OKLAHOMA STATE REGENTS FOR
HIGHER EDUCATION
STATE CAPITAL COMPEX, OKLHOMA CITY

ACADEMIC UNIT/
DEGREE PROGRAM REVIEW

FOR

SCHOOL OF CHEMICAL ENGINEERING

MARCH 1, 2005

Oklahoma State University
Academic Program Review
Executive Summary

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Summary and Recommendations

OKLAHOMA STATE UNIVERSITY
ACADEMIC PROGRAM REVIEW
EXECUTIVE SUMMARY

DEPARTMENT OR DEGREE PROGRAM: _Chemical Engineering_________________

Address items specified in OSRHE policy on program review (VI-Content of Program Review Reports): description of review process, program objectives, student outcomes assessment, and program recommendations. Please limit the summary to 1 or 2 pages.

Performance of the chemical engineering program is exceptional as evidenced by these awards and recognitions over the past 5 years.

Students:

Two Goldwater Scholars
One Udall Scholar
One undergraduate NSF Scholar
One First Place National AIChE Plant Design (3 in the past 10 years)
Five National Outstanding ratings for the Student Chapter
97% first-time pass rate on the FE Exam compared to 84% nationally

Faculty:

NSF CAREER Award – James E. Smay
ACS Victor LaMer Award – James E. Smay
AIChE Advisor of the Year – Randy S. Lewis
Fellow ISA – R. Russell Rhinehart
AIChE/ASME Max Jacob Award – Kenneth J. Bell
OSU Regents Professor – Gary L. Foutch
Regents Teaching Award – Jan Wagner

This level of performance is achieved by a faculty size that is 60% of the national average and undergraduate and graduate degree/faculty member ratios that are 15% and 25% higher than the national norm.

Each year the Chemical Engineering program quantitatively obtains assessment data related to program quality and health in all program aspects. This includes data of (a) this 5-year OSHRE program review, (b) the critical ABET undergraduate program accreditation review, (c) both the undergraduate and graduate learning assessment required by the HLC of NCA, and (d) the School's part of the OSU strategic plan. The program acts on the findings to create positive change. The program has demonstrated a commitment to continuous quality improvement for more than 15 years, by all faculty and staff; clearly students are influenced by this.

A major national issue facing Chemical Engineering is the cyclic enrollment phenomenon. Matriculation rates, hence graduation rates, cycle with a 13-year period. The phenomenon is national, with all programs rising and falling in sync. It does not appear related to the economy, as much as it relates to the surplus or deficit of BS graduates relative to employment, which the cycling itself creates. Recognizing the pattern, OSU Chemical Engineering aggressively recruited students prior to the down cycle, by appealing to diverse motives, by creating a research enrichment program, by creating a biomedical/chemical option, by promoting excellence, among other things. As a result, the low period of matriculation for Chemical Engineering was twice what it had been in the past two cycles.

This sort of observation and analysis of data on a long-term basis, and pro-active management characterizes the program leadership.

The program clearly adds value to the State economy. The employment rate for our graduates is high, and employers return strong complements about the quality of our students. The faculty has a strong applications orientation, and contributes to Oklahoma industry through both service and graduate research.

Although the quality of education is exceptional as measured by national awards, the research related outcomes are average. The program has 10 faculty members, which is 60% of the national ChE program average faculty size; in addition, we have a higher BS and graduate degree production (teaching load), higher national student achievement record (quality), and lower salary (85% of Big XII, 82% of CCR, 79% of the AIChE Region schools). If the program is to sustain its nationally recognized undergraduate program, and fully capitalize on nationally critical research opportunities in the biomedical, biochemical, intelligent systems, energy management, nanomaterials, etc., it needs additional faculty members to reduce the high time demands of a small program on faculty members. The current faculty members clearly have demonstrated excellent research and program development ability; as evidenced by their creation of new and successful graduate programs in biomedical, materials, and control, while sustaining international presence in thermodynamics, ultrapure water, and coal-bed methane. This indicates that the School will be able to properly mentor new faculty investment.

The program faces rising enrollment, which will lead to a doubling of class sizes in about 5 years. When this happens the undergraduate laboratory space will again become overcrowded, and have an insufficient number of unit operations experiments.

Some faculty members are developing their careers and reputations very well, and will be seeking promotions. In addition, some are nearing retirement. Likely, in the next 5 years, we will loose about half of the current faculty members due to retirement or promotion. Planning to increase, not simply sustain, performance as these changes happen is a challenge.

Increasing the number of faculty members and expanding the undergraduate teaching laboratory represent the two greatest needs for system investment in the program. And, we believe that the program has the demonstrated ability to return value for a system investment.

Dean Karen N. Reid Date 3/4/05
(Signature)

Note: Complete one of these forms for each degree program

OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION

2004 - 2005
ACADEMIC PROGRAM REVIEW

BACCALAUREATE, MASTERS & DOCTORAL DEGREES

OKLAHOMA STATE UNIVERSITY

Chemical Engineering - BS
Title of unit or degree program reviewed (Level III)

With options (Level IV) in: Chemical, Pre-Medical, Environmental, And Biomedical/Biochemical

___Bachelor of Science_____________
Degree designation as on diploma (Level II)

____________BS________________________
Formal degree abbreviation (Level I)

Degree-granting academic unit _Chemical Engineering_______________ (Name) __503_____ (Cost Center)

CIP code _1_ _4_ _0_ _7_ _0_ _1_

HEGIS code _0_ _9_ _0_ _6_

Instructional Program code _0_ _4_ _1_

Name of department head
(person who oversees degree program listed above) __Dr. R. Russell Rhinehart____________________

Program holds specialized accreditation from __ABET__________________________________

Name and title of contact person _____ Dr. R. Russell Rhinehart______________________ (Name)
______Head____________________________________ (Title)

Date of Institutional Governing Board Review: ______________________________

President ________________________________ (Signature) Date: ____________________

Note: Complete one of these forms for each degree program

OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION

2004 - 2005
ACADEMIC PROGRAM REVIEW

BACCALAUREATE, MASTERS & DOCTORAL DEGREES

OKLAHOMA STATE UNIVERSITY

Chemical Engineering - MS
Title of unit or degree program reviewed (Level III)

With options (Level IV) in: ______________________
____

_____Master of Science_______________
Degree designation as on diploma (Level II)

__________MS____________________
Formal degree abbreviation (Level I)

Degree-granting academic unit __Chemical Engineering_________ ___503______
(Name) (Cost Center)

CIP code _1_ _4_ _0_ _7_ _0_ _1_

HEGIS code _0_ _9_ _0_ _6_

Instructional Program code _0_ _4_ _2_

Name of department head
(person who oversees degree program listed above) ___ Dr. R. Russell Rhinehart________________

Program holds specialized accreditation from __ABET____________________________

Name and title of contact person ___ Dr. R. Russell Rhinehart______________________
(Name)
____Head________________________________
(Title)

Date of Institutional Governing Board Review: ______________________

President ______________________________ Date: ______________________
(Signature)

Note: Complete one of these forms for each degree program

OKLAHOMA STATE REGENTS FOR HIGHER EDUCATION

2004 - 2005
ACADEMIC PROGRAM REVIEW

BACCALAUREATE, MASTERS & DOCTORAL DEGREES

OKLAHOMA STATE UNIVERSITY

Chemical Engineering - PhD
Title of unit or degree program reviewed (Level III)

With options (Level IV) in: ______________________
____

_____Doctor of Philosophy_______
Degree designation as on diploma (Level II)

______________PhD__________________
Formal degree abbreviation (Level I)

Degree-granting academic unit _Chemical Engineering______ (Name) __503______ (Cost Center)

CIP code _1_ _4_ _0_ _7_ _0_ _1_

HEGIS code _0_ _9_ _0_ _6_

Instructional Program code _0_ _4_ _3_

Name of department head
(person who oversees degree program listed above) __ Dr. R. Russell Rhinehart __________________

Program holds specialized accreditation from __ABET______________________________

Name and title of contact person ___ Dr. R. Russell Rhinehart ______________________
(Name)
_____Head____________________________________
(Title)

Date of Institutional Governing Board Review: ______________________

President ______________________ Date: ______________________
(Signature)

CHEMICAL ENGINEERING

Information for the cover page (page 2 in your packet) of Oklahoma State Regents of Higher Education Program Review. Since we have changed systems for both accounting data and student data during the past five years, both old and new major designations (options) are listed under each degree program.
Both old and new academic department numbers are also listed. The current cost center code for your department is given.

The department numbers are:
Old: 12507 New: C4507
The cost center code: 503

Degree program: 041 - Chemical Engineering - BS
The HEGIS code is: 0906, the CIP code is: 140701

Old major designation:
New major designation: EN BS CHENENTR

Old major designation: 4101
New major designation: EN BS CHEN

Old major designation: 4102
New major designation: EN BS CHENPMED

Old major designation: 4105
New major designation: EN BS CHENBIMD

Old major designation: 4105
New major designation: EN BS CHENBIOM

Old major designation: 4106
New major designation: EN BS CHENENVR

Degree program: 042 - Chemical Engineering - MS
The HEGIS code is: 0906, the CIP code is: 140701

Old major designation: 7302
New major designation: EN MS CHEN

Degree program: 043 - Chemical Engineering - PHD
The HEGIS code is: 0906, the CIP code is: 140701

Old major designation: 7303
New major designation: EN PHD CHEN

0A - DESCRIPTION OF THE DEPARTMENTAL REVIEW PROCESS

This review was completed by R. Russell Rhinehart, Chemical Engineering Head.

Twice annually the school faculty participates in a comprehensive review of assessment data from which school priorities are determined and tasks are initiated to cause improvement. Members of the 10-person Industrial Advisory Committee participate in one of the reviews. Assessment data comes from diverse sources which provide a broad and corroborative base. This includes end-of-course learning assessment by both students and instructor, exit interviews of BS, MS, and PhD graduates, alumni surveys, employer surveys, financial analysis, enrollment trends, national recognitions, research publications, personnel development analysis, and comparisons with Big XII schools (through OSU) and comparisons to national Chemical Engineering program survey data from the American Institute of Chemical Engineers (AIChE) and the more research oriented Council for Chemical Research (CCR). Annually, the data reviewed by program faculty include that specified for accreditation by ABET and the HLC of NCA, the Strategic Plan, and this 5-year OSRHE review.

By updating and reviewing the data annually, this review was relatively easy to assemble.

0B - RECOMMENDATIONS FROM PREVIOUS PROGRAM REVIEWS

The review committee praised the 1999 Program Review that the School prepared and did not make recommendations.

However, each year the School faculty reviews all assessment information and updates a list of School Priorities which guides faculty efforts (especially the Head's). The priorities from 1999, were presented in the 1999 program review, and they have formed the basis for program changes. Changes made include:

1. Creation of web pages to market the School and announce its successes and activities.
2. Switch from paper newsletter to web-based articles and an email and postcard notification to constituents.
3. Renovate the Unit Operations Lab for ADA compliance, student safety, and supervision (we added a three level lift and removed intermediate walls to convert three rooms into one).
4. Add Unit Operations Lab equipment, with industrial craft an instrumentation. (We added data acquisition and control to the distillation column and two-phase flow apparatus. We installed a fully automated multi-unit heat exchanger.)
5. Eliminate Unit Operations Lab units that had lost function. We dismantled a heat exchanger, rebuilt the two-phase flow unit, and surplussed a reactor, a mixer, a cooling tower, and a pressure losses in pipes experiments.)
6. Improve undergraduate advising. We switched from a paper-based system with all faculty members advising to an electronic system with one faculty advisor. This has greatly unified advising and improved information transfer.
7. Move toward greater use of electronic technology in teaching. Nearly all lectures involve computer projection and nearly all exchange of course material between faculty and students is web-based.
8. Improve accuracy and timeliness of cost accounting on grants and contracts. Because of no ability to influence central administration to make necessary improvements for faculty management of accounts, we have developed an Excel-based internal shadow system.
9. Temper enrollment cycling. We changed incentives for high school students to choose chemical engineering and tempered the effect of national cycling phenomena so that the drop in ChE enrollment was not nearly as sever as it had been in the past two cycles.
10. Successfully meet the new undergraduate accreditation criteria. ABET started requiring a continuous improvement process to replace the inspection to compliance of specific topics. This was a major change in faculty perspectives and tasks. We were very successful.
11. Keep students skilled in contemporary tools. We have added software tools to the ChE curriculum (MathCAD, PolyMATH, and CFX) and upgraded the use of other packages (Excel, ChemCAD).

12. Increase student math skill. We switched from two 5-SCH calculus courses to a three-course 4-3-3-SCH sequence. We purposefully added progressive math exercises in the ChE courses. We are beginning to see an increase in mathematics skill.
13. Curriculum rearrangement. We shifted transport and reaction engineering to the junior-level so that students could better build on those courses in the senior year.
14. Accommodate bio-interests. We added undergraduate and graduate courses in both biomedical and biochemical engineering, and obtained the Biomedical/Chemical option in chemical engineering.
15. Increase graduate student stipends. We increased stipends from about $900/mo to about $1,400/mo for a half-time graduate research assistant. We are now marginally competitive at the national level.
16. Increase graduate program funding. We changed the graduate degree requirements to emphasize research for both students and faculty, and saw an increase of research expenditures from about $0.5M to just over $1.1M. (However, the economic impact of post 9-11 events significantly cut industrially funded research, and last year it dropped to about $0.67M.

The list of School Priorities continues to be reviewed and updated by the School faculty each year. Here is the list that is active today.

Working List of School Priorities
Chemical Engineering – Oklahoma State University
Many on the "Improve" list are well on the way sufficient improvement and deletion.
Those in bold need significant attention.
from January 31, 2005 faculty meeting

Maintain Strengths:

- Faculty and staff focus on quality, mission, and personal flexibility
- Teaching/Learning effectiveness
- Respect for students
- FE Exam Performance
- Student allegiance/happiness
- AIChE Chapter Activity
- Undergraduate student performance (national and OSU) – Design, outstanding chapter, ChemE-Car, paper presentations, scholarships, outstanding seniors, St. Pats, graduate school and employer acceptance.
- Fundamentals & Practice balance
- Quality (intellectual, leadership, commitment to excellence) of undergraduates

Improve:

- Graduate Program –
    - **Research funding income** – nearly tripled from 1997 to 2002, but has dropped about 25% since then.
    - **Enrollment** – was constrained by funding, dropped as stipend was raised. Added some unsupported, now at 40, would like about 50. However,

applications have decreased to 1/3 of recent numbers, apparently due to factors related to post 9-11 treatment of foreign nationals.

  - **Program productivity** (manuscripts, presentations, innovations) – showing a marginal rise on a per student basis, seems more dependent on faculty commitment to establishing a national impact than school policy
  - **Student performance on research** – developing metrics for proposal and defense evaluation
  - **Bureaucratic Barriers** – several OSU and CEAT policies discourage and hamper faculty participation and research productivity.
  - Student stipend – risen to match I-20 requirements, not quite nationally competitive.
  - Student retention – seems dependent on both student intent and faculty and project ability to inspire a particular person.
- Undergraduate Program
  - **UOL experiments** - We have added analytical instruments, instrumentation and control, integrated pilot-scale units, and piping craft. We have improved safety. However maintenance (of units and DAC instruments) is a problem. And, adding new experiments takes time and money. Many thanks to JW (and his generous industrial friends), JES, SVM, RSL, and KAMG. Plans are to add ChemE Car, L-L extraction, and flow loop experiments. However, we have several aging experiments and no budget funds for either replacement, maintenance, or new experiments.
  - **Practical math skills** - Improve student skill in modeling, calculus, ODEs, computer programming, computer solution tools, probability and distributions, statistics, and model validation. Professors are working to integrate student use in each course. FE scores rose, then fell. RRR investigating Sophomore and Junior seminars to replace ENGR1352 for partial use as math and software training.
  - **Undergraduate program Accreditation CQI** – created process, **need to ensure execution by all**
  - ENSC2613 (circuits) – a continuing complaint by students based on irrelevance of material and of instructional style.
  - PHYS2014, 2114 and BIOL1604 – risen to top place on student complaint list based on perceived irrelevance of material.
  - Enrollment – ChE enrollment cycles and it is safe to say that freshman matriculate numbers did not drop half as much as they had in past cycles. Thanks to many who contributed to marketing the program and adding enrichment opportunities to attract students. Now past the down cycle, in about 5 years we will be experiencing large enrollments and the classroom and laboratory space and the faculty time that high enrollments will demand. Not critical today, resources will be critically low very soon.
  - Effectiveness and efficiency of undergraduate advising – results of electronic process and single advisor look good. RSL is participating in freshmen advising to help eliminate errors. CEAT Student Services is developing metrics to better place students in CHEM and MATH courses.

    - Funding for enrichment programs (ChemE Car, ChemKidz, AIChE, Wentz Projects) We greatly appreciate the faculty efforts in sponsoring such activities, and to Chevron Phillips for ChemE Car support and ConocoPhillips for student activity support.
- Alumni and External Public
    - Alumni association/participation – needs drivers from faculty and alumni
    - ChE Academy – needs drivers from faculty and alumni
    - Newsletter/Web page outreach for alumni allegiance and pride – using web page in lieu of newsletter, semi-annual postcards and emails to alumni.
    - Web page for marketing and recruiting – Posting bragging rights and photos of activities. Need faculty to update personal sections.
- Stature
    - **National faculty recognition** (leadership, fellow, awards, publications, achievements) – seeking a volunteer to nominate faculty for national awards.
    - National student recognition (paper contests, ChemE Car and other AIChE activities; national scholarships such as Goldwater and NSF) – all faculty need to encourage students and seek opportunities to promote the program successes.
- Faculty Development
    - Software utilization (Excel, MathCAD, VBA, blackboard, CFX, DAC, etc.) – use faculty meetings and open class training sessions.
    - Catch-as-can personal & professional development – we don't know what we don't know.
- Procedures and Documents
    - **Timely and accurate accounting and appointments** – Genny and Carolyn save us with accurate, timely, and diligent data, form processing, and system fixing. It is a shame that they have to interpret university documents, maintain a shadow system, and continually fix errors.
    - Uniform and simplicity in advising – making substantial progress
    - Automatic assessment processes – in place, need to sustain activity
- Infrastructure
    - **EN Classrooms** – tables, computer, network – Adjusted schedule and moved most ChE courses to EN515 to begin room take-over.
    - **UOL space** – Crowdness of lab is a safety concern. It also has student groups with insufficient space to work without encroaching on others space. There is no room to add anything but toy-scale experiments, and we need a few larger-scale units like the flow loop and L-L extraction to broadly complement the curriculum topics.
    - **Lab Manager and Technician** – we need a person with skills several levels above what the budget will support.
    - **Computer Technician** – we need a person to manage office and research computer systems.

- **Personal Notebook computers** – require students to buy a laptop, wireless network the campus, and reduce the tech fee, and eliminate inaccessible computer labs scheduling for courses.
- Women's rest rooms – on 3 of 6 EN floors. 6 stations total for the building.

1A - GOALS AND OBJECTIVES

Information on **Degree Program**, **Program Clientele**, **Program Objectives,** and **Expected Student Outcomes** are woven into the text which follows. This text is extracted from our published goals and objectives from our three programs, which are annually reviewed and updated as a fundamental part of your continuous quality improvement philosophy. We have grounded our departmental mission in the goals and mission of the University and the college, which are stated as follows:

University Mission

The Oklahoma State University is a modern comprehensive land-grant university that serves the state, national and international communities by providing students with exceptional academic experiences, by conducting scholarly research and other creative activities that advance fundamental knowledge, and by disseminating knowledge to the people of Oklahoma and throughout the world.

College Mission

The mission of the College of Engineering, Architecture and Technology is to advance the quality of human life through strategically selected programs of instruction, research, and public service, incorporating strong social, economic and environmental dimensions, and emphasizing advanced level programs in engineering that are internationally recognized for excellence.

School Mission:

The mission of the School of Chemical Engineering at Oklahoma State University is to develop human resources, professional knowledge, and the infrastructure through which chemical engineering can contribute to human welfare. We expect to maintain national recognition for our contributions.

Degree Programs

The School offers BS, MS, and PhD degree programs. The BS ChE degree has four options (Regular, Environmental, Pre-Med, and BioMedical/Chemical). The Masters and PhD degrees are primarily research-based, but there is a creative component (non-research) option in the MS program. For each program, we have identified program clientele (which we have termed constituents because it extends beyond students), program objectives, and expected outcomes. This information is summarized in the OSU Catalog, and presented in substantial detail on the School Web site. The three degree programs have distinguishing objectives.

BS Degree: Upon graduation, our BS students will be able to cooperatively create practicable solutions for the benefit of human welfare. They will be aware of the multitude of constraints on the professional including business economics, legal, and national values such as resource conservation, quality, safety, and protection of the future. They will accept their responsibility as privileged leaders of human kind. They will understand the human process that rules their profession, and be effective in interpersonal relations and communications. They will be flexible, open, and accepting of their need for continual personal growth. They will have a strong understanding of the fundamental science and engineering principles that characterize "chemical engineering" so that their work is grounded in best practices.

MS Degree: While the BS ChE curriculum is rigorous, within the four-year curriculum students only experience the "tip of the iceberg" of each technical topic, and for most topics, students are developing their ability to use mathematics to describe the physical and chemical phenomena. Accordingly, the MS degree is viewed as a "finishing school" or "professional school." In classes of the core curriculum, students review the fundamentals, but with a greater level of complexity and mathematical rigor than is possible in the B.S. program. Then in their research or creative component project students are expected to integrate their knowledge as they demonstrate and defend completion of a comprehensive engineering project. The master's work and thesis is clearly to be a "masterpiece" creation of the student that demonstrates professional stature and skill.

PhD Degree: The PhD degree is a research degree. Building upon the skills required for the MS, the PhD candidate is expected to independently direct his/her own work to make a relevant contribution to either engineering knowledge or the use of engineering tools. The PhD candidate must defend the relevance and significance of the contribution, the methodology, and its credibility. The result of the PhD Candidate's work must be more than a "right" application of engineering principles. Either the result or the chosen path must demonstrate significant leadership and a significant advance to the state of the art of the profession.

Following is a detailed discussion of clientele, goals and objectives, and outcomes for each of the three degree programs.

Bachelors of Science in Chemical Engineering - Educational Objectives

The Educational Objectives of the School of Chemical Engineering for the undergraduate programs are published in the OSU Catalog and on the School Web site (http://www.School.okstate.edu link to "School Overview", then "Several Years After"). Over the past five years they have been stated as:

Within the first few years after graduation, our graduates will have demonstrated the ability to:

1. Work in a manner that is characterized as "good engineering".
2. Be professional partners with both employer and community, and create value.
3. Enjoy life.

However, as we have used these to guide our activities, we have sensed the need to refine the wording, and in cooperation with our Industrial Advisory Members, in May of 2004 revised the Educational Objectives to become:

Within the first few years after graduation OSU ChE BS graduates will possess:

- Competencies – skill in tools and techniques that are fundamental to the job - many of which need to be learned after graduation.
- Professionalism – partnership in the mission and within the human context of the enterprise - ethics, effectiveness, and awareness of the broad context of the detailed work
- Balance – a wise self-direction to life, community, health, and self view that finds the right balance between personal choices, which energizes self and others and enables effectiveness in relationships with others.

These are consistent with the missions of the University and College, and were developed with constituents.

Bachelors of Science in Chemical Engineering - Definition of Constituents

Primarily the program clientele are on-campus students. Most of our students seek private sector employment immediately after graduation. However, others enter professional schools (medical, law, or business) or engineering graduate schools. Some enter the military. It is common for some to leave professional practice and pursue a full-time commitment to raising a family. These are diverse life paths. Regardless of the life path, however, there is a commonality in the activities, achievements, point of view, and style that lead to happiness and success in these after-graduation challenges, where success is measured by contribution to corporate/community welfare, and attributes for success change with the environment. Our program aims to prepare students for successful lives.

However, indirectly, the human resource development aspect of the program serves employers, communities, and families of the students. Accordingly, we interpret program clientele in a broad view.

1) STUDENTS. We desire to have a program in which students enjoy their growth in understanding both life and technology. They will celebrate success in meeting the curriculum challenges that prepare them for engineering careers. Representatives of this constituent group are students. Students will formally and directly contribute to the recognition of problems and creation of ideas for solution through exit interviews, and CHE4581 (Senior Seminar) survey and discussion. All students participate in day-courses on the Stillwater campus.

2) ALUMNI. Nominally, School alumni have a 30-plus-year career followed by retirement. We desire that they be happy and successful in all phases of their life, and posses the attributes to be so. It usually requires several years for alumni to make the

transition of perspectives and habits from being a student to being a partner in the enterprise. So, immediate graduates are not considered a part of this group. However, the impact of the undergraduate education fades as alumni continue to develop personally and professionally. Accordingly, representatives of this constituent group are our alumni, about 2 to 7 years after graduation.

3) EMPLOYERS. Employers expect our graduates to become business partners who can use their skills to improve quality, flexibility, safety, economics, etc. of their processes and operations. Demographics from the past five years indicate that about 80% of our BS students enter industry directly, and that about 20% go to either professional or graduate school. Many of these subsequently enter industry. Accordingly, representatives of the employers include both industrial managers and graduate faculty. Representatives of the industrial manager group are the School Industrial Advisory Committee. See Table 1 for composition. Representatives of the graduate faculty group are the School faculty.

4) CITIZENS. Many people benefit from the profit, resource conservation, and improvement in processes and products that are created by our graduates. Citizens include all people who share the student's joy and pride in their development, accomplishments, and stature both before and after graduation. This includes the corporate State of Oklahoma, which will benefit from a first-class educational institution in national reputation, quality of life, and economic development. It also includes the families who invest in the students' education. It includes the communities in which our graduates live. Primarily, IAC members will represent this constituency group. Many are parents of OSU students, and most have upper-level managerial positions. These experiences provide them with a perspective that reflects citizens. We will also remain open to input from diverse citizenry, such as parents, the Regents, recruiters, older alumni, and others who have a claim to influence our undergraduate program.

5) SCHOOL FACULTY. School faculty members are the "trustees" of educational quality. Further, they have a first-hand and immediate awareness of the efficacy of the curriculum in meeting Program Outcomes.

The five constituent groups have a voice, but not equal weighting, in program improvement. Their input is at appropriate intervals, about appropriate issues, and their concerns appropriately accommodated by the faculty trustees to best balance all issues.

