial waste/pollution prevention and catalysis. He teaches the freshman design course that provides entering students with the fundamentals of ChE design.

■ **Clifford E. George** • Professor (PhD, Mississippi State, '85) Clifford worked in industry for over fifteen years, gaining considerable experience in the areas of new process development and project management. He has worked in various research, development, and production positions with Copolymer Rubber and Chemical Corp., Calumet Industries, and Crosby Chemical Corp., and has been involved in a variety of systems design involving waste utilization and soils remediation. Early work was sponsored by the Tennessee Valley Authority and Energy Corporation to apply radio frequency and microwave heating techniques to industrial drying processes. As work progressed, experimental techniques and equipment were developed that led to investigation of the use of electromagnetic energy as a heating medium for the detoxification of contaminated soils. George has authored more than twenty papers and has made more than sixty technical presentations at meetings and symposiums.

■ **C. Hai Kuo** • Professor (PhD, University of Houston, '64) Hai joined the faculty at MSU in 1970. Prior to his arrival, he was associated with Shell Development Company and the U.S. Environmental Protection Agency. His research interests and experience include process dynamics and simulation, kinetics of vapor and liquid phase reactions, mass transfer and chemical reactions in gas/liquid and solid/liquid systems, multiphase fluid flow and heat transfer through porous media, and air and water pollution control.

■ **Rudy Rogers** • (PhD, University of Alabama, '68) Before joining the MSU faculty, Rudy worked in industry for eleven years on projects that included non-Newtonian flow of slurries, freeze drying, and small-particle phenomena. One area of his research has involved the production of methane adsorbed on coal, and his textbook on the subject, *Coalbed Methane: Principles and Practice*, was published by Prentice-Hall in 1994. His current research interests focus on gas hydrates. In recent years, gas hydrates (which form abundantly in arctic regions and in deep ocean sediments) have been found to store very large amounts of natural gas. Research at MSU is determining the feasibility of practical uses of natural gas storage in gas hydrates for such applications as peak loads for electric power plants and as an alternative fuel for automotive vehicles. Projects are funded by DOE and Chevron in these and related gas-hydrate topics. Rudy and MSU hold a patent regarding the application. Rudy teaches the mass and energy balances course as well as process design and plant design courses in the ChE department.

■ **Charles A. Sparrow** • Professor (PhD, Georgia Institute of Technology, '77) Charles has been a faculty member at MSU since 1976. His initial appointment was in the Department of Nuclear Engineering. He specializes in computational methods for transport problems, including diffusion theory. Among his interests is the development of methods for detection of small amounts of pollutants in the atmosphere. On the MSU campus, he is associated with the Center for International Security and Strategic Studies, where he organizes symposia to discuss problems associated with disposition of excess fissile materials. His research includes both numerical studies and laboratory measurements.

■ **Steven D. Gardner** • Associate Professor (PhD, University of Florida, '90) Steven's primary research and teaching interests revolve around the chemical and physical phenomena associated with interfaces. In fact, much of his previous research has been directed toward characterizing diffusion and reaction processes occurring at solid/solid, solid/liquid, and solid/gas boundaries. As a result, he has developed considerable expertise in surface and interface analysis using techniques such as X-ray photoelectron spectroscopy, Auger electron spectroscopy, and ion scattering spectroscopy. He currently directs a surface-analysis laboratory that addresses fundamental research in the areas of heterogeneous catalysis, adhesion (with emphasis on carbon fibers and polymers), and semiconductor gas sensors. Typical activities have included (1) optimizing catalyst compositions for improved yield and selectivity, (2) designing surface treatments for carbon fibers in order to achieve improved adhesion to polymers, and (3) correlating surface composition and surface conductivity of metal oxides as a function of the ambient gas-phase composition.