Bachelors of Science in Chemical Engineering - Program Outcomes

Consistent with ABET terminology, **"Program Outcomes" are the desirable attributes of OSU ChE BS graduates upon graduation**. It is what they are expected to know and able to do at the time of graduation. It is the set of skills that they developed while in school, to meet the "Educational Objectives".

The Chemical Engineering program at Oklahoma State University has a strong history of being applications, and practice oriented. This includes structured student experience in interpersonal and communication effectiveness, as well as training to generate practicable process designs and to perform technical analysis of complex processes. As a necessary complement, OSU also has a strong history of graduating students who are competent in the fundamental sciences of chemical engineering.

Fundamentals are of paramount importance. Future technical growth of the graduate depends on his/her knowledge of the fundamentals. Credible techniques must be built upon a fundamental basis. However, engineering solutions are realized within a context of nonidealities, human enterprises, legal/regulatory and economic constraints, and uncertainty. Therefore, students must understand both the practice as well as the science of engineering.

In addition, engineering is a people-intensive vocation. Communication effectiveness, good interpersonal relationships, and both personal and professional credibility are required by the new engineer to be effective in working through others, to make his/her assignments become realized.

ABET has specified "a-k" program outcomes, and we find them to be comprehensive, and a necessary and sufficient representation of our desired outcomes. Considering this, our program outcomes desire that our graduates have:

a. An ability to apply knowledge of mathematics, science, and engineering.
b. An ability to design and conduct experiments, as well as to analyze and interpret data.
c. An ability to design a system, component, or process to meet desired needs.
d. An ability to function on multi-disciplinary teams.
e. An ability to identify, formulate, and solve engineering problems.
f. An understanding of professional and ethical responsibility.
g. An ability to communicate effectively.
h. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
i. A recognition of, the need for, and an ability to engage in life-long learning.
j. A knowledge of contemporary issues.
k. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Starting in the fall of 1999 the School CQI Committee began a process of understanding the meaning of these words, and through two years of directed discussion in faculty meetings and with IAC feedback, in the spring of 2001 we adopted the following clarifications:

a) **An ability to apply knowledge of mathematics, science, and engineering**. This criterion is interpreted in two categories. First, it specifies that graduating students have the fundamental skills commonly useful to chemical engineering. These include understanding the concepts of physical and chemical phenomena at scales from molecular to macro, describing these phenomena using mathematics, and solving the mathematics so the phenomena can be accurately represented. Second, that graduating students are able to apply theory to practice. Not every knowledge or application event has to be demonstrated. Predicated on the basis that the selected list of topics represents the breadth of fundamental phenomena and analysis techniques, demonstration in the commonly accepted fundamentals of chemical engineering implies that students have the ability to perform in other, associated topics. Our list of topics defining this knowledge base is presented in Table 2, which also reveals courses that supply that experience and the expected role of that class in providing ability in that topic (P=Primarily introduced, R=substantially Reinforced or expanded, X=utilized).

b) **An ability to design and conduct experiments, as well as to analyze and interpret data**. Design is an activity that develops specifications for a tangible process, procedure, program, or recipe, which best performs its function within the multiple and competing objectives of the human situation. Design is not the following of a recipe or set of instructions. Design is a creative, open-ended activity that continually operates in the cognitive modes of synthesis (concept), analysis (determine performance metrics for the concept), evaluation (decide if the work is complete or needs improvement), until it is determined to be finished. Design of experiments includes the choice of measurement devices, experimental order, operating conditions, basis for analysis, methods for validation, etc. The design, necessarily, must change as data and experience reveals a better understanding of the process and appropriate analysis procedures. The objectives for design of, and for conducting, experiments are to maximize operational safety, minimize cost and effort, minimize hazard and risk, minimize environmental impact, maximize data precision and accuracy, maximize validity of scale-up or other use of data, and generate a complete and credible conclusion. Students will implement their experimental designs, and then "analyze the data" in consideration of the fundamentals of engineering. While experimental design is scattered throughout the curriculum it culminates in activities of two required courses CHE4002, and 4112 (Unit Operations Laboratory I and II).

c) **An ability to design a system, component, or process to meet desired needs**. Design is an activity that develops specifications for a tangible process, procedure, program, or recipe that accomplishes a specific objective, which best performs its function within the multiple and competing objectives of the human situation. While the primary ChE image of that activity is "Plant Design and Economics", this broader understanding of design includes the design of computer executable instruction, selection and choice of process units, design of oral and written presentations, and design of integrated chemical processes. The design choices must be grounded in both the fundamental technical principles and acceptance and utility of the designed item. Design is integrated throughout the curriculum, and even in many "non-design" courses, design (of presentation of work) constitutes a substantial portion of the grade. Classical plant design is the topic of CHE4124 and 4224 (Plant Economics and Design). However, design is also an important part of the ENGR1352 (Engineering Design), ENGR1422 (Computer Programming), and CHE3123 (Reaction Engineering) courses.

d) **An ability to function on multi-disciplinary teams**. "Multi-disciplinary" is a limited vision. Our IAC members have guided us to interpret this as "humanly diverse", as relating to individuals and groups with other experiences, values, cultures, age, priorities, and training. Individuals on "teams" must share and accept unique personal expertise and resources of others, enrich the awareness of teammates, and integrate diverse aspects (safety, environmental, legal, economic, etc.) into a project. Ability to function on "humanly diverse" teams does not necessarily require participation in multi-disciplinary teams, when diversity and coaching for improved team performance is fully available within the ChE student/faculty teams. Team exercises are a part of the entire ChE curriculum, and within CHE4002, 4112, 4124, 4224, and 4581, students are instructed and coached for team performance.

e) **An ability to identify, formulate, and solve engineering problems**. This criterion relates to systematic diagnosis followed by solution. As students progress within the curriculum, assignments increase in the complexity of the technical analysis and the integration of human enterprise issues.

f) **An understanding of professional and ethical responsibility**. This criterion is interpreted as being consistent with the AIChE Code of Professional Ethics. Throughout the curriculum we hold students to high standards of academic honesty. While collaboration is encouraged, copying and plagiarism are penalized. Students are coached to get it right, accept criticism, and grading is careful to not allow a superficial presentation, or a wrong procedure that magically produces a right answer. By participating actively on student teams in UOL and Design, faculty see superficial beginnings, and can guide students onto a legitimate path. Issues of ethics associated with the profession are raised in Senior Seminar. Design and Unit Operations Lab (and the ChemE Car exercise in CHE3123 and 2033) reveal the ethics associated with safety, loss prevention, management of risk, resource conservation, and environmental impact. All ChE instructors stress academic honesty.

g) **An ability to communicate effectively**. Communication involves oral and written text, equations, graphical data presentation, and drawings. Effective communication requires audience analysis, and a presentation that is easily understood. Progressively, throughout the curriculum, students are held to standards of effective home assignment and project presentation. We provide explicit guidance for presentation structure in UOL and Design. And we provide substantial feedback on oral and written progress and project reports in UOL and Design. We are using a rubric to evaluate the second project report in 4002 and the first in 4112, to provide specific feedback to students. This spring, we conducted a survey of engineering supervisors of new ChE hires. There were 15 responses representing about 20 individuals in 9 companies that hire OSU ChE graduates. IAC and Faculty members discussed the results at the spring 2003 IAC meeting to recommend appropriate expectations and progression of communication exercises for the curriculum.

h) **The broad education necessary to understand the impact of engineering solutions in a global and societal context**. Students should understand that a "correct" engineering solution is dependent on the local culture, infrastructure, economy, resources, etc. which change with time and place, and they should accommodate these issues in their engineering activity. These concepts are particularly integrated in the CHE4002, 4112, 4124, 4224, and 4581 courses.

i) **A recognition of the need for, and an ability to engage in life-long learning**. This includes technical, professional, and personal development. Since most of the life-long learning is self-directed, the "student" must also become the "professor" in guiding his/her growth, and testing his/her ability. We need to excite students with a passion for learning, and provide them successful experiences and examples of self-learning. These concepts are particularly integrated in the CHE4002, 4112, 4124, 4224, and 4581 courses, which require independent investigation.

j) **A knowledge of contemporary issues**. This criterion includes political, social, and technical issues. These concepts are particularly integrated in the CHE4002, 4112, 4124, 4224, and 4581 courses.

k) **An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice**. We interpret these tools to support both technical work (computer aided simulation, design, math analysis, etc.) and presentation tasks (word processor, graphics, etc.), and expect that use will be integrated throughout the curriculum. We have chosen MS Word, PowerPoint, and Excel for presentation. We have chosen Excel, MathCAD, and FORTRAN for data processing (but students often program in other languages). We have chosen ChemCAD for steady state process design and analysis, and to provide thermodynamic data. We have chosen CFX for transport phenomena modeling. We are using BASIC and Camile (PL-1 like) for data acquisition and real time data analysis in the UOL. We have used a variety of software packages for simulation of process dynamics and control in CHE4843.

All eleven a-k outcomes are important, however the expectations for level of skill or ability vary between Outcomes. For example, most of the curriculum is dedicated to developing the fundamental math, science, and engineering ability described in Outcome "a".

Masters of Science in Chemical Engineering – Educational Objectives

An M.S. degree in Chemical Engineering from Oklahoma State University signifies that the recipient has demonstrated advanced knowledge of fundamental chemical engineering topics. In addition, an M.S. graduate has exhibited the ability to integrate this knowledge, successfully and independently, to solve complex quantitative problems in a logical manner.

Specific educational objectives have been established for the M.S. program, and they can be met through a combination of course work, independent study and other mechanisms (e.g., seminar). These objectives are shown below, along with the criteria used to assess success in meeting them.

Educational Objectives	**Outcome Assessments**
1. Build upon and expand the student's undergraduate education by emphasizing depth in thermodynamics, transport phenomena, kinetics, and mathematical modeling	Complete the "core" courses in the M.S. curriculum
2. Expand personal knowledge of the	Complete three credits of Chemical

broad range of applications of chemical engineering	Engineering Seminar (CHE 6010)
3. Develop the skills required to work independently to solve unique problems in chemical engineering	Complete an M.S. thesis research project
4. Attain additional knowledge (breadth and/or depth) in topics related to chemical engineering	Complete at least two M.S. elective courses related to the student's career objectives
5. Develop effective written and oral communications skills	Write, and defend orally, an M.S. thesis

The emphasis in course work during the M.S. degree is on depth of understanding of subject matter and on preparing students for careers in the areas of their interest. Depth is obtained through broad-based "core" courses addressing knowledge expected of all chemical engineers, while other courses are targeted toward the student's research and specific career interests. The core areas include fundamentals and applications of mathematical modeling, thermodynamics, kinetics and transport phenomena. The courses are structured to expand and add depth to the students' undergraduate knowledge.

Additional "elective" courses must be selected, with the advice and consent of the student's research advisor, from graduate-approved courses in any department. The choice of courses is based solely on improving skills related to the student's educational objectives. Each Fall and Spring Semester, all students will participate in a seminar class to give them an overview of – and appreciation for – the wide range of applicability of chemical engineering knowledge. Students also complete "research" courses as part of the M.S. thesis research project.

Masters of Science in Chemical Engineering - Program Clientele

We accept students with a BS in chemical engineering or related program who have a GPA of about 3.5 or higher. If not from an accredited BS ChE program, students are required to take leveling work as appropriate. We expect students to have a strong desire to pursue advanced learning in both the fundamentals and application of chemical engineering science and technology. We expect students to seek the MS degree to prepare themselves for either entering an engineering development career in industry or as preparation for a PhD.

Masters of Science in Chemical Engineering - Program Outcomes

Our degree requirements prescribe course work and levels of classroom performance which demonstrate proficiency in the primary fundamentals of chemical engineering – a level of competency in understanding which will enable the graduate to "hold their own" with advances in the field. We also expect either a creative component or thesis work that is presented and defended to demonstrate mastery of chemical engineering. The student must present a satisfactory written document and defend it in an oral examination. In these examinations, the Advisory Committee Members will seek to determine if the candidate has done the following:

- Identified a topic that is of scientific/engineering importance,
- Performed a thorough search of the existing state of knowledge on the subject and synthesized this information into an integrated body of information,
- Utilized the scientific method in solution of the problem,
- Developed a rational plan of attack on the problem,
- Executed the plan successfully in conducting the necessary research,
- Developed logical, defensible conclusions and recommendations from the work, and
- Presented the work in clear, concise, well-organized fashion in the written thesis/dissertation and in the oral defense.

PhD in Chemical Engineering – Educational Objectives

A Ph.D. in Chemical Engineering from Oklahoma State University signifies that the recipient has demonstrated a breadth of advanced knowledge in the subjects that form the foundation of chemical engineering. In addition, the graduate will have demonstrated the ability to independently and efficiently make creative, relevant, significant contributions at the forefront of knowledge in traditional or emerging fields within the Chemical Engineering discipline. The program is designed to prepare the graduate with the widest possible career opportunities as a leader in industrial and academic arenas.

The Ph.D. experience allows the candidate to develop and demonstrate the independent, self-directed, creative, productivity of an accomplished professional. As such, the Ph.D. experience must go well beyond directed classroom courses in which the professor chooses the content, assigns specific homework and grades short-term projects. Personal attributes developed during the Ph.D. program include curiosity, perseverance, creativity, productivity, leadership, communication effectiveness, interpersonal skills, and the ability to develop a comprehensive understanding of any problem under study and its relation to societal needs. Accordingly, qualification for undertaking the Ph.D. degree is predicated on attributes such as the above, plus indications that the candidate can meet the expectations of independent, accomplished, creative, engineering work. A formal "Qualifying Examination" is administered to determine the student's readiness to undertake the research component of the Ph.D. program.

Breadth of advanced knowledge is demonstrated primarily by completion of a carefully prescribed "core" of class work. Additional courses may be selected by the candidate and/or prescribed by the Advisory Committee to assist in improving the candidate's fundamental knowledge base or to allow the candidate to acquire specialized knowledge for the solution of a dissertation research project.

From the Qualifying Exam through the final defense of the dissertation, the candidate develops and demonstrates the ability to independently identify an area in which research is needed, assemble the relevant existing knowledge, develop the requisite experimental, computational or theoretical skills, synthesize the existing knowledge, available skills and facilities into a scientifically defensible research plan, pursue the plan in an efficient and timely manner to realize a significant result, and organize and communicate his/her ideas and results in a professionally acceptable manner. A required presentation of the research in a public forum is used to further demonstrate the oral communication and organizational skills of the candidate.

The specific educational objectives of the Ph.D. program may be met through a combination of course work, independent study and research, and other mechanisms (e.g., seminar). These objectives are expressed in terms of educational development beyond the B.S. degree. The criteria used to assess success in meeting the Ph.D. objectives are also listed, as follows:

Educational Objectives	**Outcome Assessments**
1. Build upon and expand the student's undergraduate education by emphasizing depth in thermodynamics, transport phenomena, kinetics and mathematical modeling	Complete the "core" courses in the M.S. curriculum (or have previously completed equivalent courses in an M.S. degree program)
2. Expand personal knowledge of the broad range of applications of chemical engineering	Complete six credits of Chemical Engineering Seminar (CHE 6010) (three credits for students entering with an M.S. degree)
3. Attain additional knowledge (breadth and/or depth) in topics related to chemical engineering	Complete at least five elective courses related to the student's career objectives
4. Refine the ability to define a research problem and develop a plan for its solution	Complete three credits of CHE 6703, Research Methods in Chemical Engineering
5. Demonstrate the independence, initiative and ability to conceive, plan, execute, complete, and defend research work at the frontier of scientific and/or engineering knowledge	Complete and defend a dissertation which includes a clear advance in the state of knowledge in some field of chemical engineering
6. Develop effective written and oral communications skills	Complete a written qualifying examination and a dissertation, present the results orally, and deliver a formal presentation at a technical society meeting or a CHE seminar

PhD in Chemical Engineering – Program Clientele

We accept students with a BS in chemical engineering or related program who have a GPA of about 3.5 or higher into a direct PhD program. If not from an accredited BS ChE program, students are required to take leveling work as appropriate. We also accept MS ChE students who have shown potential to perform nationally accepted research. We expect students to have a strong desire to pursue advanced learning in both the fundamentals and application of chemical engineering science and technology. We expect students to prepare themselves for entering an engineering research career in either industry, a national lab, or academe. While we accept such students into the program, they must qualify for candidacy.

PhD in Chemical Engineering – Program Outcomes

The PhD degree is a research degree. While a number of courses beyond the MS degree are required for either breadth of depth as the research committee prescribes, the student is primarily expected lead her or his continuing education as relevant to the research. Accordingly, while course performance is a necessary evidence of proficiency, the depth and results of research are the primary measures of student accomplishment. Expected outcomes also include successfully defending a qualifier examination, a final defense examination, and making a public presentation. In addition, we have strong expectations that the work will lead to nationally recognized publications.

The Ph.D. candidate must complete a qualifying examination no later than the end of the third semester of matriculation in the Ph.D. program. This examination will consist of a) a written proposal regarding the student's thesis research project and b) an oral defense of the proposal. The written proposal should conform to National Science Foundation formatting requirements for text, length, bibliography and budget; all other NSF-required documentation is not required. (see the Grant Proposal Guide, NSF 98-2, accessible on the Internet at www.nsf.gov). In preparation for the qualifying exam, the student must complete CHE 6703, Research Methods in Chemical Engineering, during the first or second semester in the program.

The Advisory Committee will use the written and oral portions of the defense to evaluate the student's ability to:

- Identify a specific chemical engineering problem (or analyze an existing problem) where research is needed,
- Present a defensible rationale for undertaking the research,
- Determine, through preliminary analysis of the problem, the current state of knowledge and additional knowledge needed to solve the problem, then summarize this material in logical fashion,
- Construct a plan of research to solve the problem, including details on the specific methods to be employed,
- State clearly the expected outcomes of the research and the value of the results to the profession and to society,

- Develop a budget for the proposed work, and
- Communicate all the above in clear, well-constructed written and oral presentations.

A public presentation is required as part of the Ph.D. program. This requirement can be met by (1) giving an oral, full-length seminar as part of the CHE 6010 seminar series, (2) delivering an oral presentation at a professional society meeting, or (3) a similar experience deemed acceptable by the candidate's Advisory Committee.

The student must defend the thesis. The student must present a satisfactory written document and defend it in an oral examination. The essence of the work is to be publishable in a national forum. In these examinations, the Advisory Committee Members will seek to determine if the candidate has done the following:

- Identified a topic that is of scientific/engineering importance,
- Performed a thorough search of the existing state of knowledge on the subject and synthesized this information into an integrated body of information,
- Utilized the scientific method in solution of the problem,
- Developed a rational plan of attack on the problem,
- Executed the plan successfully in conducting the necessary research,
- Developed logical, defensible conclusions and recommendations from the work, and
- Presented the work in clear, concise, well-organized fashion in the written thesis/dissertation and in the oral defense.

1B - LINKAGE TO MISSION

It seems clear that the activities of the School of Chemical Engineering are directly linked to any of the various evolutions of the University mission. From it's 1999 version "The Oklahoma State University is a modern comprehensive land grant university that serves the state, national and international communities by providing its students with exceptional academic experiences, by conducting scholarly research and other creative activities that advance fundamental knowledge, and by disseminating knowledge to the people of Oklahoma and throughout the world" to the present draft statement, "Proud of its land grant heritage, Oklahoma State University advances knowledge, enriches lives, and stimulates/enhances economic development though instruction, research, outreach, and creative activities".

The mission of the School of Chemical Engineering at Oklahoma State University is to develop human resources, professional knowledge, and the infrastructure through which chemical engineering can contribute to human welfare. We expect to maintain national recognition for our contributions.

To clarify the terms: "Contribute" means more than "Our people and technology could improve human welfare." It means that our graduates are effective within both the human and technical aspects of the practice of chemical engineering (or ChE teaching). For a lifetime of effectiveness, we prepare them for a lifetime of continuous learning.

"Human welfare" relates to all people, both present and future, who are affected by our activities. These include students, parents, employers, readers of our publications, ourselves, university administrators, Regents, legislators, Oklahoma citizens, and world humanity. "Welfare" refers to health, joy of life, abundance, and all things deemed "good."

"Develop" means to create and/or improve.

The "human resources" are students within and external to the university. "Students" include practicing engineers, other professors, the general public, and School faculty and staff. It is all of the people that we impact through our publicized examples of technical knowledge, teaching methods, our shaping of conference programs, our advising of student organizations, and other leadership activities.

The "essence of the profession" is the knowledge (numerical values, equations, analysis, evaluations) and tools (techniques, skills, methods) that we discover and create. Usually this is technology for the engineer and scientist that we produce through graduate research. However, educational "technology" is just as valid, and includes teaching methods and the development of lab and classroom exercises as we explore methods for human development.

The "system" includes the School, CEAT, OSU, external short courses, internal curriculum, office procedures, our professional societies, centers, accounting procedures, personal growth opportunities, and whatever facilitates us in fulfilling our mission.

2A - PROGRAM STRUCTURE

BS Programs: Degree requirement sheets for each of the four undergraduate options follow:

OKLAHOMA STATE UNIVERSITY

GENERAL REQUIREMENTS

COLLEGE OF ENGINEERING, ARCHITECTURE AND TECHNOLOGY

For students matriculating:

Academic Year 2005-06

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING
DEGREE

Total hours 131

CHEMICAL ENGINEERING
MAJOR

Minimum overall grade-point average 2.00
Other GPA requirements, see below.

General Education Requirements 42 Hours

Area	Hrs	To Be Selected From
Underlined courses below are Pre-Engineering requirements used simultaneously to satisy General Education requirements.		
English Composition and Oral Communication	6	ENGL 1113 ,1213, 1313, 1413,or 3323. See Academic Regulation 3.5.
American History and Government	6	HIST 1103 POLS 1113
Analytical and Quantitative	13	MATH 2144, 2153, 2163, 2233 or 3263
Humanities (H)	6	Courses designated (H) by Oklahoma State University. Consult the college and departmental requirements.
Natural Sciences (N)	5	CHEM 1515
Social and Behavioral Sciences (S)	6	Courses designated (S) by Oklahoma State University. Consult the college and departmental requirements.
International Dimension (I)	-	Course designated (I). Students are encouraged to meet the requirement in their selection of (H) or (S) course work.
Scientific Investigation (L)	-	Any course designated (L). Normally met by Natural Science and/or Basic Science requirements.

College/Departmental Requirements
Pre-Engineering 25 Hours

Basic Science	8	PHYS 2014, 2114
Engineering	5	ENGR 1111, 1352, 1412
Engineering Science	12	ENSC 2113, 2143, 2213, 2613

Major Requirements 64 Hours

Common Professional School 12 Hours

Mathematics	3	STAT 4033 or 4073
Engineering Science	6	ENSC 3233, 3313
Advanced Chemical Science	3	From: BIOC 3653 BIOL 3024 CLML 3014 CHEM 3353, 3553, 4020 GEOL 4403 or similar advanced chemical transformation of matter courses

Specific Professional School Requirements 46 Hours

Admitted to the Professional School of Chemical Engineering.
(See Professional School Admission Requirements in University Catalog.)

CHE 2033
3013
3113
3123
3333
3473
4002
4112
4124
4224
4581
4843

CHEM 3053
3112
3153
3434

Controlled Electices 6 Hours

6 credits restricted electives. See school policy and approved course list. CHE advisor must approve.

Other Requirements: A 2.00 GPA is required in all course work listed in the right hand column above.
The major engineering design experience, capstone course, requirement is satisifed by CHE 4124 and 4224.

Students will be held responsible for degree requirements in effect at the time of matriculation (date of first enrollment) and any changes that are made so long as these changes do not result in semester credit hours being added or do not delay graduation.

Karl N. Reid
DEAN

EN-6

R R Rhinehart
Department Head

OKLAHOMA STATE UNIVERSITY

GENERAL REQUIREMENTS
For students matriculating:
Academic Year 2005-06

Total hours 135

Minimum overall grade-point average 2.00
Other GPA requirements, see below.

COLLEGE OF ENGINEERING, ARCHITECTURE AND TECHNOLOGY

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING
DEGREE
CHEMICAL ENGINEERING
MAJOR
(BIOMEDICAL / BIOCHEMICAL)
OPTION

General Education Requirements 50 Hours

Underlined courses below are Pre-Engineering requirements used simultaneously to satisy General Education requirements.

Area	Hrs	To Be Selected From
English Composition and Oral Communication	6	ENGL 1113, 1213, 1313, 1413 or 3323 See Academic Regulation 3.5
American History and Government	6	HIST 1103 POLS 1113
Analytical and Quantitative Thought	13	MATH 2144, 2153, 2163, 2233 or 3263
Humanities (H)	6	Courses designated (H) by Oklahoma State University. Consult the college and departmental requirements. Must include PHIL 3823 or 3833.
Natural Sciences (N)	13	CHEM 1515, PHYS 2014, 2114
Social and Behavioral Sciences (S)	6	Courses designated (S) by Oklahoma State University. Consult the college and departmental requirements.
International Dimension (I)	-	Any course designated (I). Students are encouraged to meet the requirement in their selection of (H) or (S) course work.
Scientific Investigation (L)	-	Any course designated (L). Normally met by Natural Science and/or Basic Science requirements.

College/Departmental Requirements
Pre-Engineering 17 Hours

Engineering	5	ENGR 1111, 1352, 1412
Engineering Science	12	ENSC 2113, 2143, 2213, 2613

Major Requirements 68 Hours

Specific Professional School Requirements 59 Hours

Admitted to the Professional School of Chemical Engineering
(See Professional School Admission Requirements.)

BIOC 3653 (or CHEM 3153)
BIOC 3723 (or CHEM 3112)
BIOL 1114
CHE 2033
3013
3113
3333
3123
3473
4002
4112
4124
4224
4581
4843
CHEM 3053
3434

ENSC 3233
3313
STAT 4033 or 4073

Controlled Electives 9 Hours

Advanced Chemical Science	3	BIOC 3653,3723, 4113, BIOL 3024 CHEM 3153, 3353, 3553, 4020 CLML 3014 GEOL 4403
Bioengineering/ Bioscience Electives	6	BAE 3113, 3423, 4423 BIOC 3653, 4113, 4224, 5824 BIOL 3024 CHE 4283, 4293, 5283, 5293 CLML 3014 ZOOL 1604

Other Requirements:
A 2.00 GPA is required in all course work listed in the right hand column above.
The major engineering design experience, capstone course, requirement is satisfied by CHE 4124 and 4224.

Students will be held responsible for degree requirements in effect at the time of matriculation (date of first enrollment) and any changes that are made so long as these changes do not result in semester credit hours being added or do not delay graduation.

Karl N Reid
DEAN

DEPARTMENT HEAD

OKLAHOMA STATE UNIVERSITY

GENERAL REQUIREMENTS

COLLEGE OF ENGINEERING, ARCHITECTURE AND TECHNOLOGY

For students matriculating:

Academic Year 2005-06

Total hours 134

Minimum overall grade-point average 2.00

Other GPA requirements, see below.

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING
DEGREE

CHEMICAL ENGINEERING
MAJOR

(ENVIRONMENTAL)
OPTION

General Education Requirements 42 Hours

Area	Hrs	To Be Selected From
Underlined courses below are Pre-Engineering requirements used simultaneously to meet General Education requirements.		
English Composition and Oral Communication	6	ENGL 1113, 1213, 1313, 1413 or 3323 See Academic Regulation 3.5.
American History and Government	6	HIST 1103 POLS 1113
Analytical and Quantitative Thought (A)	13	MATH 2144, 2153, 2163, 2233 or 3263
Humanities (H)	6	Courses designaed (H) by Oklahoma State University. Consult the college and departmental requirements.
Natural Sciences (N)	5	CHEM 1515
Social and Behavioral Sciences (S)	6	Select from: ECON 3903, GEOG 3153, POLS 4363, 4593, SOC 4433. Consult a CHE advisor for substitutions.
International Dimension (I)	-	Any course designated (I). Students are encouraged to meet the requirement in their selection of (H) or (S) course work.
Scientific Investigation (L)	-	Any course designated (L). Normally met by Natural Science and/or Basic Science requirements.

College/Departmental Requirements Pre-Engineering 25 Hours

Basic Science	8	PHYS 2014, 2114
Engineering	5	ENGR 1111, 1352, 1412
Engineering Science	12	ENSC 2113, 2143, 2213, 2613

Major Requirements 67 Hours

Common Professional School 12 Hours

Mathematics	3	STAT 4033 or 4073
Engineering Science	6	ENSC 3233, 3313
Advanced Chemical Science	3	From: BIOC 3653 BIOL 3024 CLML 3014 CHEM 3353, 3553, 4020 GEOL 4403 or similar advanced chemical transformation of matter courses.

Specific Professional School Requirements 49 Hours

Admitted to the Professional School of Chemical Engineering.
(See Professional School Admission Requirements in catalog.)

CHE 2033	CHEM 3053
3013	3112
3113	3153
3123	3434
3333	
3473	
4002	
4112	
4124	
4224	
4343	
4581	
4843	

Controlled Electives 6 Hours

From: BIOL 3253, BOT 3233, BIOC 3543, CHE 5873, CIVE 4833, 5833, 5843, 5943, GEOL 4453, 4463, IEM 4943, ZOOL 3143 or other 3000 or higher level environmental-relevant course (consult a CHE advisor)

Other Requirements: A 2.00 GPA is required in all course work listed in the right hand column above.
The major engineering design experience, capstone course, requirement is satisifed by CHE 4124 and 4224.

Students will be held responsible for degree requirements in effect at the time of matriculation (date of first enrollment) and any changes that are made so long as these changes do not result in semester credit hours being added or do not delay graduation.

Karl N. Reid
DEAN

R R Rhinehart
DEPARTMENT HEAD

EN-8

OKLAHOMA STATE UNIVERSITY

GENERAL REQUIREMENTS

COLLEGE OF ENGINEERING, ARCHITECTURE AND TECHNOLOGY

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING
DEGREE

CHEMICAL ENGINEERING
MAJOR

(PREMEDICAL)
OPTION

For students matriculating:
Academic Year 2005-06

Total hours 137

Minimum overall grade-point average 2.00
Other GPA requirements, see below.

General Education Requirements 50 Hours

Area	Hrs	To Be Selected From
Underlined courses below are Pre-Engineering requirements used simultaneously to satisy General Education requirements.		
English Composition and Oral Communication	6	ENGL 1113, 1213, 1313, 1413 or 3323. See Academic Regulation 3.5.
American History and Government	6	HIST 1103 POLS 1113
Analytical and Quantitative Thought	13	MATH 2144, 2153, 2163, 2233 or 3263
Humanities (H)	6	Courses designated 'H" by Oklahoma State University. Should select 3 hrs. from ENGL and 3 hrs. from ART, ENGL, FLL, MUSI PHIL, or TH to also meet medical school requirement.
Natural Sciences (N)	13	CHEM 1515, PHYS 2014, 2114
Social and Behavioral Sciences (S)	6	Courses designated "S" by Oklahoma State University. Should select from ANTH, PSYC, or SOC to also meet medical school requirements.
International Dimension (I)	-	Any course designated (I). Students are encouraged to meet the requirement in their selection of (H) or (S) course work.
Scientific Investigation (L)	-	Any course designated (L). Normally met by Natural Science and/or Basic Science requirements.

College/Departmental Requirements
Pre-Engineering 17 Hours

Engineering	5	ENGR 1111, 1352, 1412
Engineering Science	12	ENSC 2113, 2143, 2213, 2613

Major Requirements 70 Hours

Specific Professional School Requirements 63 Hours

Admitted to the Professional School of Chemical Engineering
(See Professional School Admission Requirements.)

BIOL	1114
CHE	2033
	3013
	3113
	3123
	3333
	3473
	4002
	4112
	4124
	4224
	4581
	4843
CHEM	3053
	3112
	3153
	3434
ENSC	3313
	3233
STAT	4033 or 4073
ZOOL	1604

Controlled Electives 7 Hours

Advanced Chemical Science	4	BIOL 3024 CLML 3014
Bioengineering/ Bioscience Electives	3	CHE 4283, 4293, 5283, 5293 preferred, or with approval of an adviser, from BAE, 3113,3423,4423 BIOC 3653, 4113, 4224

Other Requirements:
A 2.00 GPA is required in all course work listed in the right hand column above.
The major engineering design experience, capstone course, requirement is satisfied by CHE 4124 and 4224.

Students will be held responsible for degree requirements in effect at the time of matriculation (date of first enrollment) and any changes that are made so long as these changes do not result in semester credit hours being added or do not delay graduation.

Karl N. Reid
DEAN

R N Rhinehart
DEPARTMENT HEAD

EN-9

MS Program: Degree requirements for the MS program are:

1. Course Work

A minimum of thirty (30) semester credits is required by the University for graduation; this requirement is met by the CHE M.S. curriculum, which is summarized as follows:

(a) twelve hours of core courses, which are
    CHE 5123 - Advanced Chemical Reaction Engineering
    CHE 5213 - Selected Diffusional Unit Operations
    CHE 5743 - Chemical Engineering Process Modeling
    CHE 5843 - Principles of Chemical Engineering Thermodynamics
(b) six hours of graduate-approved elective (CHE or other) courses, selected by the student, with approval of the student's advisor,
(c) three hours of Chemical Engineering Seminar (CHE 6010),
(d) three hours of Special Problems (CHE 5990), and
(e) six hours of M.S. Thesis (CHE 5000).

2. Thesis and Oral Examination

Each M.S. candidate must prepare a written thesis and defend it before an examining committee of at least three faculty members. The written document must satisfy the requirements of the Graduate College for format and structure. The thesis defense consists of a ten-minute oral presentation by the student, followed by questions from the committee. Questioning continues for as long as the committee chairman deems appropriate. The student is then dismissed and the committee deliberates in private, then informs the student of their decision. The committee will normally reach one of the following conclusions:

1) The candidate has completed the CHE M.S. thesis requirement,
2) The candidate must revise the thesis to the satisfaction of the Examining Committee, with possible reexamination, or
3) The candidate has failed the examination and is dismissed from the M.S. program or converted to the creative component option.

3. Minimum Enrollment

M.S. students are required to enroll as follows:

First Semester

- thirteen (13) credit hours must be taken
- courses must include all ***required*** CHE core courses offered that semester
- remedial English (ENGL 0003) may be taken in place of one of the above courses, if necessary (but may not be used to satisfy any graduation requirement)
- three (3) hours of CHE 5990 and one (1) hour of CHE 6010 must be included

Second Semester

- thirteen (13) credit hours must be taken
- courses must include all ***required*** CHE core courses offered that semester
- three (3) hours of CHE 5000 and one (1) hour of CHE 6010 must be included

Subsequent Semesters

- at least three (3) hours of CHE 5000 and one (1) hour of CHE 6010 must be taken. This applies to *all* semesters, including the last semester (or part of a semester) in which the student is enrolled. (In summer sessions, at least two hours of CHE 5000 must be taken; CHE 6010 is not required).
- minimum enrollment is six hours in the fall and spring semesters and three hours in the summer; the specific courses will be determined by the student, with approval of the advisor

Exceptions to these minimum enrollment requirements can be made to permit a student to carry fewer than 13 hours in the first two semesters if, upon *initial* enrollment in the program, the student agrees not to request financial support at any future time while in the M.S. program.

4. Creative Component Option

The M.S. degree may also be earned by the Creative Component option. The requirements are identical to those given above, except as follows. The three hours of Special Problems (CHE 5990) and six hours of M.S. Thesis (CHE 5000) specified above are replaced by (a) two hours of CHE 5990 and nine hours of elective courses, approved by the student's advisor. Thus, the total plan of study contains 32 credit hours. The CHE 5990 course is used for research, and a report (a "mini-thesis") must be submitted and defended, prepared in the style of an M.S. thesis, but not submitted for Graduate College approval. The creative component option is used *only* in unusual cases, and only at the suggestion of the student's research advisor.

PhD Degree Program: Degree requirements for the PhD program are as follows:

1. Course Requirements

Ph.D. students may enter the program in two ways, either (a) with a B.S. degree in Chemical Engineering to pursue the Ph.D. without obtaining an M.S. degree, or (b) with an M.S. degree in Chemical Engineering. The requirements for each degree path are as follows:

Students who enter with a B.S. degree, but without an M.S. degree, are required to take a minimum of ninety (90) credit hours, to include:

(a) twelve hours of core courses, which are
  CHE 5123 - Advanced Chemical Reaction Engineering
  CHE 5213 - Selected Diffusional Unit Operations
  CHE 5743 - Chemical Engineering Process Modeling
  CHE 5843 - Principles of Chemical Engineering Thermodynamics,
(b) three hours of CHE 6703 - Research Methods in Chemical Engineering,

(c) fifteen hours of graduate-approved elective (CHE or other) courses, selected by the student and approved by the student's advisor,
(d) six hours of CHE 6010 - Chemical Engineering Seminar, and
(e) fifty-four hours of CHE 6000 - Doctoral Thesis. (With approval of the student's advisory committee, additional elective courses may be taken, with a corresponding reduction in required credits in CHE 6000; but the number of CHE 6000 credits may be no less than 36.)

Students who enter with an M.S. degree are required to take a minimum of sixty (60) hours, to include:

(a) three hours of CHE 6703 - Research Methods in Chemical Engineering,
(b) nine hours of graduate-approved elective (CHE or other) courses, selected by the student and approved by the student's advisor,
(c) three hours of CHE 6010 - Chemical Engineering Seminar, and
(d) forty-five hours of CHE 6000 - Doctoral Thesis. (With approval of the student's advisory committee, additional elective courses may be taken, with a corresponding reduction in required credits in CHE 6000; but the number of CHE 6000 credits may be no less than 30.)

Students whose M.S. degrees are not from OSU must also complete:

(e) six additional hours of graduate-approved elective courses (which may replace six hours of CHE 6000), selected by the student and approved by the student's advisor, and

(f) twelve hours of the OSU core courses -- or have completed courses with equivalent subject matter as part of their M.S. degree program. Students may use up to six hours of OSU core courses (if required) to satisfy an equivalent number of elective or doctoral thesis course hour requirements.

The OSU core courses are:

CHE 5123 - Advanced Chemical Reaction Engineering
CHE 5213 - Selected Diffusional Unit Operations
CHE 5743 - Chemical Engineering Process Modeling
CHE 5843 - Principles of Chemical Engineering Thermodynamics

2. Minimum Enrollment

Ph.D. students who do not have an M.S. degree are required to enroll as follows:

First Semester

- thirteen (13) credit hours must be taken
- all courses must be in CHE (unless otherwise approved by the Graduate Program Director)
- courses must include all ***required*** CHE core courses offered that semester
- remedial English (ENGL 0003) may be taken in place of one of the above courses, if necessary (but may not be used to satisfy any graduation requirement)
- three (3) hours of CHE 6000 and one (1) hour of CHE 6010 must be included

Second Semester

- thirteen (13) credit hours must be taken

- courses must include all ***required*** CHE core courses offered that semester
- three (3) hours of CHE 6000 and one (1) hour of CHE 6010 must be included

Subsequent Semesters

- at least three (3) hours of CHE 6000 and one (1) hour of CHE 6010 must be taken. This applies to *all* semesters, including the last semester (or part of a semester) in which the student is enrolled. (In summer sessions, at least two hours of CHE 6000 must be taken; CHE 6010 is not required).
- a minimum of six hours in the fall and spring semesters and three hours in the summer; the specific courses will be determined by the student, with approval of the advisor

Ph.D. students who have an M.S. degree from a university other than OSU are required to enroll as follows:

First Semester

- thirteen (13) credit hours must be taken
- courses must include all ***required*** CHE core courses offered that semester (except for previously-completed graduate courses, containing equivalent material, from another university)
- remedial English (ENGL 0003) may be taken in place of one of the above courses, if necessary (but may not satisfy any graduation requirement)
- three (3) hours of CHE 6000 and one (1) hour of CHE 6010 must be included

Second Semester

- a minimum of six (6) credit hours must be taken
- courses must include all ***required*** CHE core courses offered that semester (except for previously-completed graduate courses, containing equivalent material, from another university)
- three (3) hours of CHE 6000 and one (1) hour of CHE 6010 must be included

Subsequent Semesters

- at least three (3) hours of CHE 6000 and one (1) hour of CHE 6010 must be taken. This applies to *all* semesters, including the last semester (or part of a semester) in which the student is enrolled. (In summer sessions, at least two hours of CHE 6000 must be taken; CHE 6010 is not required).
- a minimum of six hours in the fall and spring semesters and three hours in the summer; the specific courses will be determined by the student, with approval of the advisor

In each of the above categories, exception to the above minimum enrollment requirements can be made to permit a student to carry fewer than 13 hours in the first semester if, upon *initial* enrollment in the program, the student agrees not to request financial support at any future time while in the Ph.D. program.

Ph.D. students who have an M.S. degree from OSU are required to enroll as follows:

All Semesters

- at least three (3) hours of CHE 6000 and one (1) hour of CHE 6010 must be taken. This applies to *all* semesters, including the last semester (or part of a semester) in which the student is enrolled. (In summer sessions, at least two hours of CHE 6000 must be taken; CHE 6010 is not required).
- a minimum of six hours in the fall and spring semesters and three hours in the summer; the specific courses will be determined by the student, with approval of the advisor.

2B - DISTANCE EDUCATION

The School had initiated offering an off-campus MS ChE degree through extension courses in the mid 90s. But, after an initial burst of enrollment, there were no students left to start new cohorts to justify offering extension courses in subsequent. We attempted several marketing approaches, but could not obtain threshold enrollments. Accordingly, as the initial batch progressed, even when off-campus enrollments dwindled we offered the needed courses. Since then we have not been able to enroll a sufficient number of off-campus students to justify offering all ChE courses through the extension program.

However, there is a continuing off-campus demand for an interdisciplinary Control Systems Engineering Masters degree, and the ChE faculty coordinated a college-wide initiative to create the MS CSE degree. Chemical Engineering offers two courses through extension in the program. One is CHE 5703 "Optimization Applications" offered each spring semester. The other is CHE 5853 "Advanced Chemical Process Control" offered every other spring. Both are well populated and receive high ratings by both the off-campus and on-campus students, in spite of the differences in student expectations. The on-campus students typically have higher math skills and want these courses to take them to the next level. The off-campus students are seeking practical utility.

2C - ARTICULATION

The School follows the OSRHE Articulation agreements. The specifics of engineering (ENGR) and engineering science (ENSC) courses are presented in the table that follows.

OSU ARTICULATION
ENGINEERING

Institutions	Statics	Dynamics	Strength of Materials	Thermodynamics	Electrical Science	Fluid Mechanics	Material Science
CASC							
CSC							
CU							
ECU							
EOSC							
LU							
MSC							
NEOAMC		ENGR 2123					
NOC	ENGR 2113	ENGR 2123					
NSU					EPHY 3513		
NWOSU							
OCCC	ENGR 2133**			ENGR 2333**	ENGR 2613	ENGR 2343*	
OPSU							
OSU	ENSC 2113	ENSC 2123	ENSC 2143	ENSC 2213	ENSC 2613	ENSC 3233	ENSC 3313
OSUTB-OKC	ENSC 2113	ENSC 2123	ENSC 2143**		ENSC 2613***		
OSUTB-OKM							
OU			ENGR 2153	ENGR 2213	ENGR 2613	ENGR 3223	
RCC							
RSU							
Rose	ENGR 2123						
SEOSU							
SSC							
SWOSU							
SWOSU-Sayre							
TCC	EGR 2103	EGR 2503	EGR 2143	EGR 2213	EGR 2613		
TU	ES 2013	ES 2023		ES 3053			ES 3013
UCO		ENGR 3063			ENGR 2303		
USAO							
WOSC							

*But students must take an extra 3xxx or 4xxx class.

** Effective for fall 2004 only unless resubmitted materials are approved.

*** Effective for spring 2005 only unless submitted material are approved.

2D - MULTIDISCIPLINARY PROGRAMS

A ChE professor was the lead, and OSU PI, for the formation of the Integrated Petroleum Environmental Consortium. IPEC is a collaboration between OSU, the University of Tulsa, the University of Oklahoma, the University of Arkansas, and about 20 companies to direct and perform research and training to improve the environmental impact of oil production. The IPEC Principles have been able to obtain line item funding from the federal government through the US EPA.

The ChE faculty were strong partners in the Biomass Conversion to Fuel Alcohol research project that includes researchers at the University of Oklahoma and Mississippi State University and the colleges of DASNR and CEAT at OSU. This collaboration has led to line item funding through the Department of Energy, and the 2-college, 4-PI sharing of common lab facilities at OSU. An evolution of the program is now being proposed to NSF as an Engineering Research Center. The lead PI for this multi-university proposal is an OSU ChE professor.

The ChE faculty initiated and coordinated a college-wide initiative to create the MS degree in Control Systems Engineering. Chemical Engineering offers two courses through extension in the program. One is CHE 5703 "Optimization Applications" offered each spring semester. The other is CHE 5853 "Advanced Chemical Process Control" offered every other spring. Both are well populated and receive high ratings by both the off-campus and on-campus students, in spite of the differences in student expectations. The on-campus students typically have higher math skills and want these courses to take them to the next level. The off-campus students are seeking practical utility.

The ChE faculty initiated and coordinated the action leading to OSU's affiliate membership in the Measurement and Control Engineering Center. MCEC is an NSF I/UCRC in which industrial sponsorship supports graduate research in chemistry and chemical engineering at the University of Tennessee and in electrical and computer engineering, industrial engineering and management, and chemical engineering at OSU.

3A - NEW FACILTIES AND MAJOR EQUIPMENT

The Unit Operations Laboratory (UOL) has been a school priority for a long time. In it, students run experiments on chemical processing units (heat exchangers, reactors, distillation columns, absorption, pumps and pipes, etc.) which provide practice experiences on the equipment which they must understand for employment success. The UOL experience is critical to our educational missions.

In the presence of chemicals, pressure, temperature, and machinery, lab safety is critical. Unfortunately the lab is overcrowded with students. While removing walls to make the 4-room lab into 2 open areas improved visual supervision and increased space, it is still crowded, which raises continued concerns for safety. While we could open multiple lab sections, each section creates a new 6-hour faculty commitment. Faculty positions are not available to support the increased course load. Additional space remains a school priority.

There are 15 units in the lab, and many are complicated with instrument and control systems and multiple devices integrated into one unit. The complexity of an automobile or refrigerator provides a reasonable view of a chemical process unit. If each is replaced once per year, then the oldest would always be 15 years old. The reader understands the reliability of a 15-year old automobile or refrigerator, and can see the criticality of obtaining quality units, having annual maintenance, and having supervision by experience. Graduate students as TAs are inadequate because of the multidisciplinary, depth, and applications experience needed to operate, repair, and upgrade the equipment; or needed to guide student novices.

In the past 5 years, faculty attention in the lab has added several new features; the distillation column, and two-phase flow units were fully instrumented for automatic control. Equipment was supplied through research funding and industrial donations. This improves the data collection speed and precision for undergraduates, and prepares them for control systems which they will encounter. The value is about $150,000. Faculty designed, and through industrial and alumni donations, built a heat exchanger network of industrial craft, to replace an embarrassingly assembled heat exchanger from ages past. The unit has about a $500,000 value. During this time the system and student lab fees have provided about $60,000 in instructional equipment funds which has been used to buy a CO_2 analyzer and to replace expendables such as pH meters, gages, glassware, etc.

The lab is the showcase for visitors to Chemical Engineering. And, while we have made considerable progress in space renovation and credibility of units, and while the demonstrations have strong visual impact, the space is unattractive.

Space renovation, additional space, skilled maintenance personnel, and replacement units continue to be a school priority.

The school gained an emeritus faculty. We now have three, all of whom continue to be active in graduate research, teaching, or professional activity. They add value, one was in a fairly trashed portion of the building, and there was no office space for the third. With a variety of funding sources, we renovated a graduate student area to make office space for two emeriti faculty members and a storage space for formerly scattered school records. The renovated lab storage space was to accommodate the displaced graduate students. Much of the displaced equipment was either surplussed or moved into the storage area in Cordell Hall.

We lost storage area in the “MAE North Annex” which was razed to accommodate softball expansion.

3B - ACADEMIC AND ADMINISTRATION EFFICIENCY

We have been exceptionally fortunate to replace office staff with high quality, dedicated partners. Their initiative in improving their work processes have substantially improved quality and timeliness of data processing and allowed us to add new activities such as web page maintenance, support for national activities of professors, classroom lecture material development, and the increase in assessment-related activities.

Faculty members have provided maintenance and upgrading to our school computer systems, which have added features which faculty or staff can use.

Most faculty members are using web-based "Blackboard" for posting course materials, end-of-course surveys, and enhancing student discussion groups.

Our web site has substantially replaced paper communications with applicants. This reduces cost and speeds up the recruiting process.

Our web site has replaced our printed newsletter for communication with alumni and recording news. Twice annually we email and send inexpensive postcards to alumni and friends indicating highlights and directing them to visit the website. The web site also provides a searchable mechanism to market our program.

Our internal accounting processes are timely, accurate, professor-friendly, and provide a paper trail for tracking events. This was developed by and is maintained by staff members has provided an exceptional benefit to the faculty members for rational management of accounts.

3C - EXTERNAL FUNDING

The growth in external funding for grants and contracts, up until 2002, was intentionally achieved. Faculty turnover in the '90's left new faculty members encumbered with graduate courses and teaching loads which did not support the new research areas or free faculty time to write proposals. We substantially revised the graduate program in 1999 to shift emphasis from classroom instruction to research; to introduce graduate courses in biotechnology control, and optimization; and to revise the PhD qualifier process. We began an annual assessment process of measuring graduate productivity in a variety of ways such as papers per student, external income, qualifying rates, retention, etc. These changes allowed faculty time to focus on research and funding.

These changes were the foundation of research expenditure increase by about 2.5 times from 1996 to 2002.

We were pleased that nearly half of our income was from industrial sources, because of the theory and practice balance this represents, and because of the practice affirmation this represents. However, post September 11, 2001 events in the chemical industry economy led to a drop in industrial funding. Since 2002 we have had about a 20% drop in program funding. These same events have influenced industrial revenue for the state.

However, the economy is recovering and we believe we have the continued credibility and relevance to industry priorities to return to our industrial funding levels. In addition, our faculty work in the past several years to tie into the bio and nano thrusts seems to be coming to fruition: Assistant professor James Smay just received a NSF CAREER Award for micro-scale materials fabrication, and R. N. Maddox professor Randy Lewis is leading a multi-university effort in creating an NSF ERC in biofuels and bioprocessing.

We believe that we have made and continue to make the right changes to position the school for growth.

We hope that the system recognizes the potential for Chemical Engineering opportunities and the excellence of the faculty to make substantial progress in research, and facilitates our efforts by increasing faculty positions and removing system imposed research impediments.

Financial Summary

Annual Trend in External Award Funds and Total Expenditures, $k.

(FY = Fiscal Year = July 1-June 30 of year)

Year	Award Funds	Expenditures
FY96	456	637
FY97	865	715
FY98	643	579
FY99	624	805
FY00	1071	999
FY01	1196	1191
FY02	1024	711
FY03	820	1012

OSU FOUNDATION
INDUSTRIAL SUPPORT*
(ACADEMIC YEAR)**

2004	$49,075
2003	$56,665
2002	$36,000
2001	$71,101
2000	$69,465
1999	$142,460
1998	$253,579
1997	$224,230
1996	$197,783
1995	$157,899
1994	$140,389

*fiscal Year (example: July 1, 2003 thru June 30, 2004)

**Includes: Laboratory and computer equipment, unrestricted grants, scholarships, faculty development, and matching grants.

INDIVIDUAL FINANCIAL SUPPORT OF CHEMCIAL ENGINEERING
Alumni and Friends

YEAR	NUMBER OF DONORS	AMOUNT (ENDOWMENT)*
2004	29 (thru 6/30/04)	$13,971.00 ($0)
2003	34 (thru 6/30/03)	$15,362.00 ($600)
2002	30 (thru 6/30/02)	$13,541.71 ($500)
2001	39 (thru 6/30/01)	$32,555.00 ($500)
2000	58 (thru 6/30/00)	$27,684.00 ($505)
1999	51 (thru 6/30/99)	$19,143.33 ($300)
1998	48 (thru 6/30/98)	$35,317.78 ($17,579)
1997	46 (thru 6/30/97)	$35,049.24 ($416,000)
1996	46 (thru 6/30/96)	$24,340.80 ($6,500)
1995	48 (thru 6/30/95)	$17,334 ($986)
1994	20 (thru 6/30/94)	$10,280 ($1,115)

*Figures in parenthesis represent additional funds specified for endowments.