■ **Hossein Toghiani** • Associate Professor (PhD, University of Missouri-Columbia, '88) "Dr. H." (as he is known around the department) was born in Isfahan, Iran, and teaches the senior-level process control course. He also often teaches the reactor design and unit operations laboratory courses as well as graduate courses. He has worked with DIAL in the area of process gas analysis and is a major team player in the control efforts currently underway within DIAL. He also maintains research activities in the areas of polymer composites and phase equilibria. In collaboration with Dr. Hill, he is investigating the production of alcohols from synthesis gas derived from a variety of waste materials found throughout the state, including sawdust.

■ **Rebecca K. Besselsen Toghiani** • Associate Professor (PhD, University of Missouri-Columbia, '88) "Dr. R" is co-PI on a DIAL project investigating the thermodynamics of salt-cake dissolution in support of DOE remediation efforts at the Hanford DOE Complex. Additional DIAL activities focus on use of membrane technology for mercury removal from gas streams. Other research interests include phase equilibria and separations. She has established a laboratory for the measurement of vapor-liquid data (sub-atmospheric to 30 bar pressure) and for the examination of supercritical fluid extraction as a remediation tool. She teaches a variety of courses at the undergraduate level and has developed graduate-level courses in process computations and membrane separation processes.

■ **Mark E. Zappi** • Associate Professor (PhD, Mississippi State University, '95) Mark joined the faculty in 1996 and serves as the director of the recently established Environmental Technology Research and Applications Laboratory. His research focus has been on the development of innovative cleanup techniques that use biological, physical, and/or chemical oxidative mechanisms for contaminant destruction. These efforts involve research dealing with the treatment of contaminated water, soil, and air using both bench and pilot-scale reactor systems. He has been actively involved in the cleanup efforts at over twenty sites and has participated in over ninety engineering projects.

■ **Nancy S. Losure** • Assistant Professor (PhD, Michigan State University, '94) After receiving her BS degree, Nancy accepted an entry-level engineering position at Dow Chemical and carried out various assignments in polymer research and production plants, culminating with four years in the Styrene/Butadiene Latex production plant as a production engineer. In 1987 she resigned from Dow to pursue graduate study at Michigan State University. Since coming to MSU in 1994, she has pursued projects in polymer recycling and composite material production methods (notably in reaction injection modeling) and Kenaf/polymer blends. Her industrial experience has also been put to use in service of MISSTAP, where she conducts waste elimination and pollution prevention audits of Mississippi industries. She teaches polymer and materials science courses and the unit operations laboratory course.

The ground-breaking ceremony included Dave C. Swalm, Governor Kirk Fordice, President Donald Zacharias, College of Engineering Dean A. Wayne Bennett, and a host of alumni and friends of chemical engineering. The new 95,000 ft² building will feature state-of-the-art multimedia technology in the classrooms and will significantly expand the department's research and teaching facilities. The first two floors of the five-story red brick structure will include classrooms for general university use and a 140-seat auditorium. The upper floors will house chemical engineering classrooms, laboratories, and offices. Construction will be completed in 1999.

TODAY'S UNDERGRADUATE PROGRAM

The undergraduate program features the common core of science, engineering, and mathematics courses combined with traditional chemical engineering offerings. Electives drawing on faculty research expertise provide students with an opportunity to broaden their undergraduate academic experience in membrane separation processes, pollution abatement and remediation, air pollution control, hazardous waste incineration, experimental methods in materials research, and high polymer theory. The undergraduate program is accredited by ABET, requires 138 semester credit hours (see Table 2), and currently has 320 students. Departmental enrollment of women and minorities is highest in the College of Engineering, with 103 women and 82 minority students currently enrolled. The entering freshman class to the chemical engineering program always makes its presence known by having the highest average ACT score of any department in the College of Engineering.

The undergraduate curriculum has recently undergone significant modifications that allow students to focus elective courses in an area of interest to them. Other major modifications to the four-year BS-degree program include the addition of a seminar (1 hour) and a design-concepts course (3 hours) in the freshman year as well as more even distribution of the required ChE courses over the sophomore through senior years.