CORPORATE FINANCIAL REPORT
OF
CHEMICAL ENGINEERING
2003-2004

Graduate Fellowships **$40,000.00**

ConocoPhillips

Restricted Grants **$50,000.00**

Chevron Phillips Chemical CO LP
ConocoPhillips

Unrestricted Grants **$45,050.00**

Air Liquide AmericaCorp
Chevron Company
Chevron Phillips Chemical Company LP
Chevron Texaco
ConocoPhillips
ConocoPhillips Company
El Paso Energy Foundation
ExxonMobil
ExxonMobil Foundation
National Instruments

Matching Funds **$4,025.00**

Air Liquide America Corp.
Chevron Phillips Chemical Company LP
ConocoPhillips Co.
El Paso Energy Foundation
ExxonMobil Foundation
Kerr-McGee Corp.
National Instruments
Shell Oil Company Foundation

New Endowments **$0.00**

No New Endowments

2003-2004 TOTAL **$139,075.00**

College of Engineering and Technology - FY2004 Expenditures

Dept	**Lead PI**	**Account**	**Description**	**FND SRC**	**FNC**	**Total Expenditures**
CHE	GASEM KA	AA552139	SEQUESTERING CARBON	FF	RS	(2,508.83)
CHE	GASEM KA	AA558000	CARB DIOXIDE IN COAL	FF	RS	(2,961.26)
CHE	HIGH KA	AA558520	I/UCRL FOR MEAS & CT	FF	RS	57,278.30
CHE	HIGH KA	AA575553	NSF TRAVEL GRANT	FF	RS	458.50
CHE	JOHANNES AH	AA573593	BIOMASS-JOHANNES	FF	RS	15,608.88
CHE	JOHANNES AH	AA577513	BIOMASS ENERGY	FF	RS	11,874.59
CHE	LEWIS RS	AA563601	BIOMASS TO ETHANOL	FF	RS	65,031.75
CHE	LEWIS RS	AA564781	NOVEL POLYMERS	FF	RS	36,305.93
CHE	LEWIS RS	AA566372	BIOMASS-BASED ENERGY	FF	RS	(1,668.53)
CHE	LEWIS RS	AA573583	BIOMASS-LEWIS	FF	RS	65,013.98
CHE	SMAY JE	AA582764	EPSCOR/SMAY FY05	FF	RS	2,180.08
CHE	WHITELEY JR	AA554869	SMART BRIDGE 4.3.1.3	FF	RS	23,160.50
CHE	FOUTCH GL	AH552551	ALTECH-GAS PHASE-(CE	FF	RS	10,579.79
CHE	GASEM KA	AA565831	IPEC	FF	RS	11,237.91
CHE	GASEM KA	AA579064	IPEC ASSOC DIRECTOR	FF	RS	19,662.62
CHE	GASEM KA	AA581064	EFFECTIVE STORMWATER	FF	RS	11,181.15
CHE	JOHANNES AH	AH554050	CASI-TMI/GAS PHASE	FF	RS	68,366.31
CHE	SMAY JE	AA581964	ROBOTIC DEPOSITION	FF	RS	11,084.90
CHE	WAGNER J	AA544367	COMPUTER MODULES TST	FF	RS	1,075.00
CHE	FOUTCH GL	AA555139	PROD OF TITANIUM O2	PP	RS	(0.02)
CHE	FOUTCH GL	AA562271	ULTRAPURE WATER	PP	RS	30,508.63
CHE	FOUTCH GL	AA569242	ULTRPURE WATER-PHASE	PP	RS	(0.37)
CHE	FOUTCH GL	AA575563	TITANIUM DIOXIDE/FOU	PP	RS	118,803.94
CHE	HIGH KA	AA555660	ECONOMIC OPTIMUM CON	PP	RS	27,203.08
CHE	HIGH KA	AA562091	MEASUREMENT ENGR CEN	PP	RS	1,943.39
CHE	HIGH KA	AA563591	EXP BATCH OPTIMIZATI	PP	RS	8,122.59
CHE	HIGH MS	AA537896	DOWNHOLE CORROSION	PP	RS	7,312.82
CHE	HIGH MS	AA564161	CATALYTIC ACTIVITY	PP	RS	3,183.43
CHE	RHINEHART RR	AA566332	HEALTH MONITOR AUTOM	PP	RS	2,928.23
CHE	SMAY JE	AA580704	ROBOTIC DEPOSITION	PP	RS	21,104.38
CHE	MADIHALLY SV	AA572532	BIODEGRADABLE SCAFFO	SS	RS	2,236.28
CHE	MADIHALLY SV	AA577623	BIODEGRADABLE SCAFFO	SS	RS	43,002.40
CHE	SMAY JE	AA573252	NANONET SEED GRANT	SS	RS	(2,537.12)
CHE Total						666,773.23

Appendix A

External Grants, Contracts, and Gifts Awarded to Program Faculty

External Funds			Dollar Amounts				
Name of Grant, Contract, or Gift	**Principal Investigator(s)**	**Source of Funds**	**1999-2000**	**2000-2001**	**2001-2002**	**2002-2003**	**2003-2004**
Ultrapure Water Research Consortium	Foutch, G.L.	British Energy	$10,000.00		$10,000.00	$10,000.00	
Ultrapure Water Research Consortium	Foutch, G.L.	Dow Chemical Company		$20,000.00	$10,000.00		
Expanding Efforts in the Ultrapure Water Group to Address Resin Chemistry Issues - Phase 2	Foutch, G.L.	Electric Power Research Institute			$40,361.00	$20,636.00	
Ultrapure Water Research Consortium	Foutch, G.L.	Intel Corporation	$10,000.00				
Ultrapure Water Research Consortium	Foutch, G.L.	Knolls Atomic Power Laboratory	$10,000.00	$10,000.00		$20,000.00	$10,000.00
Ultrapure Water Research Consortium	Foutch, G.L.	Pennsylvania Power & Light	$10,000.00				
Ultrapure Water Research Consortium	Foutch, G.L.	PPL Susquehanna, LLC			$10,000.00		
CHENG Ion Exchange Project -Phase III	Foutch, G.L.	Ultrapure Water Consortium	$20,000.00				
Ultrapure Water Research Consortium	Foutch, G.L.	Various (Ultrapure Water Research Consortium)		$7,000.00			
Ultrapure Water Research Consortium	Foutch, G.L.	Various (Ultrapure Water Research Consortium)		$330.71			
Ultrapure Water Research Consortium	Foutch, G.L.	Various (Ultrapure Water Research Consortium)	($20,000.00)				
ETA Impact on CP Resins	Foutch, G.L.	Electric Power Research Institute		$30,717.00	$2,216.81		
Disinfection of Potable Water with Metal Ions	Foutch, G.L.	H_2Ovation	$56,000.00				
Disinfection of Potable Water with Metal Ions	Foutch, G.L.	Oklahoma Center for the Advancement of Science and Technology	$56,000.00				
SBIR Phase II: Continuous On-Line Monitor to Detect and Quantify Inorganic Contaminants in Water	Foutch, G.L. High, M.S.	Brims Ness Corporation		$89,999.00		($32,700.00)	
Gas Phase Corona Technology for Treatment of VOC Paint Booth Emissions	Foutch, G.L. Johannes, A.H.	Altech Services, Inc.				$69,633.93	
Research Related to the Production of Titanium Dioxide	Foutch, G.L. Johannes, A.H.	Kerr-McGee Chemical Corporation	$125,656.00	$89,408.00	$60,000.00	$101,063.00	$61,403.00
Effective Stormwater and Sediment Control During Pipeline Construction Using a New Filter Fence	Gasem, K.A.M.	University of Tulsa - Integrated Petroleum Environmental Consortium for Environmental Protection Agency					$33,926.00

Appendix A

External Grants, Contracts, and Gifts Awarded to Program Faculty

External Funds			Dollar Amounts				
Name of Grant, Contract, or Gift	**Principal Investigator(s)**	**Source of Funds**	**1999-2000**	**2000-2001**	**2001-2002**	**2002-2003**	**2003-2004**
Integrated Petroleum Environmental Consortium Associate Director Allocation	Gasem, K.A.M.	University of Tulsa - Integrated Petroleum Environmental Consortium for Environmental Protection Agency	$22,838.00		$39,426.00		$18,184.00
Sequestering Carbon Dioxide in Coal Beds	Gasem, K.A.M. Robinson, R.L.	Department of Energy	$204,000.00	$150,341.00	$366,308.00		
Design of Improved Solvents for Extractive Distillation	Gasem, K.A.M. Robinson, R.L.	Oklahoma Center for the Advancement of Science and Technology	$50,000.00				
Design of Improved Solvents for Extractive Distillation	Gasem, K.A.M. Robinson, R.L.	Phillips Petroleum Company	$50,000.00				
Green Technology Process Design and Assessment with Energy and Sustainability Considerations	High, K.A.	Environmental Institute's Energy Research Center			$25,000.00		
Travel Grant: AIChE Inaugural Woman's Initiative Committee Session for "Turn of the Century Engineers"	High, K.A.	National Science Foundation		$6,000.00			
Travel Grant: AIChE Women's Initiative Committee Session for "Advancement and Retention of Female Chemical Engineers: Issues and Strategies"	High, K.A.	National Science Foundation				$1,000.00	
Travel Grant: AIChE Women's Initiative Committee Session for "Women Engineering Success from the Inside Out"	High, K.A.	National Science Foundation			$2,600.00		
Measurement and Control Engineering Center - Income Account	High, K.A. Rhinehart, R.R.	Various (Measurement and Control Engineering Center)	$5,120.00			$3,991.24	
Measurement and Control Engineering Center	High, K.A. Rhinehart, R.R.	IMC-Agrico	$35,000.00	$35,000.00	$35,000.00		
Measurement and Control Engineering Center	High, K.A. Rhinehart, R.R.	BP Amoco Chemical Company		$35,000.00			
Measurement and Control Engineering Center	High, K.A. Rhinehart, R.R.	Dow Chemical Company	$35,000.00	$35,000.00	$35,000.00		
Measurement and Control Engineering Center	High, K.A. Rhinehart, R.R.	Gensym Corporation	$70,000.00			$35,000.00	

Appendix A

External Grants, Contracts, and Gifts Awarded to Program Faculty

External Funds			Dollar Amounts				
Name of Grant, Contract, or Gift	**Principal Investigator(s)**	**Source of Funds**	**1999-2000**	**2000-2001**	**2001-2002**	**2002-2003**	**2003-2004**
Industry/University Cooperative Research Center for Measurement and Control Engineering	High, K.A. Rhinehart, R.R.	National Science Foundation	$50,000.00	$105,000.00		$100,000.00	
Experimental Batch Optimization	High, K.A. Rhinehart, R.R.	University of Tennessee		$18,000.00			
Measurement and Control Engineering Center	High, K.A. Rhinehart, R.R.	UOP LLC				$35,000.00	
Measurement and Control Engineering Center	High, K.A. Rhinehart, R.R.	UOP LLC	$70,000.00	$35,000.00			
Control to Economic Optimum	High, K.A. Rhinehart, R.R.	Various (Measurement and Control Engineering Center)	$28,000.00	$28,000.00	$29,000.00	$24,642.00	
Experimental Batch Optimization	High, K.A. Rhinehart, R.R.	Various (Measurement and Control Engineering Center)			$32,000.00	$28,876.00	
Measurement and Control Engineering Center	High, K.A., Rhinehart, R.R.	IMC Phosphates Company				$35,000.00	$35,000.00
Measurement and Control Engineering Center	High, K.A., Rhinehart, R.R.	Various (Measurement and Control Engineering Center)	($86,000.00)	$0.00	($137,958.84)	($69,642.02)	($1,895.37)
Measurement and Control Engineering Center Administration	High, K.A., Rhinehart, R.R.	Various (Measurement and Control Engineering Center)		$32,000.00	$26,080.00	($47,000.00)	$1,895.37
Catalytic Activity of Nafion Solid Acid Catalysts	High, M.S. High, K.A.	Conoco, Inc.		$125,000.00	$175,000.00		
Downhole Corrosion Research Consortium	High, M.S. Wagner, J.	Conoco, Inc.		$10,000.00			
Downhole Corrosion Research Consortium	High, M.S. Wagner, J.	Various (Downhole Corrosion Research Consortium)		$20,000.00			
Downhole Corrosion Research Consortium	High,M.S. Wagner, J.	Chevron	$10,000.00				
Biomass-based Energy Research	Johannes, A.H.	United States Department of Agriculture				$56,174.00	
Gas Phase Corona Technology for Treatment of VOC Paint Booth Emissions (Phase II)	Johannes, A.H., Foutch, G.L.	Tec-Masters, Inc.					$49,326.88
Novel Polymers Designed to Minimize Platelet Adhesion	Lewis, R.S.	National Science Foundation		$121,238.00	$60,618.00	$60,619.00	
Biomass-based Energy Research	Lewis, R.S.	United States Department of Agriculture				$157,643.00	

Appendix A

External Grants, Contracts, and Gifts Awarded to Program Faculty

External Funds			Dollar Amounts				
Name of Grant, Contract, or Gift	**Principal Investigator(s)**	**Source of Funds**	**1999-2000**	**2000-2001**	**2001-2002**	**2002-2003**	**2003-2004**
Elucidation of Metabolic Pathways of an Acetogenic Organism able to Convert Synthesis Gas into Ethanol and Other Byproducts	Lewis, R.S.	Environmental Institute's Energy Research Center		$14,184.00			
Biomass-based Energy Research	Lewis, R.S. Johannes, A.H.	U.S. Department of Agriculture			$91,443.00		
Conversion of Low-Cost Biomass to Ethanol	Lewis, R.S. Johannes, A.H.	US Department of Agriculture		$228,158.00			
Biodegradable Scaffolds for Tissue Regeneration	Madihally, S.V.	Oklahoma Center for the Advancement of Science and Technology				$44,381.00	$44,315.00
Health Monitor for Automation	Rhinehart, R.R.	Various (Measurement and Control Engineering Center)				$33,137.00	
Formation and Assembly of Complex Nanoparticle Building Blocks	Smay, J.	Oklahoma EPSCoR for Oklahoma State Regents for Higher Education			$23,400.00	$8,992.00	
EPSCoR Research Infrastructure Improvement Plan	Smay, J.E.	National Science Foundation			$6,662.00		$14,813.00
Robotic Deposition of Dental Restorations	Smay, J.E.	New York University for National Institute of Health					$65,682.00
Robotic Deposition of Tissue Engineering Scaffolds from Latex-Based Inks	Smay, J.E.	Sciperio, Inc.					$34,528.00
Viscoelastic Effects in the Control of Web Lines	Tree, D.A.	Web Handling Center	$9,200.00	$8,000.00			
Integration of Models and Data	Whiteley, J.R.	Various (Measurement and Control Engineering Center)	$28,000.00	$7,000.00	($41.16)		
Oklahoma State University Geothermal Smart Bridge Task 4.3.1.3 Integrated Control Strategies	Whiteley, J.R.	United States Department of Transporation - Federal Highway Administration	$185,793.00	$66,305.00	($70,865.55)	$59,375.76	
Automatic Model Adjustment	Whiteley, J.R. Rhinehart, R.R.	Various (Measurement and Control Engineering Center)	$10,000.00	$28,000.00	$6,920.00	($3,810.22)	
Development of Process Cause and Effect by Artificial Intelligence (AI)	Yen, G.G. Rhinehart, R.R.	Various (Measurement and Control Engineering Center)				$31,306.00	

4A - NUMBER OF MAJORS

Chemical Engineering undergraduate enrollment cycles with a 13-year period and a 2:2:1 amplitude ratio. The phenomenon is national. All programs rise and fall in unison. And, the phenomenon is uncorrelated to the economy. Please see the following graphs. A hypothesized mechanism proposes that periods of undersupply of graduates lead to inflated number of job offers, making demand appear high, making the program attractive to high school students, who provide an excessive graduating pool about 6 years later, which results in low employment rates, and a drop in recruiting high school matriculates, which lowers BS ChE supply about 6 years later.

Presently we are at the minimum point in the cycle.

Recognizing the cyclic nature in the late '90s, the program began a substantial revision in recruiting practices and in providing enrichment opportunities to maintain program attractiveness to undergraduate recruits. As a result, our minimum enrollment at OSU in this cycle doubled the minimum for the past two cycles.

These recruiting enhancements are aimed at shifting student focus from entry level salary to: ability to contribute to society, personal challenge of a difficult curriculum, joining an exclusive nationally recognized group of performers, participating in undergraduate research enrichment, and entering the biomedical/biochemical field.

As a secondary benefit, it appears that both our nationally normed student performance and the fraction of students entering graduate studies have risen.

Now, however, we anticipate student enrollment will rise as we preserve these features of excellence and program enrichment. We now need system resources to accommodate the peak enrollment that we anticipate.

Just prior to the last review ChE Faculty recognized the need to increase stipends to attract the quality of graduate students, which is required to build a competitive program. We raised stipends from $900 to $1400 per month over a 5-year period. Initially, this led to a drop in enrollment, which had reached about a desired 5 RAs per faculty member average. However, the substantial loss of industrial income due to post September 11 events, coupled with the drop in applications (to 1/3 of prior levels) due to visa and other entry difficulties for foreign nationals has caused our graduate student numbers to drop to about 4.5 RAs per faculty member.

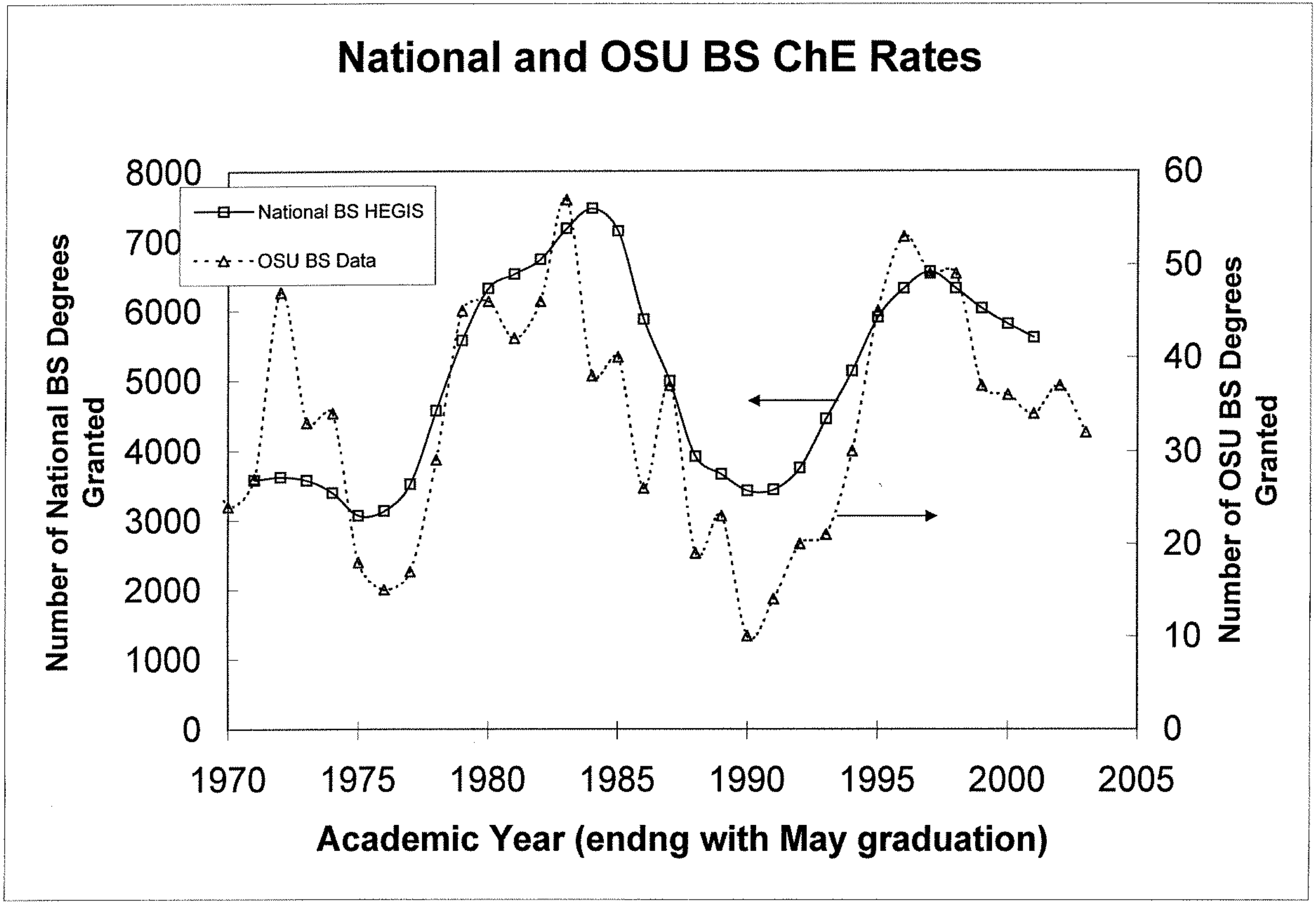
We are shifting recruiting focus to nationals, energetically seeking graduate funding, and anticipate a return to our desired 5 RA/faculty member graduate body size.

The attached data on number of graduates, student credit hours generated, faculty FTE, etc. is somewhat different from numbers which the school generates. However, it indicates the same enrollment trends as discussed above. The reason for an increase in credit hours generated when enrollment decreased is not obvious.

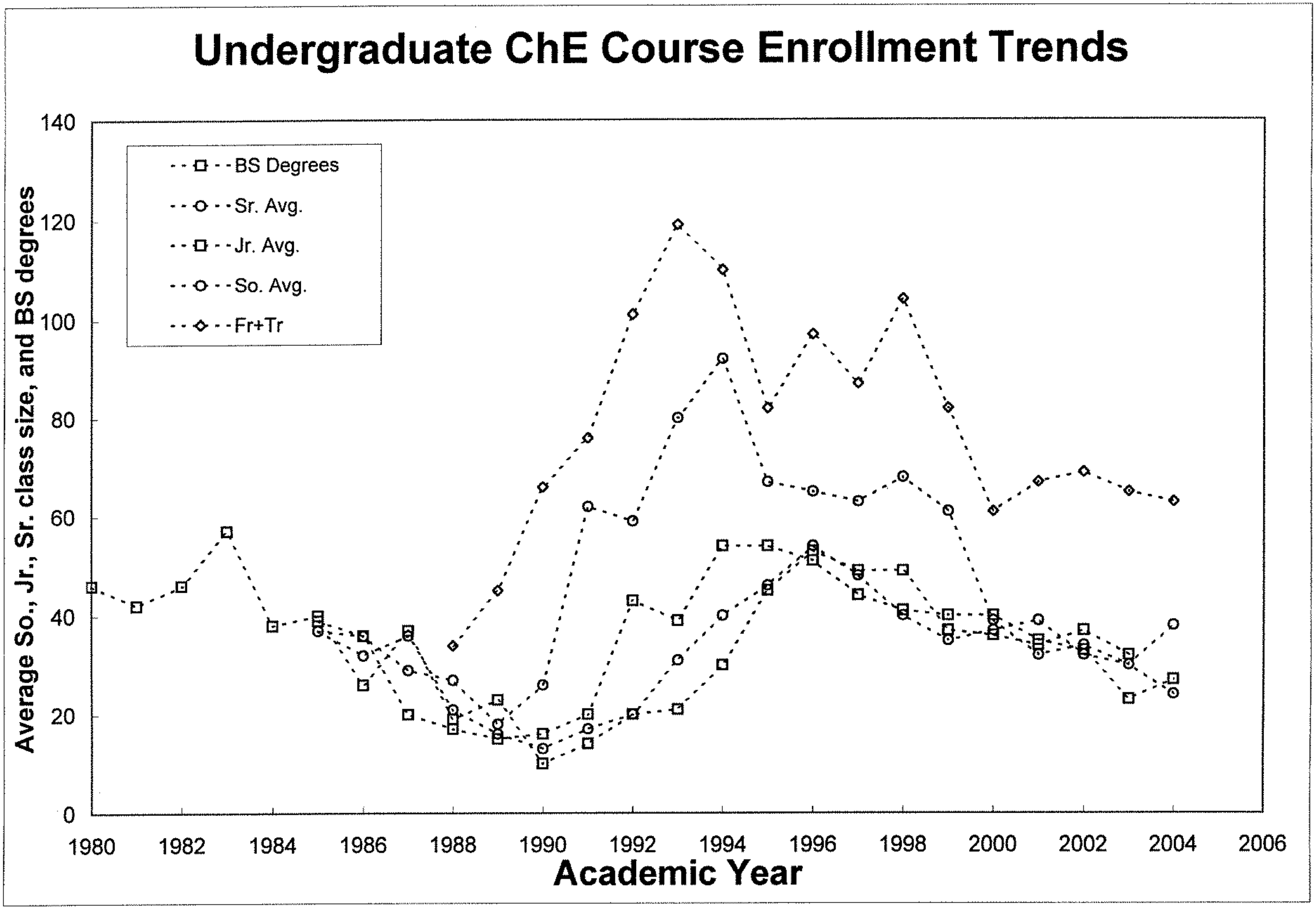
The average time to graduate is an important measure. It has remained stable for the past 5 years, indicating no substantial barriers to student success have been either created or removed. Considering that many undergraduates choose a 5-year version of our 4-year curriculum for many good reasons (obtain co-op experience, participate in research to prepare for graduate school, participate in campus leadership to prepare for careers, work part-time to support self or family, or switch majors), it would not be unexpected that the time-to-graduate is more than 4 years (8 semesters). It has averaged 9.4 semesters (4.7 years). Considering that about 1/3 of our students graduate with a BS ChE in 4 years and that our average time-to-graduate is nearly identical to the national ChE norm (4.8 years), we see no reason to use this metric as a basis for change.

Data in the following table is updated and reviewed annually. Note that it reveals gender and minority trends as well as overall trends. While females comprise roughly one third of the total ChE undergraduate enrollment, our graduating classes are just under 50% female. Feedback from the Industrial Advisory Board members reveals that they are satisfied with our production of individual BS degrees from underrepresented groups.

The following Pie-Charts reveal the placement of chemical engineers nationally. Placement from OSU ChEs is similar with the one exception being that about 40% of our BS graduates continue onto graduate or professional school. The national norm is 22%. Our students are regularly accepted by the top graduate schools in the country, and we are pleased with this reflection of academic success of our students.