Undergraduates enjoy an excellent unit-operations laboratory experience made possible through the generosity of the Dow Chemical Company, Eastman Chemical Company, and the hard work of the Drs. Toghiani and Dr. Hill. Funding in the amount of \$250,000 from Dow and \$118,000 from Eastman allowed the design, construction, and integration of equipment for over eighteen new experiments to be added to the laboratory between 1989 and 1993. These experiments cover the spectrum from traditional unit operations to emerging technologies. Much of the equipment was built in-house and was designed to demonstrate textbook principles. Integration of the equipment with an industrial-style control system provides the undergraduates with a solid laboratory experience.

TABLE 2
Chemical Engineering Curriculum at MSU

FRESHMAN YEAR			
First Semester		Second Semester	
Inv. in Chemistry	1	Inv. in Chemistry	1
Fund. of Chemistry I	3	Fund. of Chemistry II	3
ChE Freshman Seminar	1	Design Concepts for ChE	3
English Comp. I	3	English Comp. II	3
Calculus I	3	Calculus II	3
Fund. of Public Speaking	3	Physics I	3
Humanities Elective	<u>3</u>	Social Science Elective	<u>3</u>
<i>Total Credit Hours</i>	<i>17</i>	<i>Total Credit Hours</i>	<i>19</i>
SOPHOMORE YEAR			
First Semester		Second Semester	
Calculus III	3	Calculus IV	3
Physics II	3	Physics III	3
Mass/Energy Balances	4	ChE Thermo I	3
Fluid Flow Operations	3	Heat Transfer Operations	3
Fine Arts Elective	<u>3</u>	Differential Equations	3
		Social Science Elective	<u>3</u>
<i>Total Credit Hours</i>	<i>16</i>	<i>Total Credit Hours</i>	<i>18</i>
JUNIOR YEAR			
First Semester		Second Semester	
Organic Chem. Lab I	1	Organic Chem. Lab II	1
Organic Chemistry I	3	Organic Chemistry II	3
ChE Thermo II	3	Mass Transfer Operations	3
Analysis & Simulation	3	Chem. Reactor Design	3
Engineering Mechanics I	3	ChE Lab I	2
Technical Writing	3	Engineering Materials	3
Humanities Elective	<u>3</u>	HU/FA/SS Elective	<u>3</u>
<i>Total Credit Hours</i>	<i>19</i>	<i>Total Credit Hours</i>	<i>18</i>
SENIOR YEAR			
First Semester		Second Semester	
Physical Chem. I	3	Plant Design	4
Physical Chem. Lab	1	Process Control	3
Process Design	3	ChE Elective	3
ChE Lab II	2	Chemistry Elective	3
EE Systems	3	Technical Elective	<u>3</u>
Technical Elective	<u>3</u>		
<i>Total Credit Hours</i>	<i>15</i>	<i>Total Credit Hours</i>	<i>16</i>

The ChE department is a strong proponent of cooperative education, and over 40% of our undergraduates participate in the program. Students in the program rotate three (or more) work semesters with school semesters. Most students begin their co-op rotation in the second semester of the sophomore year. The reorganization of the ChE curriculum provides them with classroom exposure to more ChE concepts as they move through the co-op sequence. To accommodate the various work/school rotations, the department offers all but two of the undergraduate required courses each fall and spring semester and also offers a number of key prerequisite courses during the summer session.

THE GRADUATE PROGRAM

The department offers two programs of study at the MS level. Students pursuing the traditional chemical engineering option complete a set of four core graduate courses encompassing the topics of transport phenomena, thermodynamics, chemical reaction kinetics, and process computations. The core graduate courses are offered on a three/four semester rotation. Six semester credit hours in advanced mathematics are required, as are six hours of technical electives for the MS in chemical engineering. In addition, candidates from other fields of study (chemistry or another engineering discipline) can pursue the MS in chemical engineering after they have completed a select set of undergraduate prerequisite courses.