National and OSU BS ChE Rates



Undergraduate ChE Course Enrollment Trends

OSU ENROLLMENT – Fall Semester

	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
University	23,571	22,992	21,252	19,860	21,087	19,350	18,519	19,201	19,125	18,561	19,001
CEAT	2,885	2858	2665	2638	2663	2637	2589	2623	2544	2597	2671
Chemical Engineering	188	206	210	224	221	252	250	258	273	285	295
Women	66	61	79	80	77	71	80	84	78	79	93
African American	6	4	3	3	4	7	5	5	3	6	8
Asian American	6	5	9	10	17	9	12	12	12	16	9
Hispanic	0	1	5	4	9	2	2	4	3	6	7
Native American	13	17	17	13	17	15	18	13	14	15	16
Foreign Nationals	18	16	18	17	18	29	35	46	53	35	25
Graduate	48	43	37	38	46	49	52	52	52	69	73

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                              OSRHE PROGRAM REVIEW                          16:11 Sunday, October 24, 2004   7
                        CRITERION IV - PROGRAM PRODUCTIVITY
                 NUMBER OF MAJORS IN EACH PROGRAM FOR PAST FIVE FALL SEMESTERS

----------------------------------------------- DEPARTMENT_NAME=CHEMICAL ENGINEERING -----------------------------------------------

                 ---------------------------------------------------------------
                 |                                |             FALL             |
                 |                                |------------------------------|
                 |                                |FALL  |FALL  |FALL  |FALL  |FALL  |
                 |                                |2000  |2001  |2002  |2003  |2004  |
                 |                                |------+------+------+------+------|
                 |                                |  N   |  N   |  N   |  N   |  N   |
                 |--------------------------------+------+------+------+------+------|
                 |PROGRAM                         |      |      |      |      |      |
                 |--------------------------------|      |      |      |      |      |
                 |Chemical Engineering - BS       |   221|   206|   183|   188|   180|
                 |--------------------------------+------+------+------+------+------|
                 |Chemical Engineering - MS       |    11|    12|    10|    21|    18|
                 |--------------------------------+------+------+------+------+------|
                 |Chemical Engineering - PHD      |    26|    25|    33|    27|    23|
                 ---------------------------------------------------------------
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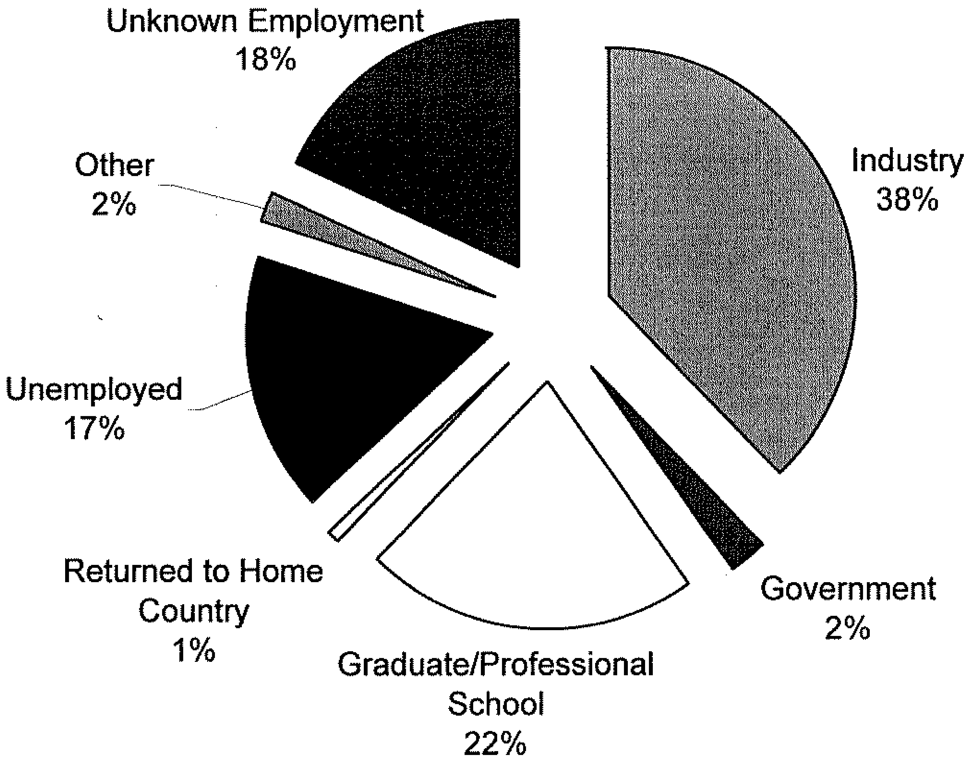
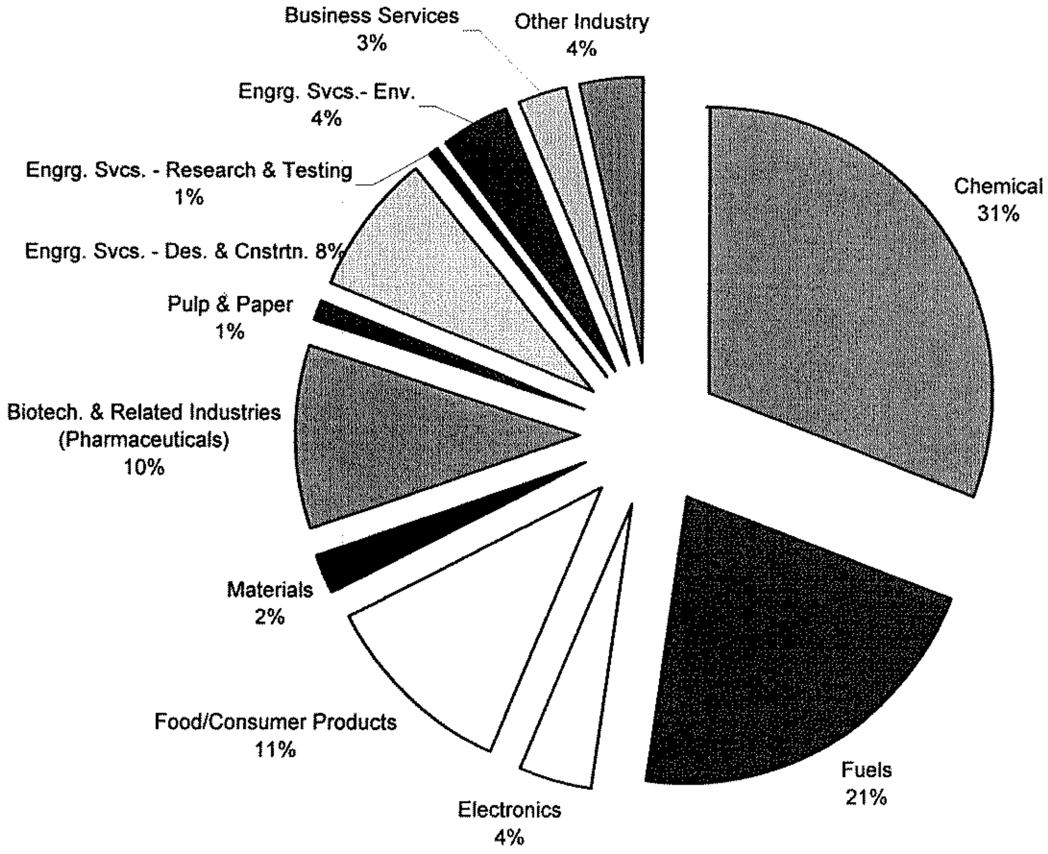
Initial Placement of BS Chemical Engineers

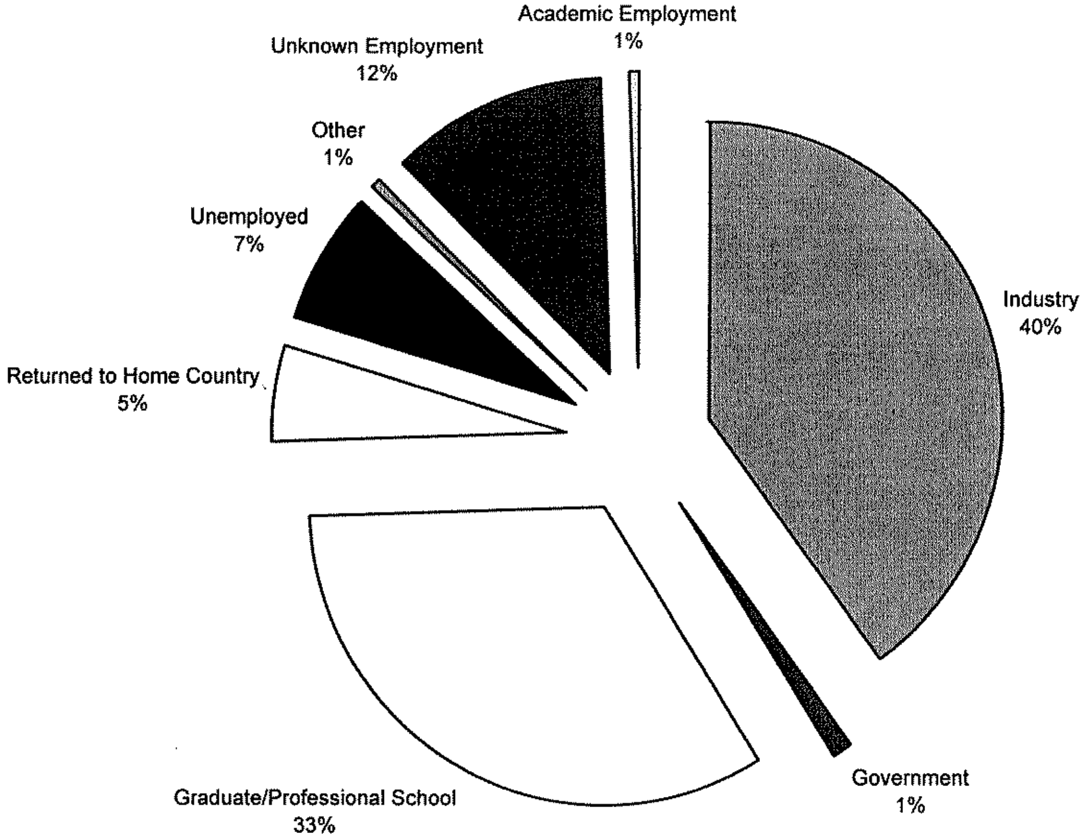


Initial Placement Survey of Chemical Engineering Graduates, Academic Year '01-'02, Prepared by AIChE Career Services Department

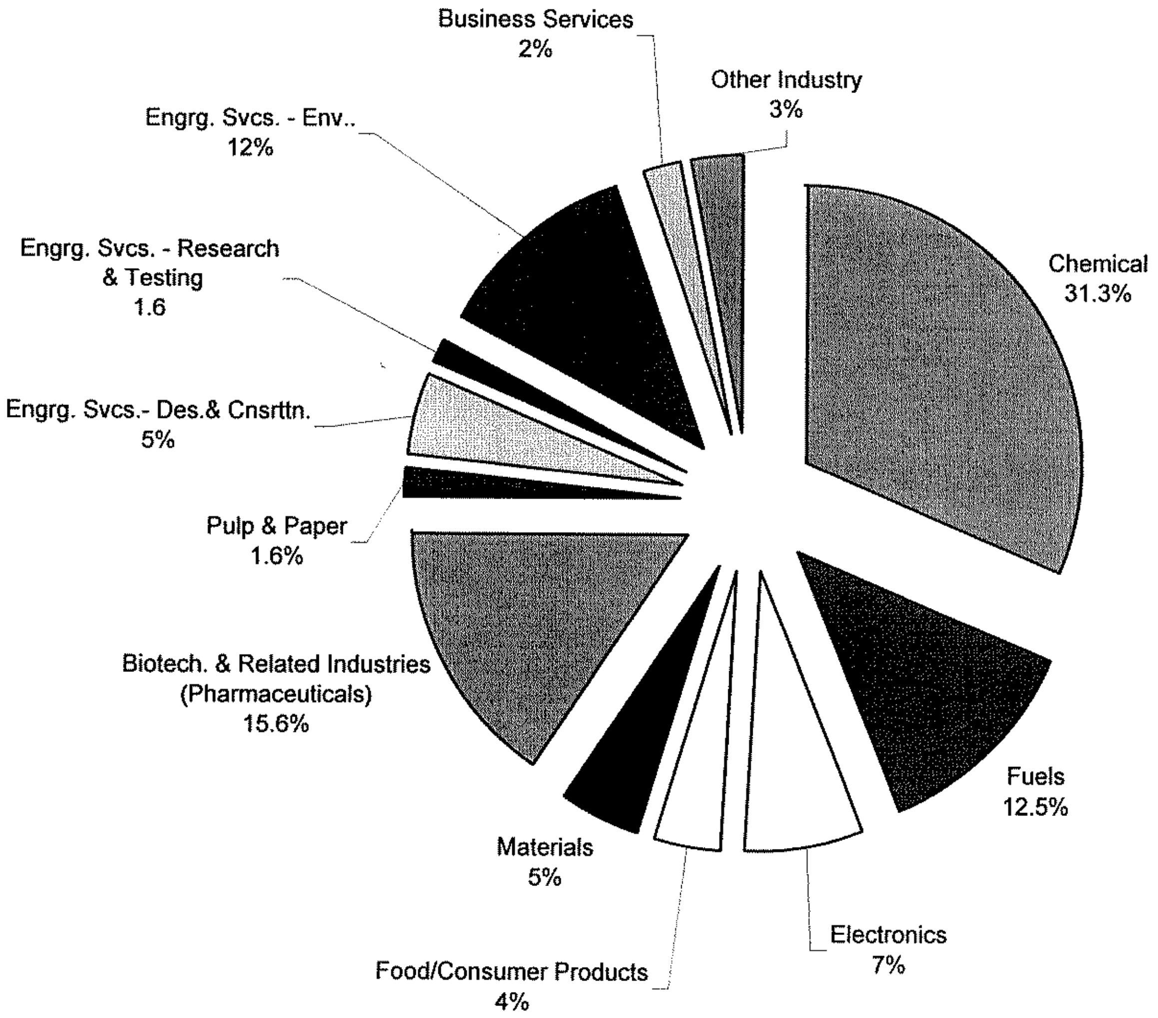
Breakdown of Industrial Employment of BS Chemical Engineers



Initial Placement of MS Chemical Engineers

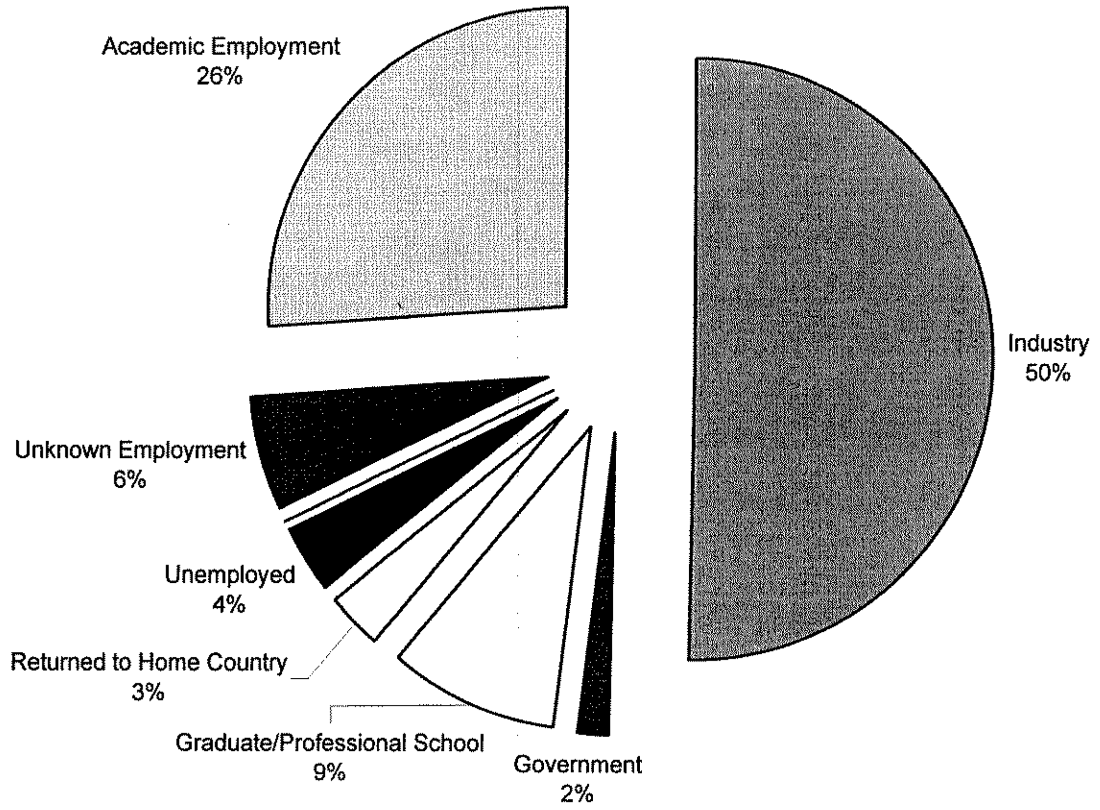


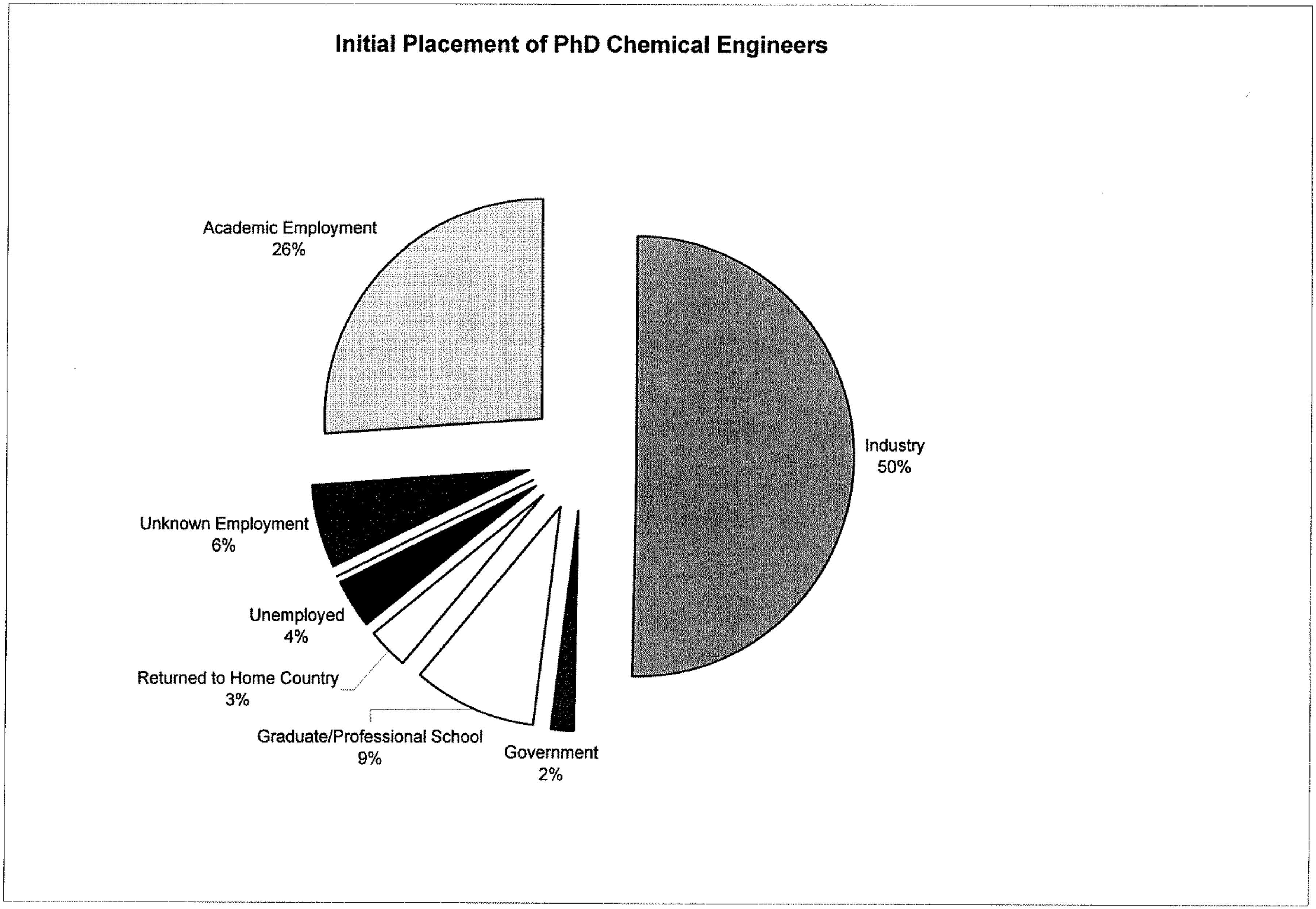
Breakdown of Industrial Employment of MS Chemical Engineers



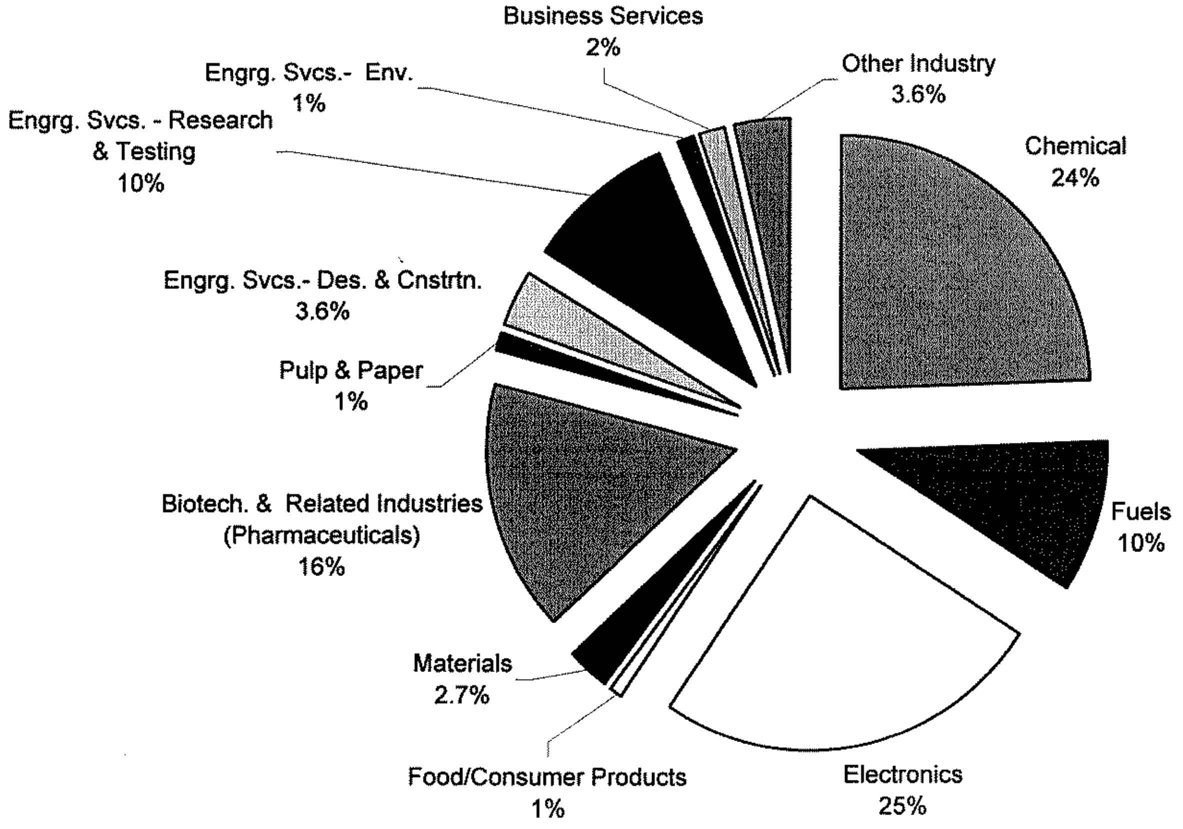
Initial Placement Survey of Chemical Engineering Graduates, Academic Year '01-'02, Prepared by AIChE Career Services Department

Initial Placement of PhD Chemical Engineers




Initial Placement of PhD Chemical Engineers
Academic Employment
26%
Industry
50%
Unknown Employment
6%
Unemployed
4%
Returned to Home Country
3%
Graduate/Professional School
9%
Government
2%

Breakdown of Industrial Employment of PhD Chemical Engineers



4B - FACULTY RATIO AND CLASS SIZE

As described in Section 4A, chemical engineering enrollment is cyclic, with a 13-year period and a National amplitude ratio of 2.2:1. This 2.2:1 amplitude ratio is based on the national production of about 6000 BS ChEs per year, and it tempers the effect of independent fluctuations on enrollment of each of the 160 ChE programs in the nation. In individual schools, random fluctuation on the annual matriculation makes the amplitude ratio nearly 5:1, as it has been at OSU for the previous two cycles (1970-2000). As a mechanism for changing student to faculty ratio in ChE classes, enrollment cycling dominates the data.

However, in the college ChE faculty are heavily involved in teaching the common courses that are required from students in all disciplines. These include ENGR1412 computer programming, ENGR13x2 introduction to design, ENSC2213 thermodynamics, ENSC3233 fluid dynamics, and ENGR3313 Materials Science.

As a result of teaching many of the core courses, the large student load from other disciplines tempers the influence of ChE enrollment cycling. Further, since the cycling phenomenon has a 13-year period, the 5-year history of the Report Card presents a short term view which would not reveal the cycling phenomenon.

One evaluation of faculty teaching load would be to compare the BS graduation number to faculty size for peer institutions.

Data from the Council for Chemical Research is attached. The CCR promotes research and collaboration between academe, federal labs, and industry. OSU is a member of CCR, as is nearly all of the universities in the top 50 rank. Bi-annually CCR surveys the schools in a benchmarking study related to faculty and student sizes, salaries, and related management-type issues. The data lead to the following comparisons of the OSU ChE to the national average of the research schools.

- The average number of filled FTE Tenure track positions is 13.9. At OSU it is 10. And, the average number of filled or open FTE Tenure track or non-tenure track positions is 16.7. At OSU it is 10. The schools that we anticipate competing with have 67% larger faculty sizes than we do.
- The average 9-month salary for full professors (including Head) is $110k. That for OSU is $87k. The schools that we anticipate competing with have 26% higher faculty salary than we do.
- The average number of full-time graduate students is 63.5. At OSU it is 45. When divided by faculty FTE, the average number of full-time graduate students per faculty member is 3.8. At OSU it is 4.5. The schools that we anticipate competing with have 15% smaller per capita graduate advising load than we do.
- The average number of BS degrees produced is 44.3. At OSU it is 35. When divided by faculty FTE, the average number of full-time graduate students per faculty member is 2.7. At OSU it is 3.5. The schools that we anticipate

competing with have 25% smaller per capita undergraduate teaching load than we do.