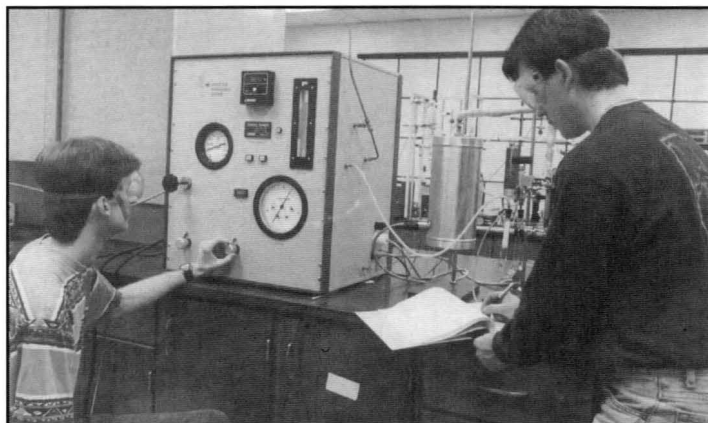
Students pursuing the industrial hazardous-waste-management option complete 24 hours of graduate courses that are selected to provide them with depth and breadth in the areas of environmental engineering and hazardous/industrial waste treatment/remediation technology. This option is available only to those who enter the graduate program with an undergraduate degree from an accredited engineering program. Successful completion of either MS degree program requires the submission and defense of a thesis by the candidate.

The ChE department participates in an interdisciplinary PhD program leading to the PhD in Engineering. The program requires 24 hours of graduate course work in addition to the MS requirements and a minimum of 20 hours of dissertation research. Students must also complete a qualifying examination, a preliminary/comprehensive examination and submit and defend a PhD dissertation.

Students can pursue a graduate degree through the off-campus graduate program. A number of recent graduates from the program have pursued their MS degrees while working in industry. Because of its moderate size, graduate classes of approximately ten students are common, providing for close association between the graduate students and their teachers and research advisors. Students interested in pursuing a graduate degree at MSU are encouraged to contact the department. Faculty research activity is growing steadily, and we are always seeking qualified students for our graduate programs.

RESEARCH FACILITIES

Since 1989, the department has experienced significant growth in research. Energy and the environment continue to



Op lab students investigate the solubility of naphthalene in supercritical carbon dioxide.

be strong areas of research interest within the department. George, Sparrow, H. Toghiani, and R. Toghiani collaborate with DIAL, while Gardner and Losure are actively involved in the Materials Research Group within the College of Engineering.

The Mississippi Technical Assistance Program (MISSTAP) was established in 1989 through a grant from the Mississippi Department of Environmental Quality. It is

a non-regulatory, client-confidential, technical-assistance program designed to assist Mississippi industries, businesses, and communities in identifying pollution prevention (P2) solutions for both their RCRA waste and their conventional waste. On-site technical assistance, waste assessments, and compliance monitoring are provided at no charge to industry. MISSTAP personnel are available to provide assistance as an informational clearinghouse and through a library devoted to P2 and the environment. The library and a hotline to the Waste Reduction Resource Center in Raleigh, North Carolina, provide the basis for fast and efficient technology-transfer activities. Research and development activities are carried out confidentially, but require a funding source.

The Environmental Technology Research and Applications Laboratory (E-TECH Laboratory) is the newest research laboratory established in the department. Its mission is to support government and industry through the development and application of pollution treatment and abatement techniques that provide cost-effective treatment of the environment. Mark Zappi serves as its director, and Hill, Kuo, and George contribute in research endeavors.

THE COMING YEARS

The past decade has been one of tremendous growth and change for the department. We are excited about all of the opportunities that we will be part of over the coming years. Our new building is set for completion during 1999 and our current freshman class will be among the first to fully utilize the facility. We anticipate growth of our graduate programs and our research endeavors in the years to come. Mississippi State is a great place to pursue chemical engineering studies, and Starkville is a great place to live. Y'all come down and see us, y'hear?

ACKNOWLEDGMENT

Photos are courtesy of Fred Faulk, University Relations, Mississippi State University. □