When considering the national successes of OSU undergraduate students, this data clearly shows that OSU ChE faculty sustaining a higher workload, for a smaller salary, and achieving outstanding results on a national level.

If we are to break into the top 75 schools in research reputation, we need additional faculty to develop synergistic programs that can compete nationally, and to reduce the advising-teaching load to allow focus on research. We need appropriate salaries to attract the new faculty and retain those in place. We have the drive, dedication, values, and talent. We have the potential. We need additional faculty members.

The national priorities of bio-engineering, sustainable energy, environment, nano-engineering, anti-terrorism, etc., all have chemical engineering playing a fundamental role in research and development. If we are to capitalize on these funding opportunities for research, we need to have a faculty size sufficient to create synergism and free-up time from instruction.

If we are to jump to the national average in faculty size and salary, the addition of 6 faculty members and 25% rise in salaries will require an increase in the OSU CHE salary budget of 80%.

OSHRE PROGRAM REVIEW
CRITERION IV - PROGRAM PRODUCTIVITY
FIVE YEAR HISTORY OF DEGREES AWARDED

COLLEGE=ENGIN, ARCH & TECH, DEPARTMENT=CHEMICAL ENGINEERING

		YEAR				
		1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
		N	N	N	N	N
PROGRAM	TERM					
Chemical Engineering - BS	SUMMER	3	4	4	1	1
	FALL	5	9	5	4	5
	SPRING	24	24	29	18	24
	All	32	37	38	23	30
Chemical Engineering - MS	TERM					
	SUMMER		3		1	2
	FALL	5	3	3		5
	SPRING	4	1	1	2	1
	All	9	7	4	3	8
Chemical Engineering - PHD	TERM					
	SUMMER	1	2	2		
	FALL	2	1		2	3
	SPRING	1	2	1		2
	All	4	5	3	2	5

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                                FIVE YEAR ACADEMIC REPORT CARD
        COLLEGE: ENGR, ARCH & TECH
        CHEMICAL ENGR (C4507)

    FALL SEMESTER -->   2000           2001           2002           2003           2004              5-YEAR
    - * - * - * - * - * - * - * - * S T U D E N T   I N F O R M A T I O N * - * - * - * - * - * - * - *  DIFFERENCE
:ADC[illegible]NT OF STUDENTS
  U[illegible]GRADUATE               221            206            183            188            180          -41 -18.5%
  GR[illegible]UATE                   37             37             43             48             41            4 +10.8%
  PROFESSIONAL             0              0              0              0              0            0      .
)TAL                     258            243            226            236            221          -37 -14.3%
  MINORITY                69             75             73             82             78            9 +13.0%
  NONMINORITY            189            168            153            154            143          -46 -24.3%

JTRY INFORMATION      SCORE  NUM     SCORE  NUM     SCORE  NUM     SCORE  NUM     SCORE  NUM
  ACT AVERAGE          27.2   53      27.1   48      26.5   51      27.7   43      27.4   50     0.3  +0.9%
  ACT RANGE (25TH-75TH) 24-31         24-31          24-30          25-31          24-31
  TOP 10% OF HS CLASS    49%            54%            43%            35%            44%            -5   PTS

:TENTION/GRADUATION RATES
  FULLTIME SEMESTERS       .            9.7            9.0            9.7            9.4          -0.3  -3.0%

:MESTER CREDIT HOURS
;TATE FUNDED ONLY)
  UNDERGRADUATE        1,373          1,268          1,457          1,308          1,609          236 +17.1%
  GRADUATE               265            292            347            372            272            7  +2.6%
  PROFESSIONAL             0              0              0              0              0            0      .
)TAL                   1,638          1,560          1,804          1,680          1,881          243 +14.8%

 AND AVG SIZE OF LECTURE
.ASSES TAUGHT       NUMBER   AVG   NUMBER   AVG   NUMBER   AVG   NUMBER   AVG   NUMBER   AVG
  UNDERGRADUATE            7  65.4          8  51.3          9  61.3         11  63.2          9  65.0      2 +28.5%
  GRADUATE/PROF            3  10.0          3  14.0          5  10.0          4  12.0          4   8.0      1 +33.3%
)TAL                      10  48.8         11  41.1         14  43.0         15  49.5         13  47.5      3 +30.0%

    - * - * - * - * - * - * - * - * F A C U L T Y   I N F O R M A T I O N * - * - * - * - * - * - * - * -
:ADCOUNT OF FACULTY
  PROF - LECTURER
     TOTAL                12             10             12             13             12              0  +0.0%
     MINORITY              1    8%        1    10%       3    25%       3    23%       3    25%       2+200.0%
  TENURED & TENURE TRACK
  [illegible]TAL                    10              8             11             11             11              1 +10.0%
  [illegible]NURED                  10  100%          8  100%          9   82%          9   82%          9   82%      -1 -10.0%

ISTRUCTIONAL FTE
  PROF - LECTURER       7.64           6.39           8.36           7.62           7.85          0.21  +2.7%
  GRAD ASSISTANT        6.09           6.86           3.69           3.48           5.90         -0.19  -3.1%
)TAL                   13.73          13.25          12.05          11.10          13.75          0.02  +0.1%

'UDENT-FACULTY RATIO    14.9           17.0           15.1           15.5           16.6           1.7 +11.3%

'G ACADEMIC YEAR SALARY  OSU   % OF     OSU   % OF     OSU   % OF     OSU   % OF     OSU   % OF
'ULL-TIME, 9 OR 10 MO.)      BIG 12         BIG 12         BIG 12         BIG 12         BIG 12
  PROFESSOR          90,932  91%    89,576  86%    89,576  85%    90,444  82%    93,357   .%     2,425  +2.6%
  ASSOC PROF         68,299  96%    69,210  92%    70,610  93%    71,516  93%    73,215   .%     4,916  +7.1%
  ASST PROF               0   .%         0   .%    65,250  95%    65,250  94%    69,080   .%    69,080      .

.ASSES TAUGHT BY
:NURED & TENURE TRACK
  % LOWER DIV           100%           100%           100%           100%           100%              0   PTS
  % UNDERGRAD           100%           100%           100%           100%           100%              0   PTS




  NOTE: NUMBERS FOR FALL 2004 ARE PRELIMINARY. FINAL FIGURES WILL BE AVAILABLE AFTER THE END OF THE SEMESTER.

  NOV 4, 2004                     PROJ04.SAS(REPTCARD)                        INST RESEARCH & INFORMATION MGMT
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Oklahoma State University
FIVE-YEAR ACADEMIC REPORT CARD
CHEMICAL ENGR

Fiscal Year	2000	2001	2002	2003	2004	Change	
						Amount	Percent
F[illegible]l Information							
Faculty Salaries	$774,878	$775,043	$897,000	$854,971	$765,379	($9,499)	-1.2%
Other Salaries	$104,870	$131,409	$116,712	$198,058	$200,538	$95,668	91.2%
Fringe Benefits	$183,165	$214,374	$252,445	$277,966	$264,087	$80,922	44.2%
Travel	$2,089	$6,025	$6,960	$3,288	$762	($1,327)	-63.5%
Utilities	$0	$0	$0	$0	$0	$0	-
Supplies Other Oper. Exp.	$43,754	$60,051	$75,521	$39,867	$33,452	($10,302)	-23.5%
Property, Furniture Equip.	$5,334	$16,343	$12,196	$11,078	$13,066	$7,732	145.0%
Library Books Periodicals	$0	$0	$0	$0	$0	$0	-
Transfers Other Disbur.	$0	$0	$0	$0	$0	$0	-
Total	$1,114,090	$1,203,245	$1,360,833	$1,385,228	$1,277,285	$163,194	14.6%
Cost per SCH	$400.75	$334.79	$421.57	$355.64	$377.11	($23.64)	-5.9%
Cost per SCH in Constantt	$400.75	$325.27	$402.77	$331.35	$338.35	($62.40)	-15.6%
Other Revenue							
Other Student Fees	$0	$0	$0	$0	$0	$0	-
Gifts and Grants	$100,580	$106,131	$302,147	$69,228	$328,236	$227,657	226.3%
Fees Related to Educ. Depts.	$270	$0	$0	$0	$0	($270)	-100.0%
Other Income	$69,773	$24,937	$129,572	$618,308	$2,447	($67,325)	-96.5%
Total	$170,622	$131,068	$431,719	$687,536	$330,684	$160,062	93.8%
External Funding							
Sponsored Expenditures**	$814,698	$753,707	$712,240	$1,010,577	$666,333	($148,365)	-18.2%
Fundraising							

**Excludes federal appropriations for College of Agriculture Sciences and Natural Resources.

Council for Chemical Research
Survey of Chemical Engineering Departments

Academic Year *2002-2003*

Tabulated Results (April 3, 2003)
N = 38 responding schools
NB: Not all schools reported figures for all data requested.

The results of this survey will be presented in the Chemical Engineering Chairs Meeting at the Council for Chemical Research Annual Meeting in Austin, Texas, April 5-7, 2003.

I. Faculty

1. Number of FTE tenured-track faculty in place AY ***2002-03*** 13.9
2. Number of FTE non-tenure track teaching faculty AY ***2002-03*** 1.7
3. Number of new faculty starting during AY ***2002-03*** (included in total in #1) 1.1
4. Number of approved tenure-track openings for interview AY ***2002-03*** 1.0
5. Salaries for AY ***2002-03*** (9-month, academic year)
Include department head at appropriate rank

	Mean Age	High Salary	Low Salary	Average	OSU ChE
Professors	54	$145,210	$84,972	$110,264	87,487
(extremes)		($230,000)	($22,400)		
Associate Prof.	43.5	$84,210	$73,295	$79,065	70,614
		($117,848)	$50,204		
Assistant Prof.	33.8	$70,872	$65,575	$67,815	65,250
		($99,000)	($43,171)		

6. Start-up package to new assistant professors starting AY ***2002-03*** (total value) $456,031

Number of graduate-student years support	4.03
Number of summer months (include cost)	3.6 ($21,522)
$ for equipment, supplies, travel, etc.	$291,144

II. Postdoctoral

7. Number of postdocs (September, ***2002***) 8.6
8. Approximate range of postdoctoral stipends $29,521 - $35,757
(extremes) $20,000 - $60,000

III. Graduate Students

9. Total number of full-time graduate students (September, ***2001***) 63.5
10. Number of new graduate students (September, ***2002***) 16
11. Range of graduate student stipends High $21,198

	(12-month support excluding tuition)	Low	$17,611
		Average	$18,926
12.	Cost to student of health insurance plus matriculation & other fees		$2,272
13.	Number of FTEs for teaching assistantships as line item in university budget		7.5
14.	Normal cost to research grant to support a graduate student (Actual cost including stipend, tuition, fringe, overhead for an NSF grant)		$37,667
15.	Number of Ph.D. degrees granted **July 1, 2001 - June 30, 2002**		7.3
	and average years from B.S. to Ph.D. for full-time students excluding time in absentia		5.0
16.	Number of M.S. degrees granted **July 1, 2001 - June 30, 2002**		7.7
	and average (estimated) months required for M.S. degree (B.S. – M.S.)		23.4
17.	Number of M.S. degrees included in #16 that are professional master's degrees (non thesis)		2.6
18.	Are graduate students "employees" of the university?		74%
IV.	Research Expenditures		
19.	Federal Research Expenses **July 1, 2001 - June 30, 2002**		$2,274,833
20.	Industrial Research Expenses **July 1, 2001 - June 30, 2002**		$520,205
21.	Foundation (non-profit) research support **July 1, 2001 - June 30, 2002**		$234,043
V.	Undergraduates		
22.	Number of B.S. degrees granted **July 1, 2001 - June 30, 2002**		44.3
23.	Number of semester credit hours required to obtain a B.S. degree		132.1
	and average number of years to degree		4.33
24.	Estimate % B.S. graduates reported in #22 who neither have a job nor are attending graduate/professional school at this time		17.8%
25.	Average starting salary for BS students taking jobs		$52,045

Summary of CCR Survey of CHE Departments
(1997 - 2002)

	1997	1998	1999	2000	2001	2002
Number of Responses	88	47	52	53	50	38
CHE Department Faculty Size						
Avg. Tenure Track Lines	11.2	13.7	13	13.4	13.1	13.9
Avg. no. of non-tenure track lines	1.08	1.0	1.09	1.1	1.9	1.7
Avg. no. of New Faculty starts	.5	0.7	.8	.8	1.2	1.1
Avg. no. of Approved searches	.85	1.1	1.1	1.1	1.6	1.0
Faculty Salaries (9-month basis)						
Professors (Average age)	54	53	53	53.9	54	54
High Salary	$84,451	$119,140	$123,736	$133,735	$139,554	$145,210
Low Salary	$85,879	$75,891	$74,781	$80,066	$82,073	$84,972
Average Salary of Prof.	$79,818	$92,341	$94,987	$101,541	$105,749	$110,264
Associate Professors (Average age)	43	40	42	40.9	43	43.5
High Salary	$62,321	$73,072	$74,118	$76,019	$78,684	$84,210
Low Salary	$61,865	$61,865	$65,405	$66,594	$70,178	$73,295
Average Salary of Associate Prof.	$58,845	$68,025	$70,153	$71,091	$73,986	$79,065
Assistant Professors (Average age)	33	33	34	34	34	33.8
High Salary	$52,500	$61,354	$63,924	$64,482	$67,878	$70,872
Low Salary	$55,051	$57,525	$58,790	$60,209	$63,634	$65,575
Average Salary of Associate Prof.	$52,313	$59,117	$61,438	$61,404	$65,137	$67,815
Start-up Packages						
Total Value of Start-up Package for Assistant Profs.	N/A	N/A	N/A	$252,294	$323,267	$456,031
No. of graduate student years support	3.2	3.5	3.6	3.5	3.5	4.03
No. of summer months	3.1	3.4	3.6	3.5	3.5	3.6
Cost for summer months	N/A	N/A	N/A	N/A	$33,916	$21,522
Funds for equipment, supplies, etc.	$128,451	$134,500	$146,148	$166,886	$223,848	$291,144
Postdoctoral Research Associates Numbers Range of salaries	5.01 $25,888- $33,860	6.4 $25,686- $35,221	7.4 $26,765- $35,040	7.5 $28,095- $36,311	7.9 $14,400- $51,000	8.6 $29,521 - $35,757
Average Postdoctoral Salary/year	N/A	N/A	N/A	N/A	$29,628	
Graduates Students						
Total no. of full-time grad. Students	50.2	61	61	57.9	53.4	63.5
Number of new grad. Students	13.34	16	15.1	17	14	16

Range of stipends						
High	$16,274	$17,443	$18,768	$18, 928	$19,982	$21,198
Low	$12,806	$14,335	$14,695	$14,692	$15,949	$17,611
Average	$14,323	$15,816	$16,439	$17,582	$18,033	$18,926
Cost of health insurance and fees	$1,391	$753	$799	$1,388	$1,445	$2,272
Number of TA lines in Univ. budget	6.2	8.0	7.7	6.6	7.9	7.5
Cost of a GRA to a grant	$27,920	$32,065	$31,374	$32,495	$35,845	$37,667
Number of Ph.D.s granted	6.37	8.7	6.8	7.6	7.6	7.3
Avg. years from B.S. to Ph.D.	5.68	4.9	5.2	5.2	4.7	5.0
Number of Masters granted				9.3	9.2	7.7
Avg. Months from B.S. to M.S.	21.9	21.5	23.6	24	24.5	23.4
Number of Professional Masters				3.5	4.7	2.6
Undergraduate Students						
Number of B.S. degrees granted	51.9	62	56	51.6	46.4	44.3
Credits required for B.S. degree	132.1	131	132	130.1	133.8	132.1
Avg. years to B.S.	4.4	4.3	4.3	4.3	4.2	4.3
% B.S. grads. w/o a job or school	N/A	N/A	11	14.6	22.3	17.8
Research Expenditures						
Federal Research Expenses	N/A	N/A	$1,815,727	$1,836,849	$1,900,452	$2,274,833
Industrial Research Expenses	N/A	N/A	$741,968	$571,116	$867,618	$520,205
Foundation (non-profit) research support	N/A	N/A	N/A	$213,596	$564,978	$234,043

4C - FIVE-YEAR AVERAGE NUMBER OF DEGREES CONFERRED

See the following tables.

B.S. Graduate Employment/Salaries

	2002-2003	2001-2002	2000-2001	1999-2000	1998-1999	1996-1997	1995-1996
Number of BS Graduates	32	37	35	33	37	56	53
Placements							
Industry	14	10	20	22	19	26	30
Graduate School							
OSU	2	3	3	2	8	1	3
Other	12	9	6	3	4	4	6
Government	0	3	2	1	2	2	
No Data	7	12	5	4	5	16	9
No Job						6	3
Salary Range*	$42,000-$58,400	$42,000-$60,000	$48,000-$57,000	$44,000-$54,870	$41,000-$52,000	$40,000-$49,000	$30,000-$45,600
Overall Average Salary	$54,100	$52,222	$52,947	$48,022	$47,375	$44,660	$41,000

***Bonus and sign up offers not included**

Chemical Eng

GRADUATE STUDENT APPLICATIONS AND ENROLLMENT CHANGES
2002 - 2004

	Enrolled			Applications			Acceptances			New Enrollments from Applications Accepted			Graduations (Summer, Fall, Spring totals shown)		
	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004
EN MS CHEN															
Domestic	7	4	2	2	6	2	0	2	1	0	2	1	4	3	2
		(3)	(2)		4	(4)		2	(1)		2	(1)		(1)	(1)
International	3	17	16	36	76	53	6	29	12	0	3	1	0	0	6
		14	(1)		40	(23)		23	(17)		3	(2)		0	6
Totals	10	21	18	38	82	55	6	31	13	0	5	2	4	3	8
		11	(3)		44	(27)		25	(18)		5	(3)		(1)	5
EN PHD CHEN															
Domestic	6	5	4	0	4	3	2	2	2	1	1	0	0	2	1
		(1)	(1)		4	(1)		0	0		0	(1)		2	(1)
International	27	22	19	34	37	29	12	10	9	2	0	2	3	0	4
		(5)	(3)		3	(8)		(2)	(1)		(2)	2		(3)	4
Totals	33	27	23	34	41	32	14	12	11	3	1	2	3	2	5
		(6)	(4)		7	(9)		(2)	(1)		(2)	1		(1)	3

5A - FACULTY QUALIFICATIONS

All faculty members have a PhD from a strong university program. Through research and other scholarly work, consulting, and/or service to the profession, all faculty members are professionally engaged and continue to grow professionally. On average the faculty members have 4 years of practice experience, and three have over 10 years; and about half are registered professional engineers. This practice experience pervades the classroom and laboratory experiences of the students, providing relevance in their education.

The reader may enjoy the data in the "Related Work Experience" column. Interpretations of the requested number of years ranged from full-time employment in industry to the accumulated equivalent to years of 40-hour/week work in the university setting.

Regardless of the way that column was interpreted, we have an award-winning faculty. Three of our senior or emeritus faculty members have been elected as Fellows of the AIChE, another of ISA, and many are National Officers in professional organizations. Some of these positions include: Chair of the Fullbright Search Committee, Chair of the AIChE National Council for Careers and Education, ChE Program Director for NTU, Editor-in-Chief of ISA Transactions, Treasurer for the American Automatic Control Council, and National AIChE Director for the Computing and Systems Technology Division. The number one priority of our faculty, however, is classroom teaching. As a highlight for several awards, Dr. Randy Lewis won the 2000 AIChE National Advisor of the Year Award; Dr. Rob Whiteley won the prestigious 1998 OSU Regent's Award for Excellence in Teaching; and Dr. Jan Wagner the 2004 Regent's Teaching Award. For similar reasons, both Dr. Rob Robinson and Dr. Gary Foutch hold the title of Regents Professor. Three faculty members have ten or more years of full-time industrial experience each, and most have significant interaction with industry. Last year ChE Professor Emeritus Dr. Ken Bell won the national Jacob Award for his contributions to the science of heat exchange, and Associate Professor Dr. Jim Smay won the American Chemical Society LaMer Award for contributions to colloidal chemistry and is the recipient of a prestigious National Science Foundation CAREER Award. Just recently, Dr. Russ Rhinehart was the featured educator in Chemical Engineering Education, and will be inducted into the CONTROL Automation Hall of Fame this May.

These faculty members have influenced the students that have won many national awards and recognitions: 3 first place wins in 10 years for the national AIChE Plant design contest, national places in student paper and the ChemE-Car contests, Outstanding rankings for the AIChE Student Chapter 6 years in a row, 2 Goldwater scholarships in the past year, a Udall 4 years back, a USA-Today Academic All-American last year, and several contenders for Rhodes Scholarships.

The faculty membership has been relatively constant. In the past 5 years one associate professor left through promotion to associate dean, and one full professor retired. One position was closed. We hired one replacement with a young assistant professor. Then, we were able to obtain a new "growth" position to hire another young assistant professor. Both assistant professors are developing very well. However, four full professors, will likely retire within the next 5 years. This represents nearly 40% of the faculty numbers, and the predominance of industrial experience. It also appears that career decisions will lead to two or three other faculty members leaving OSU. There could be a 60% turnover of faculty faces in the next 5 years, which raises concerns: Will the value system that guides hiring seek to replace the industry experience, depth and diversity of teaching expertise, and dedication to the undergraduate curriculum that has become a nationally-visible, and treasured legacy of the School, and an asset to OSU?

CRITERION V
Quality

A. Program faculty qualifications

Name	Faculty Status (Regular or Adjunct)	Faculty FTE in program	Degrees Earned		Related Work Experience
			Highest	Highest in Teaching Area	(years)
			Type	Type	
Gary L. Foutch, Ph.D., P.E.	Regular	1.00	Ph.D.	Ph.D.	28
Khaled A.M. Gasem, Ph.D.	Regular	1.00	Ph.D.	Ph.D.	53
Karen A. High, Ph.D.	Regular	1.00	Ph.D.	Ph.D.	17
Martin S. High, Ph.D., P.E.	Regular	1.00	Ph.D.	Ph.D.	32
Arland H. Johannes, Ph.D., P.E.	Regular	1.00	Ph.D.	Ph.D.	37
Randy S. Lewis, Ph.D.	Regular	1.00	Ph.D.	Ph.D.	20
Sundararajan V. Madihally, Ph.D.	Regular	1.00	Ph.D.	Ph.D.	11
R. Russell Rhinehart, Ph.D.	Regular	1.00	Ph.D.	Ph.D.	13
James Earl Smay, Ph.D.	Regular	1.00	Ph.D.	Ph.D.	13
Jan Wagner, Ph.D., P.E.	Regular	1.00	Ph.D.	Ph.D.	38
James Robert Whiteley, Ph.D., P.E.	Regular	1.00	Ph.D.	Ph.D.	23

Oklahoma State University
School of Chemical Engineering Faculty
2003-2004

Gary L. Foutch, Ph.D., P.E.	**Kerr-McGee Chair and Regents Professor**

B.S., Chemical Engineering
University of Missouri-Rolla, 1975
M.S., Chemical Engineering
University of Missouri-Rolla, 1977
Ph.D., Chemical Engineering
University of Missouri-Rolla, 1980

Khaled A.M. Gasem, Ph.D.	**Amoco Chair and Professor**

B.S., Chemical Engineering
University of California at Berkeley, 1976
M.S., chemical and Petroleum Refining Engineering
Colorado School of Mines, 1979
Ph.D., Chemical Engineering
Oklahoma State University, 1986

Karen A. High, Ph.D.	**Associate Professor**

B.S., Chemical Engineering
The University of Michigan, 1985
M.S., Chemical Engineering
Pennsylvania State University, 1988
Ph.D., Chemical Engineering
Pennsylvania State University, 1991

Martin S. High, Ph.D., P.E.	**Associate Professor**

B.S., Chemical Engineering
Pennsylvania State University, 1981
M.S., Chemical Engineering
Pennsylvania State University, 1983
Ph.D., Chemical Engineering
Pennsylvania State University, 1990

Arland H. Johannes, Ph.D., P.E.	**Professor**

B.S., Chemistry and Physics
Illinois State University, 1970
M.S.E., Civil Engineering
West Virginia University, 1974
Ph.D., Chemical Engineering
University of Kentucky, 1977

Randy S. Lewis, Ph.D. **R.N. Maddox Associate Professor**

B.S., Chemical Engineering
Brigham Young University, 1989
Ph.D., Chemical Engineering
Massachusetts Institute of Technology, 1994

Sundararajan V. Madihally, Ph.D. **Assistant Professor**

B.S., Chemical Engineering
Bangalore University, India, 1992
M.S., Chemical Engineering
Wayne State University, 1995
Ph.D., Chemical Engineering
Wayne State University, 1998

R. Russell Rhinehart, Ph.D. **Edward E. Bartlett Chair and School Head**

B.S., Chemical Engineering
University of Maryland, College Park, 1968
M.S., Nuclear Engineering
University of Maryland, College Park, 1968
Ph.D., Chemical Engineering
North Carolina State University, Raleigh, 1985

James Earl Smay, Ph.D. **Assistant Professor**

B.S., Mechanical Engineering
Oklahoma State University, 1996
Ph.D., Materials Science and Engineering
University of Illinois, 2002

Jan Wagner, Ph.D., P.E. **Professor**

B.Ch.E., Chemical Engineering
Cleveland State University, 1967
M.S., Environmental Health Engineering
University of Alaska, 1970
M.A., Biology
University of Kansas, 1975
Ph.D., Chemical Engineering
University of Kansas, 1976

James Robert Whiteley, Ph.D., P.E. **Associate Professor**

B.S., Chemical Engineering
Oklahoma State University, 1977
M.S., Chemical Engineering
Ohio State University, 1989
Ph.D., Chemical Engineering
Ohio State University, 1991

5B - REGIONAL AND NATIONAL REPUTATION AND RANKING

Undergraduate Team Recognition

Our Seniors won **1st Place Overall in the National Team Process Design Contest**, three of the ten times that it has been held since 1995, and first place in the safety and loss prevention category in 2001. The contest is managed by the American Institute of Chemical Engineers, headquartered in New York, and open to submissions from all 160 ChE programs in the US. Judging is by both academics and practicing engineers. We have won 30% of the national competitions.

Our Seniors who take the Fundamentals of Engineering Exam have averaged an average **pass rate of 97%** over the past 10 years. See the following graph. The national pass rate for chemical engineering students is 84%. The FE exam is administered by the National Council for Examining Engineering and Surveyors, and is the first step toward getting the Professional Engineering License. About 4,000 US ChE Seniors take the exam each year.

Our AIChE **Student Chapter won an "Outstanding" national award** for **each of the past six years** (and 7 out of 8 years) for their activities that enhance education and opportunities for student leadership. They hosted the national conference in 1999. We encourage **extra curricular and team activities.** The "outstanding" ranking recognizes the top 10% students chapters in the nation.

For **4 of the past 5 years** a team of OSU ChE students qualified through regional competition to enter their **chemical reaction powered car in the national competition.** Only 24 teams qualify each year. Each of the 160 schools can send three teams to regional competition.

Undergraduate Individual Recognition

In the 2003-4 academic year, the **two Goldwater Scholars** in the State of Oklahoma were OSU ChE undergraduates. In 2001, the one **Udall** scholar in the state was an OSU ChE undergraduate.

In 2004 USA Today selected an OSU ChE senior to their **Academic First-Team** their selection if the top 20 students in the nation – all disciplines, all colleges.

About 40% of the graduating seniors continue into graduate school and they are regularly accepted by the top ranked programs of their choice. Recently our students were accepted by Berkeley, Cal Tech, Cambridge (England), Illinois, MIT, Michigan, Rice, Wisconsin, and many others.

In each of the past two years an OSU ChE student has almost made it as a Rhodes Scholar, and this year we have one as a finalist for a Gates Scholarship.

In 2003 one of our students took first in the regional students paper contest, which qualified him for national competition. He took **second place in the 2004 national AIChE student paper presentation contest.**

National Faculty Individual Recognition

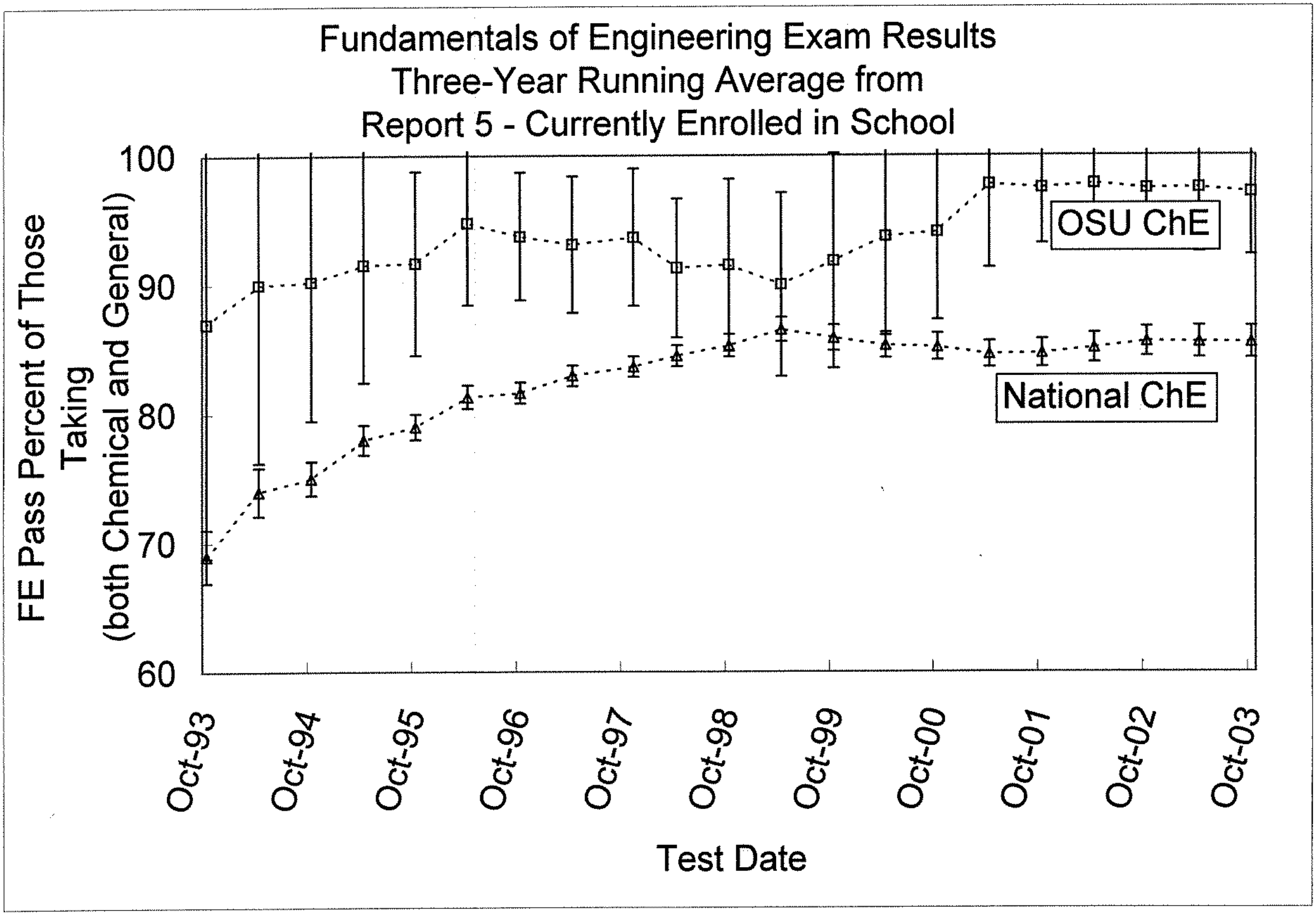
In 2000 Randy S. Lewis received the **AIChE National Student Chapter Advisor of the Year Award**.

In 2003 Kenneth E. Bell (emeritus) won the joint **AIChE/ASME Max Jacob Memorial Award**.

In 2002 R. Russell Rhinehart was inducted as a **Fellow of the Instrument, Systems, and Automation Society.**

In 2003 James E Smay received the **American Chemical Society Victor K. LaMer Award.**

In 2005 R. Russell Rhinehart will be inducted to the **Control (magazine) Automation Hall of Fame.**



Fundamentals of Engineering Exam Results
Three-Year Running Average from
Report 5 - Currently Enrolled in School

5C - SCHOLARLY ACTIVITY

Introduction

Primarily scholarly activity of the Chemical Engineering faculty is indicated by publications, which are listed in Appendix B, and segregated into three categories related to traditional stature within the academic community.

The first category is titled "Refereed Journals and Equivalent". This includes science and engineering journals or other rigorously refereed publication outlets, which require authors to revise work to comply with critical review by leaders in the discipline. Normally, the primary audience of these scientific journals is comprised of academic researchers, and they value mathematical rigor, novelty, creativity, breadth and depth of analysis, and innovation which expands the knowledge base of the discipline.

The second category is titled "Refereed Conference Proceedings, Periodicals, Chapters, and Equivalent". While the intent is similar, the criticality of the review and expectations for comprehensiveness and completeness is less. The benefit is that initial findings and new directions can be disseminated faster. Activity in this category is not necessarily from activity of "lesser stature", but likely indicates strong intellectual leadership within the community.

The third category titled "Newsletters, Abstract-Refereed Proceedings, and Equivalent" indicates activity in disseminating overviews of possible methods or tutorials standard (but new) techniques, and these are normally aimed at the practitioner. Activity here often represents the invited work of accepted leaders, and constitutes the publication avenue most related to the mission of economic development, extension, or service.

However, scholarly and creative activity related to excellence in course management and laboratory equipment are not necessarily expressed in publications.

Analysis

People may likely argue into which category a particular publication should be included. But, if a few publications are shifted from one category to another, the analysis of faculty scholarly performance is unchanged:

- All faculty members of the School are participating in publishing work.
- Collectively, the School faculty provides a desired balance of publications in all categories revealing the breadth of activity from fundamental scientific leadership to dissemination to the engineering practice.
- The two new faculty members are showing desirable activity of desirable stature.
- The various levels of activity in publication, as indicated by numbers of publications, reflect individual interest and activity in research, not in individual value to the program.

- The growth in total number of publications (26 in 1999, averaging 2.4 per faculty member, to 37 in 2004, averaging 3.4 per faculty member) is consistent with several changes that the School to increase productivity within the graduate program.

Appendix B

Record of Significant Scholarly, Artistic and/or Creative Work

Name and Type of Scholarly, Artistic and/or Creative Work	Program Faculty	Year Completed (1999-2005)
"Refereed Journals and Equivalent"		
Apblett, A., G. L. Foutch and P. Tran, "The ETA Fouling Mechanism of Mixed Bed Ion Exchange Resin," *IEX 2004 – Ion Exchange Technology for Today and Tomorrow*, Cambridge, England, pp. 37-44. 2004: Reprinted in *Power Plant Chemistry*, Vol. 6, No. 9, pp. 523-528, 2004	Foutch	2004
Jia, Yi and G. L. Foutch, "True Multicomponent Mixed-Bed Ion-Exchange Modeling ," *Reactive Polymers*, Invited paper in an issue honoring Michael Streat, Vol 60C pp 121-135, 2004.	Foutch	2004
Hussey, D. F. and G. L. Foutch, "Ion Exchange Kinetics for Ultrapure Water," Sengupta, A. K. and Y. Marcus, editors; Ion Exchange and Solvent Extraction, 16th Edition, March, 2004.	Foutch	2004
Foutch, G. L., "You Really Need a Good Recommendation Letter," *Chemical Engineering Education*, Spring, pp. 122-124, 2003	Foutch	2003
Chowdiah, V. N., G.C. Lee, and G. L. Foutch, "Binary Liquid-Phase Mass Transport in Mixed-Bed Ion-Exchange at Low Solute Concentration," *Industrial and Engineering Chemistry*, Vol. 42(7), 1485, 2003	Foutch	2003
Hussey, D. F., G. L. Foutch and M. A. Ward, "Ultrapure Water," Ullmann's Encyclopedia of Industrial Chemistry, 6th Edition, September 2001. Electronic version available online at http://www.wiley-vch.de/vch/software/ullmann/	Foutch	2001
Lee, J., D. F. Hussey and G. L. Foutch, "Ion Exchange Modeling of Borates for Ultrapure Water Applications," Ion Exchange at the Millennium, Proceedings IEX 2000, 8th, Cambridge, United Kingdom, Imperial College Press, London, UK, pp. 61-68, 2000.	Foutch	2000

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5D - ASSESSMENT OF STUDENT ACHIEVEMENT

The following table shows the AY04 assessment methods used and numbers of individuals assessed for the BS degree programs offered by the School of Chemical Engineering. The methods and numbers are representative of that used from 1999 to the present.

Degree Program Assessed	**Assessment Methods Used**	**Numbers of Individuals Assessed**
Bachelor's Of Science in Chemical Engineering	Fundamentals of Engineering Exam	69 (5-years)
	Senior Survey in the fall semester	25
	Exit interview fall and spring	21
	End of course survey – student response to objectives	7x25
	End of course evaluation by the faculty	7x25
	Course evaluations	10x25
	Feedback by Celanese visitors on student design problem	1x25
	External academic contests and scholarships	8
	Student participation in School's activities	>100
	AIChE National Data	Many
	Industrial feedback (IAC and recruiters)	~20
	OSU Alumni Survey	28 (96 and 00)
	Employer Survey of Communications	24
	ABET Accreditation Visit	1

The following table shows the assessment methods used and numbers of students assessed for the graduate degree programs offered by the School of Chemical Engineering.

Degree Program Assessed	**Assessment Methods Used**	**Numbers of Individuals Assessed**
M.S. and Ph.D. in Chemical Engineering	Fundamentals of Engineering Exam	2
	Exit interview (fall and spring)	5
	GRE Scores	9
	Course teaching evaluations (all graduate ChE courses)	7x12
	Course grade distributions (Core ChE courses)	5x10
	Probation events	0 out of 32
	Research publication/presentation activity	42
	Safety citations	33
	Faculty opinion on quality of student performance	10
	Faculty end-of-course assessment	6x10

5E - OVERVIEW OF ASSESSMENT RESULTS

A few statements from the annual assessment reports follow, to illustrate the analysis of key outcomes:

From the undergraduate program annual assessment

The Accreditation Board for Engineering and Technology (ABET) requires a continuous improvement process for engineering education programs. In preparation, during the past five years (and substantially in the past three) the School has explicitly defined Educational Objectives (what we expect graduates to be able to do/have done by two years after graduation); and, from those, Program Outcomes (skills and assets that students have upon graduation), and the topics and skills that define the essence of chemical engineering. We developed a continuous assessment process, and for the past two years, closed the feedback loop. Most of our efforts for the University Assessment of Instruction are within the ABET activities. In AY04 ABET provided a thorough 3-day inspection of all aspects of our BS ChE program. We remain accredited.

Feedback from both our internal alumni phone interview, OSU Alumni phone interview, and our own survey of employers indicates that our program prepared the alumni well for practically all aspects in their diverse careers. Feedback suggests better preparation in computer programming, dealing with ambiguity, integration of business economics, and better preparation for team effectiveness.

Analysis of performance on the Fundamentals of Engineering Exam indicates that OSU ChE student test-takers are significantly better prepared in the science and engineering fundamentals than the average national student test-taker. We have sustained a 96% pass rate, compared to a national pass rate of 84% for the past ten years. In 6 of the past 7 test administrations, our students had a 100% pass rate. Only in one category, mathematics, do we frequently test lower (marginally significant) than the national average. This is a continuing finding, parallels the feedback of most all OSU engineering disciplines, and is part of active efforts of the college to improve the math skill in our graduates.

It is not simply and FE Exam finding. In the past students, faculty, and alumni in graduate school feel that the mathematics ability of our undergraduates needs to be improved. The students want more "practical math" ability; not math theory. They want engineering analysis skill. Faculty has accepted the challenge of integrating such experiences into their classes. Last year was the first year that senior students did not complain about insufficient skill in practical math. This April, out students out-scored or tied the national average in the several math categories on the FE Exam.

Students, alumni, and IAC members encouraged us (the college) to replace Fortran with VB and prepare students to use Macros in Excel. This fall begins the change.

Computing facilities have improved each year. However, problems persist. The facilities, software, and user instruction on software and hardware are inadequate. There are too few computers, in inconvenient locations. Class use of the "open" labs blocks student use, and is very frustrating. Students need instruction on system and software operation to be proficient. We added a lab section to CHE2033 and have a ChE instructor teaching a lab in ENGR1352 for software training. We need sufficient tabletop workspace in the labs. Students want 24-hr access to EN labs where the reference books are located, and where encounters with professors are likely. Being in the labs for long hours, students would like a coffee/snack shop in Cordell.

We continued using a single ChE advisor this academic year. Data from two years shows it to be an improvement over the use of all faculty for advising, because the academic advising process requires experienced advisors to interpret and locate the convoluted rules and conditions. Students cannot effectively advise themselves because the degree requirements are not clearly stated, and because credit amount and category of transfer courses often requires interpretation, with multiple OSU departments claiming authority. However, as students progress from pre-professional school to professional school, advising shifts from CEAT Student Services to the CHE Faculty, whereupon interpretation of the degree requirements changes. Advisors within any one group give conflicting direction. While this is a continuing finding, the frequency and severity of complaints seem to have lessened.

Students struggle with certain prerequisite material when they enter subsequent courses. Key prerequisite topics that pose subsequent difficulty are computer programming, differential equations, material balances with recycle, and statistical analysis of data. This is a continuing finding.

Maintenance of experimental teaching units in the Unit Operations Laboratory continues as a major problem for the school. UOL experience is fundamental to meeting our educational objectives and accreditation, and to presentation of the School to visitors and prospective students. But, there are about 16 separate units. If one is replaced each year, that means that one-third of the teaching units are 11 to 16 years old. Imagine your personal vehicle being that old - unreliable, a reflection of your personal being to others, and technically irrelevant. This year volunteers from the industrial community, led by Professor Jan Wagner, built a heat exchanger unit for our lab. It has a $400 to 500k value. While we added one unit this year, we scrapped two. The $18K per year lab equipment funding barely covers maintenance and replacement of expendables.

ChE enrollment cycles with a 13-year period, and all US schools are in phase. We have been in the downward trend of matriculation, but each of the last three year's data showed a significant increase over the past several cycles.

The GRE scores of the incoming students are among the "leading" indicators for learning potential at the graduate level. GRE testing is not required for domestic students, so this metric only relates to those entering from international undergraduate programs. In general, the higher the average score the better potential there is for learning. However, statistical variability must be considered, so the standard deviation is also shown on the table. Our conclusion is that the scores are pleasantly high, and they indicate small improvement on average for the past four years. Since the scores are already very high, only small improvement could be expected. The variation in the scores is decreasing which indicates that the increase in the average is more likely due to our ability to fill RA positions with top students without having to recruit from a lower GRE group. This probably reflects our recent increase in stipend, which makes OSU

ChE more attractive to students. In addition, anecdotal evidence suggests that the reputation of some of our professors through publication visibility provide a substantial attraction to OSU. We are expecting to see more evidence of this as publication output increases.

Research expenditure can indicate many things. One of them is a measure of the quality of facilities and experiences that our research program provides for the graduate students. Another is a measure of the external respect for our graduate program, which is partly the result of graduate student performance, which is predicated on graduate student learning. Another influence on graduate program expenditures is the faculty time devoted to writing proposals. We are very pleased that the trend in School research expenditures has shown a significant increase over the past several years. While we credit the increase to faculty focus, it certainly has an impact and is influenced by student academic performance.

Eight students defended a thesis or a PhD qualifying exam, and none failed. This indicates acceptable student academic performance.

Course GPA of the five core courses reveals continued good classroom performance by the students. There were two instances of graduate students receiving a grade of "C" or lower. There seems to be no trends in classroom performance.

We are beginning to track the number of publications and presentations in which our graduate students are a substantial contributor. This will, perhaps, be the strongest indication of the learning effectiveness of the research portion of the graduate program. Expectedly, to date there is no statistical evidence of an increase in the number of refereed journal publications per graduate student. This is because the program changes that would lead to greater publication numbers will take several years to reach fruition. Over the next few years, we should observe an increase in journal publications, if our graduate program modifications are effective. It should be noted that the number of conference publications per full-time graduate student has increased. These have a shorter incubation period than journal acceptance and indicate positive outcomes for the program changes.

We have started to require and track public presentations by students. We are pleased with the increase from 5 to 15 in such presentations over the past year.

The ratio of the number of PhD to MS degrees would be one indication of the desirability of our program. A high ratio would indicate external reputation and internal allegiance. Admittedly, there are other controlling factors. There appears to have been an increase in the PhD-to-MS ratio over the past five years.

Laboratory and office safety is very important to the chemical engineering profession. Graduate students are instructed formally about safety procedures and good practices and are present when the School Safety Committee formally inspects their offices and labs. We also have unscheduled inspections and give citations for high-risk events. Although the number of safety citations is an indication of failure to learn a basic value of performance, it is also an indication of the potential for reinforced learning. No citations were issued last year; however, a few verbal communications were made to students about clutter and labeling.

And, from the graduate program annual assessment

Quality of the product of the students' written and oral presentations and quality of the students' participation in the partnership of research can only be subjectively rated. The last rows in the table represent the collective opinion of a variety of School faculty members. The format and content of the PhD qualifier was changed three years ago. Expectedly, the first year's qualifiers were rated "adequate". Since then we have revised the core course CHE6703 and instituted clear qualifier requirements. Consequently, the quality of the qualifier has increased. We are pleased with the trend but still desire improvements in connectivity of the proposed work to societal needs, connectivity of the proposed work to fundamental analysis, appreciation of propagation of error, details in work plan, and English use. These issues have been fed back to the CHE6703 course instructor, and sufficient time will be required before a meaningful evaluation of progress in the PhD qualifier could be made. We are planning to create a rubric for more quantitatively assessing the quality of student's oral and written performance.

Finally, exit interviews with students (graduating and otherwise leaving) provide individualized feedback on a variety of aspects of the program. In general, students were satisfied with their graduate education, especially the classroom instruction. They like the change in the PhD qualifier exam, which eliminates the 20-day problem and places a focus on their research proposal; albeit, some students are having difficulty in formulating NSF-type hypothesis-driven research proposals. Students seem to have a primary focus on using the graduate program as preparation for an industrial career. Thus, they are mission-oriented, and want to rapidly achieve research results and develop personal skills that will have value in their job application. As a result, they give a high rating to professors who are able to contribute to their research progress (by providing productive and continuing guidance), and to those who can credibly establish the industrial value of the research.

5F - ALUMNI FEEDBACK AND ACHIEVEMENT

In 1999 we initiated an extensive phone interview program with alumni to reveal perceptions about the program. We also have since participated with program specific questions in the OSU alumni survey. In addition, most of the 10 members of the ChE Industrial Advisory Committee are OSU ChE alumni who have risen to engineering and technology management positions. Feedback from these groups has provided valuable information as we have continuously shaped the program.

Primarily, however, is the feedback that they received an outstanding education at OSU which makes them competitive with graduates from any ChE program.

Program changes made in response to alumni feedback was to switch from Fortran to VBA as a programming language, to add more software tools within the curriculum, to replace ENGL3323 with ENGL1213, and to move the transport and kinetics courses into the junior level.

Our alumni are quite successful after graduation, as the nationally normed performance of our students would predict. Students are accepted into the top graduate programs in the US and successfully complete their MS, PhD or MD degrees. Those entering industry directly averaged a starting salary of $56,800 per year last May, which was above the national starting salary for chemical engineers as reported by the AIChE.

5G - OTHER PROGRAM EVALUATIONS

The Accreditation Board for Engineering and Technology (ABET) requires a continuous improvement process for engineering education programs. In preparation, during the past five years (and substantially in the past three) the School has explicitly defined Educational Objectives (what we expect graduates to be able to do/have done by two years after graduation); and, from those, Program Outcomes (skills and assets that students have upon graduation), and the topics and skills that define the essence of chemical engineering. We developed a continuous assessment process, and for the past two years, closed the feedback loop. Most of our efforts for the University Assessment of Instruction are within the ABET activities. In AY04 ABET provided a thorough 3-day inspection of all aspects of our BS ChE program. We remain accredited.

6A - INDUSTRIAL ADVISORY COMMITTEE

The School maintains an advisory committee comprised of industrial managers of chemical engineers. The committee members rotate through a three-year term, and represent the major companies which hire OSU ChE graduates. The committee meets annually with the faculty to review program issues, and comment on directions, and the feedback has been one primary source of information in shaping the program to meet employer and societal needs. The present IAC membership is:

Mr. Mitch R. Lumry
Plant Manager
ExxonMobil
41501 Wolverine Rd.
Shawnee, OK 74804

Ms. Ann M. Oglesby
Manager, Emerging Technology
ConocoPhillips
868 Phillips Building
Bartlesville, OK 74004

Dr. Stan Zisman
Team Leader Normal Alpha Olefins
Chevron Phillips Chemical Co
Cedar Bayou Plant, Cedar Bayou, Texas

Mr. John Hatmaker
Director of Engineering
Kerr McGee Chemical, LLC
PO Box 25861
Oklahoma City, OK 73125

Ms. Karen Kenny
Biocides – The Dow Chemical Company
ANGUS Chemical Company
A Subsidiary of The Dow Chemical Company
1500 E. Lake Cook Road
Buffalo Grove, IL 80069

J. Scott Lewis
Project Manager
Linde BOC Process Plants LLC
8522 East 61st St.
Tulsa, OK 74133-1923

Mr. Steve Messick

Pulp, Wastepaper & Technical Team Leader
Georgia Pacific Corp
4901 Chandler Rd.
Muskogee, OK 74403-4904

Dr. Ron Morgan
Senior Research Scientist
Research Department
Halliburton Energy Services
2600 South 2nd St.
P.O. Box 1431
Duncan, OK 73536-0470

Dr. Victor L. Rice
President & COO
PAS, Inc.
16055 Space Center Blvd., Suite 600
Houston, TX 77062

Mr. Ronnie D. Stephens
Global Project/Process 3-Way Catalyst Engineering Manager
Delphi Catalyst
1301 Main Parkway
Catoosa, OK 74015

Mr. Mark Wilson
President & CEO
Black Rock Partners, LLC
10910 S. Hudson Ave.
Tulsa, OK 74137

6B - SOCIETAL NEEDS FOR THE PROGRAM

The following is extracted from our undergraduate recruiting materials:

Engineers are noted for their ability to use the language of mathematics to describe the behavior of nature, and then to use that knowledge to design, operate, and improve the processes. In addition, chemical engineers also use math to describe the chemistry of processes that shape and organize molecules. The profession started in the late 1800's, and there are now about 160 departments of Chemical Engineering across the Nation.

Solutions to many of today's problems require a combination of chemistry and engineering for their solutions. A few examples include:

Energy - We must develop alternate sources of energy, such as fuel cells, solar collection, and geothermal sources; and improve our utilization of natural resources. Each of these requires an application of chemical engineering. Notably, the Oklahoma economy is strongly related to the energy industry.

Environment – Chemical Engineers protect the environment by removing pollutants when they occur, and by designing processes that will eliminate the production of such pollutants. We are the leaders in the application of bioprocesses to produce chemicals and raw materials. Notably, whether from energy production or agricultural businesses, Oklahoma, like the rest of the country is strongly affected by environmental compliance and resource recovery.

Food - Chemical Engineers are often leaders in the production of improved agricultural fertilizers, soil conditioners, and pesticides to enhance production; and in the processing and preservation of food products.

Materials - We develop and produce new materials, with properties that satisfy demanding applications. Examples include improved plastics and composite materials for automobile construction, and ceramics and metals for computer chips and corrosion-resistant materials.

Medical - It is chemical engineers that design and improve the processes that make medicines at higher quality and lower cost. And, chemical engineers are often involved in analyzing the chemical and pharmaceutical processing within the body organs to develop new medicines, treatments and artificial organs.

Exploration – Whether space, sub-terrestrial, or sub-marine chemical engineers design and operate the life support systems.

Practicing chemical engineers use computers in their daily work, and in the control and monitoring of their manufacturing processes. In preparation, students in our program make extensive use of computers to solve engineering problems, in almost every engineering course, including the Unit Operations Laboratory where computers autonomously control and monitor experiments.

Many of our B.S. graduates enter industry, where the job opportunities for Chemical Engineering graduates are excellent, as evidenced by 2004 starting salaries for our B.S. graduates being in the $47 to 64 k/yr. range, averaging $56.8k with a 3% signing bonus.

B.S. Graduate Employment/Salaries

	2002-2003	2001-2002	2000-2001	1999-2000	1998-1999	1996-1997	1995-1996
Number of BS Graduates	32	37	35	33	37	56	53
Placements							
Industry	14	10	20	22	19	26	30
Graduate School							
OSU	2	3	3	2	8	1	3
Other	12	9	6	3	4	4	6
Government	0	3	2	1	2	2	
No Data	7	12	5	4	5	16	9
No Job						6	3
Salary Range*	$42,000-$58,400	$42,000-$60,000	$48,000-$57,000	$44,000-$54,870	$41,000-$52,000	$40,000-$49,000	$30,000-$45,600
Overall Average Salary	$54,100	$52,222	$52,947	$48,022	$47,375	$44,660	$41,000

*Bonus and sign up offers not included

6C - GRADUATE APPLICATIONS AND ENROLLMENT CHANGES

Until about two years ago, the number of graduate applications remained steady at about 45-55 per year. However, this year we only received 15 applications. The drastic change has been due to the drop in applications from foreign nationals.

We are unsure of the mechanism, however the trend would be unexpected considering that our program has increased RA stipends, broadening research in the "hot" bio area, and the reputation of our faculty is increasing (as evidenced by awards and publications).

We believe that the drop in graduate applicants that we experience is part of the national phenomena which is credited to post 9-11 regulations on admission to the US and costs and treatment once in the country. We believe that there are two aspects: 1) Foreign nationals face new difficulties in their home country when trying to apply for US visas, and 2) Reports from their countrymen-students in the US to those back home about difficulties once having arrived here discourage them from considering the US.

Exacerbating the drop in applications, the OSU ChE research funding dropped about 33% in the post 9-11 period. As mentioned earlier, we have been proud that a substantial fraction of our program funding was direct from industry, but the 9-11 impact on the economy led to about a $350k per year loss in graduate program support. While we are observing the economy recover, and anticipate that industry will return to fund graduate projects, presently we are not able to "buy" a desired number of new graduate students each year. While we admit many on an unsupported basis, rarely do they accept.

The three year trend in the attached data does not allow these long-term trends to be seen, and the "statistics of small numbers" precludes making conclusions from normal year-to-year variability of enrollment and graduation rates in a 3-year period.

However, our time-to-graduate MS and PhD students is consistent with the national data as reported by the Council for Chemical Research.

7A&B - OSU PROGRAMS OF SIMILAR TITLE OR FUNCTION

There is no program that contains the essence of chemical engineering or requires any of the 12 core courses in the chemical engineering undergraduate program or any of the five core courses of the chemical engineering graduate program.

8A - STRENGTHS

- Faculty and staff focus on quality, mission, and personal flexibility – as evidenced by outcomes and feedback
- Teaching/Learning effectiveness – as measured by a wide variety of assessment instruments
- Respect for students – as evidenced by exit interview and alumni survey feedback
- Fundamentals of Engineering Exam Performance
- Student allegiance/happiness – as evidenced by exit interview, alumni survey, and visitor feedback
- AIChE Chapter Activity – as evidenced by national awards and responsibilities
- Undergraduate student performance (national and OSU) – 3 national Design contest wins in 10 years, outstanding chapter 6 years in a row, ChemE-Car competition qualified for nationals 4 of 5 years, regional and national awards for student paper presentations, scholarships (2 Goldwater, 1 NSF, 1 Udall in the past 5 years), OSU Alumni Assoc outstanding seniors (at least one each of the past five years), graduate school and employer acceptance, etc..
- Fundamentals & Practice balance of instructional program
- Quality (intellectual, leadership, commitment to excellence) of undergraduates

8B - AREAS FOR IMPROVEMENT

These are explicitly reflected in the school priorities which are reviewed and updated each year by the ChE faculty.

- Graduate Program –
    - **Research funding income** – nearly tripled from 1997 to 2002, but has dropped about 25% since then.
    - **Enrollment** – was constrained by funding, dropped as stipend was raised. Added some unsupported, now at 40, would like about 50. However, applications have decreased to 1/3 of recent numbers, apparently due to factors related to post 9-11 treatment of foreign nationals.
    - **Program productivity** (manuscripts, presentations, innovations) – showing a marginal rise on a per student basis, seems more dependent on faculty commitment to establishing a national impact than school policy
    - **Student performance on research** – developing metrics for proposal and defense evaluation
    - **Bureaucratic Barriers** – several OSU and CEAT policies discourage and hamper faculty participation and research productivity.
- Undergraduate Program
    - **UOL experiments** - We have added analytical instruments, instrumentation and control, integrated pilot-scale units, and piping craft. We have improved safety. However maintenance (of units and DAC instruments) is a problem. And, adding new experiments takes time and money. Many thanks to JW (and his generous industrial friends), JES, SVM, RSL, and KAMG. Plans are to add ChemE Car, L-L extraction, and flow loop experiments. However, we have several aging experiments and no budget funds for either replacement, maintenance, or new experiments.
    - **Practical math skills** - Improve student skill in modeling, calculus, ODEs, computer programming, computer solution tools, probability and distributions, statistics, and model validation. Professors are working to integrate student use in each course. FE scores rose, then fell. RRR investigating Sophomore and Junior seminars to replace ENGR1352 for partial use as math and software training.
    - **Undergraduate program Accreditation CQI** – created process, **need to ensure execution by all**
- Stature
    - **National faculty recognition** (leadership, fellow, awards, publications, achievements) – seeking a volunteer to nominate faculty for national awards.

- Procedures and Documents
    - **Timely and accurate accounting and appointments** – Genny and Carolyn save us with accurate, timely, and diligent data, form processing, and system fixing. It is a shame that they have to interpret university documents, maintain a shadow system, and continually fix errors.
- Infrastructure
    - **EN Classrooms** – tables, computer, network – Adjusted schedule and moved most ChE courses to EN515 to begin room take-over.
    - **UOL space** – Crowdness of lab is a safety concern. It also has student groups with insufficient space to work without encroaching on others space. There is no room to add anything but toy-scale experiments, and we need a few larger-scale units like the flow loop and L-L extraction to broadly complement the curriculum topics.
    - **Lab Manager and Technician** – we need a person with skills several levels above what the budget will support.
    - **Computer Technician** – we need a person to manage office and research computer systems.
    - **Personal Notebook computers** – require students to buy a laptop, wireless network the campus, and reduce the tech fee, and eliminate inaccessible computer labs scheduling for courses.
- Faculty Size and Salaries
    - **Increase faculty size 60%** to the national average, to be competitive in national research while maintaining undergraduate program quality.
    - **Increase faculty salary 25%** to the national average, to be competitive in attracting and retaining performers. If the reader missed the CCR data analysis of Section 4B, the following AIChE data independently confirms the findings.

Chemical Engineering Faculty Salary Survey

compiled by:

Geoffrey L. Price
Professor and Chairman
Department of Chemical Engineering
University of Tulsa

Fall, 2004

Each US chemical engineering department listed at www.che.utexas.edu/che-faculty/ was contacted by e-mail through the chair/head/director of the department, and they were asked to fill out an Excel Spreadsheet and e-mail it back. Instructions were to base all salaries on a 9-month contract basis for full time, tenured and tenure-track individuals in the professorial ranks, while the instructors could be tenure track or not. All monetary compensation including any salary enhancements for chaired or titled positions were to be included in the reported salaries. The results from each department were condensed to number of faculty, high and low salaries, and average salary at each rank. Two departments in Region 2, one in Region 3, one in Region 5, and one in Region 8 did not submit high and low salary data and therefore could not be included in calculations involving high and low salary data, but their averages were included. The results are attached broken down by rank and region. Regions were defined as follows:

Region 1, New England. Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Region 2, Mid Atlantic. New York, New Jersey, Pennsylvania
Region 3, East North Central. Illinois, Indiana, Michigan, Ohio, Wisconsin
Region 4, West North Central. Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
Region 5, South Atlantic. Delaware, Distr. of Columbia, Florida, Georgia, Maryland, North and South Carolina, Puerto Rico, Virginia, West Virginia
Region 6, East South Central. Alabama, Kentucky, Mississippi, Tennessee
Region 7, West South Central. Arkansas, Louisiana, Oklahoma, Texas
Region 8, Mountain. Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
Region 9, Pacific. Alaska, California, Hawaii, Oregon, Washington

95 schools (up from 71 from last academic year) responded to the survey. Percentage increase in the average salaries have been computed, but please note that the same group of schools did not respond this year as last year, though the increase in the overall averages appear to be quite reasonable. Some major outliers are especially evident in instructor salaries where few data are available, and the overall instructor average change seems high but can be traced to some instructor salaries which were reported to be below $12,000 last year which I believe were either for graduate assistants or part time positions. I pointed out in the instructions that such salaries should not be included this year.

A number of schools that submitted data last year asked if I was going to include data on the department chair's compensation, and I included a category for that this year. I asked for a monthly salary for the 9-month nominal academic year period, then asked for the months of non-research support for that position, followed by weeks of paid vacation. I had to correct many who showed $90,000 - $150,000 or so *monthly* salaries, but this was probably my own fault for switching between 9-month salaries on the faculty part to monthly salaries on the department chair's section. I will correct that next year. Since this is the first year I have included the chair's compensation, I could not compute the change from last year.

The final data are attached. Questions may be directed to price@utulsa.edu.

4.7

8.2

		Full Professor						
	Schools Reporting	# of full professors	Highest Salary reported	Lowest Salary reported	Average of High Salaries	Average of Low Salaries	Average Salary	change from 2003-04
Overall	95	632	$206,640	$55,000	$134,050	$86,167	$112,654	3.8%
Region 1	8	42	$197,825	$84,931	$143,400	$94,980	$118,208	1.7%
Region 2	14	92	$180,477	$71,502	$142,371	$88,477	$115,645	-0.4%
Region 3	16	104	$189,303	$55,000	$129,409	$88,683	$116,031	11.1%
Region 4	7	31	$181,755	$77,903	$122,087	$81,616	$105,556	-0.2%
Region 5	16	129	$192,219	$65,772	$135,440	$81,982	$108,205	8.8%
Region 6	9	47	$140,340	$72,673	$115,807	$82,545	$103,346	13.1%
Region 7	9	74	$177,717	$74,154	$128,998	$89,673	$112,108	4.2%
Region 8	8	36	$158,016	$69,780	$127,344	$81,166	$104,054	0.9%
Region 9	8	77	$206,640	$69,584	$164,489	$86,015	$122,028	-3.9%

OSU after raises 94,104 84,915 90,200
" at time of survey 90,054 79,416 85,639

76.4 % of 9-school 74 prof avs.

2.7

1.9

		Associate Professor						
	Schools Reporting	# of associate professors	Highest Salary reported	Lowest Salary reported	Average of High Salaries	Average of Low Salaries	Average Salary	change from 2003-04
Overall	95	252	$125,263	$45,000	$85,881	$75,287	$80,506	4.1%
Region 1	8	11	$125,263	$63,929	$95,647	$88,213	$89,495	-0.8%
Region 2	14	38	$119,100	$60,200	$92,637	$81,817	$87,892	3.5%
Region 3	16	57	$111,000	$45,000	$87,159	$71,664	$78,452	5.1%
Region 4	7	20	$111,395	$67,000	$83,572	$74,859	$81,753	3.0%
Region 5	16	52	$100,000	$60,252	$84,480	$72,564	$79,051	6.6%
Region 6	9	21	$85,020	$58,000	$77,650	$70,460	$77,476	11.1%
Region 7	9	17	$99,808	$66,580	$82,041	$76,273	$79,525	8.0%
Region 8	8	28	$105,000	$58,072	$82,533	$68,776	$74,811	-0.1%
Region 9	8	8	$100,000	$65,292	$84,180	$77,430	$84,015	2.7%

78453 69,912 73215
74,808 67,959 70,551

88.7 % of 9-school 17 assoc prof facults,

2.3

2.1

		Assistant Professor						
	Schools Reporting	# of assistant professors	Highest Salary reported	Lowest Salary reported	Average of High Salaries	Average of Low Salaries	Average Salary	change from 2003-04
Overall	95	222	$104,100	$44,466	$71,238	$67,536	$71,190	4.7%
Region 1	8	15	$86,624	$69,000	$77,125	$70,853	$74,528	3.3%
Region 2	14	32	$104,100	$62,320	$79,105	$72,633	$76,524	4.6%
Region 3	16	39	$86,500	$45,000	$70,660	$67,579	$71,324	8.3%
Region 4	7	11	$74,836	$57,180	$66,681	$65,525	$65,771	-3.0%
Region 5	16	46	$80,268	$44,466	$69,486	$65,794	$69,353	6.8%
Region 6	9	18	$74,880	$60,542	$69,287	$66,986	$68,944	8.0%
Region 7	9	28	$82,333	$57,598	$71,402	$66,686	$70,754	6.1%
Region 8	8	15	$80,189	$59,389	$67,868	$67,747	$69,182	3.8%
Region 9	8	18	$85,000	$53,616	$72,253	$65,569	$71,240	0.0%

~~7723~~ ~~7628~~
69507 68652 69080
65250 65250 65250

92.2 % of 9-school 28 asst prof avs.

	Schools Reporting	Instructor						
		# of instructors	Highest Salary reported	Lowest Salary reported	Average of High Salaries	Average of Low Salaries	Average Salary	change from 2003-04
Overall	95	45	$92,700	$11,000	$53,925	$49,565	$52,718	4.5%
Region 1	8	1	$72,712	$72,712	$72,712	$72,712	$72,712	0.0%
Region 2	14	7	$90,000	$49,680	$67,358	$64,038	$55,129	3.8%
Region 3	16	7	$62,850	$42,000	$45,802	$45,727	$60,167	7.1%
Region 4	7	7	$60,776	$36,087	$47,692	$41,390	$45,305	-2.4%
Region 5	16	6	$49,264	$11,000	$20,088	$20,088	$28,044	50.3%
Region 6	9	1	$66,270	$66,270	$66,270	$66,270	$66,270	-
Region 7	9	9	$74,430	$30,569	$62,480	$48,765	$55,305	-10.2%
Region 8	8	4	$67,500	$48,000	$59,150	$55,833	$57,363	-
Region 9	8	3	$92,700	$57,888	$75,294	$60,480	$71,220	-5.9%

	Schools Reporting	Department Chair					
		Chairs providing information	Highest Monthly Salary reported	Lowest Monthly Salary reported	Average Monthly Salary	Average Months of non-research pay	Average Weeks of Paid Vacation
Overall	95	76	$19,283	$6,111	$12,882	10.5	1.4
Region 1	8	4	$19,283	$11,649	$14,789	10.0	2.3
Region 2	14	11	$17,944	$9,857	$13,651	9.7	0.3
Region 3	16	14	$18,796	$6,111	$12,660	10.6	0.9
Region 4	7	4	$16,274	$8,656	$12,886	10.8	1.0
Region 5	16	13	$18,960	$8,032	$12,466	10.8	2.1
Region 6	9	9	$14,480	$9,762	$11,984	10.9	1.8
Region 7	9	8	$18,435	$10,434	$13,482	11.3	1.6
Region 8	8	8	$17,557	$8,333	$12,665	10.5	2.2
Region 9	8	5	$15,346	$11,047	$12,362	9.6	0.9

10914
10434

R^3 is 77.4%
of Region 7
8-school average

8C - RECOMMENDATIONS FOR ACTION

The program performed a comprehensive analysis as part of the Strategic Plan, and recommendations for action for faculty and administration are expressed with respect to each Strategic Goal. The planning included an analysis of our role within OSU, the State, and the Nation, our strengths and weaknesses, a led to strategies. The strategies reveal recommended action. Actions which can be initiated with in the school are being implemented. Alternately, some require additional resources or OSU administrative action. Strategies are listed here relative to each program goal, and those in bold font need action from individuals external to the School.

GOAL 1 - Sustain our Excellent Undergraduate Instructional Program while Developing the Graduate Instructional Program.

Objective 1.1 – Maintain undergraduate accreditation

Strategies:

- Head to ensure compliance with schedule of activities in CQI processes for undergraduate programs.

Objective 1.2 – Sustain effective CQI graduate program.

Strategies:

- Comply with accreditation criteria

Objective 1.3 – Improve quality of critical service courses.

Strategies:

- Inform system of needs identified from assessment data

Objective 1.4 – Continue dedication to undergraduate program (recruiting, student coaching, instruction, student research, student activities).

Strategies:

- Maintain, affirm, and support School values and faculty perspective that the undergraduate program is the priority.
- Encourage faculty dedication to excellence through recognition.
- Encourage faculty dedication to advising of student activities through awards, accommodation, and resource allocation.

Objective 1.5 – Shape student perspectives to promote right attitudes.

Strategies:

- Integrate right values in recruiting messages
- Reinforce right values in daily messages to students.
- Publicize "Desirable Engineering Attributes"

GOAL 2 - Build Toward International Status in Research and Scholarly Activity Performance.

GOAL 4 - Recruit Outstanding Students and Provide Enrichment Activities that Prepare them for Leadership.

Objective 4.1 – Recruit

Strategies

- Participate in on-campus visits by individuals and groups
- Participate in off-campus Engineering and Recruiting Fairs
- Develop the Fluidized Bed Popcorn Popper for displays
- Maintain Web pages with bragging points about student achievement and national success
- Regularly update the trifold brochure
- Provide High School Excellence Scholarships

Objective 4.2 – Enrichment Activities

Strategies

- Sustain an active AIChE Student Chapter
- Sustain an active Omega Chi Epsilon Student Chapter
- Sustain an active ChemKidz student group
- Provide undergraduate research opportunities

GOAL 5 - Contribute to Economic Development of the State and Beyond.

Objective 5.1 – Increase FTE funding to fully support 15 ChE faculty members, to broaden and strengthen our ability to provide value to Oklahoma.

Strategies:

- **Enlist help from upper administration**

Objective 5.2 – Integrate industrial and alumni partners into program activities.

Strategies:

- Maintain an active Industrial Advisory Committee
- Seek research and develop collaboration with industry
- Market ChE faculty expertise to have industry seek us

GOAL 6 - Prepare Students to Work Effectively with Diverse Peoples and Environments

Objective 6.1 – Include personal effectiveness training in faculty and staff meetings.

Strategies:

- Invite presentations by industrial HR personnel on human factors for faculty, staff, and students.

Objective 6.2 – Shape student perspectives to promote right attitudes.

Strategies:

- Integrate right values in recruiting messages
- Reinforce right values in daily messages to students.

Objective 6.3 – Include personal effectiveness and team effectiveness training and experiences in ChE courses

Strategies:

- Introduce concepts of diversity, synergism, and team effectiveness in UOL and Design Classes.
- Have students work in teams, which include participation by professor, and which are randomly comprised to ensure diverse participants by age, sex, race, religion, accent, and city/country origin.

GOAL 7 - Develop Technical and Human Skills in Self and Others.

Objective 7.1 – Sustain effective CQI programs in graduate and undergraduate programs.

Strategies:

- Comply with accreditation criteria

Objective 7.3 – Include personal effectiveness training in faculty and staff meetings.

Strategies:

- Invite presentations by industrial HR personnel on human factors for faculty, staff, and students.

GOAL 8 - Create an Infrastructure of Facilities, Personnel, Policy, and Procedures that Facilitate our Mission.

Objective 8.1 – Improve uniformity and simplicity in advising (much has been done, process is much improved, need to assess lingering problems)

Strategies:

- Head to survey students in senior survey and exit interviews.
- Advisor to document instances discovered through advising and graduation checks.

Objective 8.2 – Provide a functional, timely, accurate, intelligible accounting and appointment process.

Strategies:

- **Inform OSU administration of needs.**

Objective 8.3 – Seek multiple use/benefit of activities, leverage of resources, do not settle for one outcome.

Strategies:

- Encourage and acknowledge faculty for creating synergistic situations
- Encourage and acknowledge faculty for sharing research facilities to enhance educational program
- Encourage and facilitate faculty and students to creating papers and publications from undergraduate activities
- Promote values of "add value" and "follow through to completion"

Objective 2.1 – Eliminate CEAT practices associated with AY contribution, third summer month penalty, conditions on use of chair and professorship funds, etc. CEAT faculty survey places this as the number one impediment to research.

Strategies:

- **Enlist help from OSU administration**

Objective 2.2 – Provide remuneration for faculty overtime on research. It is possible through teaching, but not allowed for those working 70 hours per week to develop research programs. CEAT faculty survey places this as the number two impediment to research.

Strategies:

- **Enlist help from upper administration**

Objective 2.3 – Unburden faculty and staff from appointment, accounting, and purchasing activities. CEAT faculty survey placed these in third place as impediments to research.

Strategies:

- **Inform OSU administration of needs**

Objective 2.4 – Add 6 faculty members to rise above the minimal number required to teach courses, to create synergistic teams in critical areas for graduate program building, and to prepare for retirements.

Strategies:

- **Inform OSU administration of needs**

Objective 2.5 – Increase faculty salaries by 25% reach the national average.

Strategies:

- **Inform OSU administration of needs**

Objective 2.6 – Improve quality of graduate students

Strategies

- Raise stipend through research funding.
- Reinforce right values in daily mentoring and messages to students

Objective 2.7 – Have about 5 graduate research assistants per faculty member

Strategies

- Raise funding through research proposals.

GOAL 3 - Contribute to Outreach Activities.

Objective 3.1 – Participate in Extension courses and programs

Strategies

- Develop the MS CSE program
- Teach Courses in the MS CSE program

Objective 8.4 – Unburden faculty and staff from appointment, accounting, and purchasing activities. CEAT faculty survey placed these in third place as impediments to research.

Strategies:

- **Inform OSU administration of needs.**

Objective 8.5 – Add a staff position for IT services.

Strategies:

- **Inform OSU administration of needs.**

Objective 8.6 – Upgrade classroom and labs.

Strategies:

- **Inform system of needs identified from assessment data**
- Solicit help from industrial partners to provide functional, effective, flexible, Unit Operations Lab experiments which represent a comprehensive range of units and industrial craft and instrumentation practice

Objective 8.7 – Upgrade facilities.

Strategies:

- **Inform OSU administration of office and lab space needed to accommodate additional faculty and IT technician.**
- **Inform OSU administration of insufficient numbers of Women's rest rooms in EN**

Objective 8.8 – Provide query access to student data base to obtain statistics, and contact information

Strategies:

- **Seek help from OSU administration**

GOAL 9 - Effectively Partner with Internal and External individuals and Organizations to Accelerate Progress

Objective 9.1 – Seek multiple use/benefit of activities, leverage of resources, do not settle for one outcome.

Strategies:

- Encourage and acknowledge faculty for creating synergistic situations
- Encourage and acknowledge faculty for sharing research facilities to enhance educational program
- Encourage and facilitate faculty and students to creating papers and publications from undergraduate activities
- Promote values of "add value" and "follow through to completion"

Objective 9.2 – Integrate industrial and alumni partners into research and education.

Strategies:

- Use industrial lecturers and fieldtrips in classes

- Maintain a strong AIChE chapter program of evening speakers and fieldtrips
- Solicit funding to support strong student activities in national contests (Design, ChemE Car, paper presentations, web page)
- Acknowledge alumni and industrial partners in marketing materials.

GOAL 10 - Develop National Recognition for our Program.

Objective 10.1 – Publicize "Desirable Engineering Attributes"

Strategies:

- Fine-tune wording with faculty and IAC members.
- Present "Desirable Engineering Attributes" in Senior Seminar.
- Publish "Desirable Engineering Attributes" on the Web.

Objective 10.2 – Promote faculty for national recognition and awards.

Strategies:

- Form a faculty committee to prepare nominations

Objective 10.3 – Maintain and improve the ChE web pages.

Strategies:

- Review and update frequently with information and appearance.

Objective 10.4 – Maintain and improve the ConocoPhillips lecture series and lecture dissemination.

Strategies:

- Maintain dissemination through pamphlet and web, and encouragement of periodical.
- Faculty and sponsor to review all aspects of lecture series and seek ways to improve quality and impact.

8D - FIVE-YEAR GOALS FOR THE PROGRAM

As stated in the Strategic Plan for the School of Chemical Engineering, the Strategic Goals represent the 5-year Goals for the Program. They are derived from the Values, and from the Vision that is derived from the Mission.

MISSION

The School of Chemical Engineering develops human resources, professional knowledge, and infrastructure for chemical engineering to contribute to human welfare.

VISION

- Sustain a nationally competitive undergraduate chemical engineering program recognized for quality, fundamental-practice balance, and educational leadership.
- Attain widespread recognition for contributions to professional knowledge and tools, which are useful, widely accepted, and practiced by others.
- Sustain and create infrastructures that facilitate synergism, creativity, personal and professional growth, and productivity by students and professional personnel both within OSU and in the outside world.

VALUES

1. Excellence – We seek balanced excellence in all of our endeavors, and are committed to continuous improvement.
2. Integrity – We will be equitable, honest, ethical, and professional.
3. Diversity – We respect others. We value diversity of opinions, freedom of expression, and other ethnic and cultural backgrounds.
4. Intellectual Freedom – We believe in ethical and scholarly questioning in an environment that respects the rights to freely pursue knowledge.
5. Stewardship – We are dedicated to sustainability. We accept the responsibility of the public's trust and are accountable for our actions. Providing benefit to others must temper personal gain
6. Action – We are committed to causing beneficent change within human, technical, and economic systems.
7. Joy – We believe that individual pursuit of happiness, predicated on a sense of purpose and virtue, within a nurturing and harassment-free environment, promotes individual and corporate health and productivity.

STRATEGIC GOALS

1. Sustain our Excellent Undergraduate Program while Developing the Graduate Program.
2. Build Toward International Status in Research and Scholarly Activity Performance.
3. Contribute to Outreach Activities.
4. Recruit Outstanding Students and Provide Enrichment Activities that Prepare them for Leadership.
5. Contribute to Economic Development of the State and Beyond.
6. Prepare Students to Work Effectively with Diverse Peoples
7. Develop Technical and Human Skills in Self and Others.
8. Create an Infrastructure of Facilities, Personnel, Policy, and Procedures that Facilitates our Mission.
9. Effectively Partner with Internal and External individuals and Organizations to Accelerate Progress
10. Develop National Recognition for our Program.